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

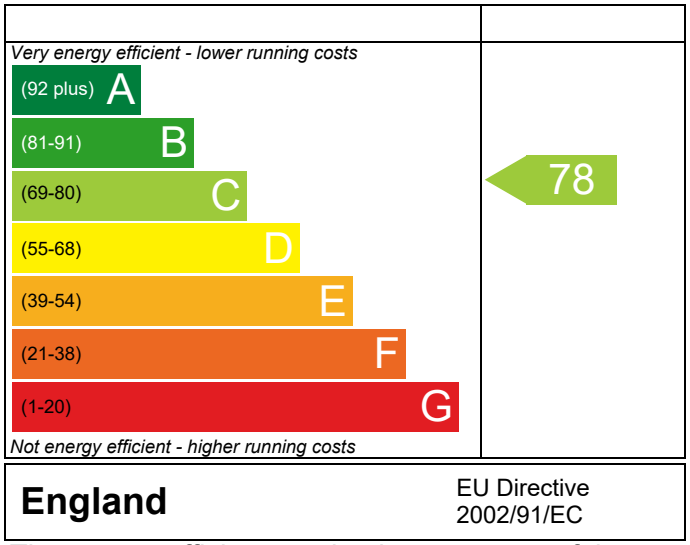
Flat 2:01, 9-10 George Street,
Richmond,
London,
TW9 1JY

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	30/11/2020
Produced by:	Energy Calculations Limited
Total floor area:	53.8 m²
DRRN:	9270-0793-0985

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.

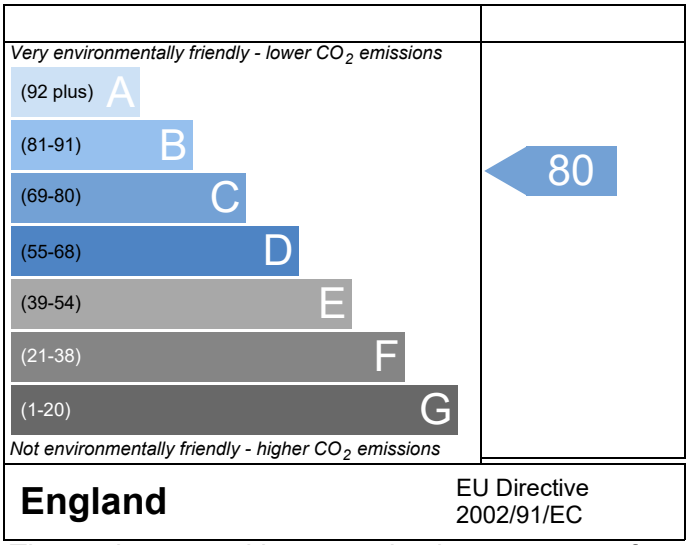
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO_2) emissions.

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	001 - Lean	**Prop Type Ref**	
Property	Flat 2:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	78 C	**DER**	30.98	**TER**	26.10
Environmental	80 C	**% DER<TER**	-18.69		
CO_2 Emissions (t/year)	1.31	**DFEE**	37.82	**TFEE**	42.89
General Requirements Compliance	Fail	**% DFEE<TFEE**	11.83		

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)	Table K1 - Approved	0.300	9.83	2.95	
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)	Table K1 - Approved	0.070	22.25	1.56	
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: 6.19 **W/mK:**

Y-Value: 0.107 **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

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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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) 30.98 kgCO□/m²Fail
Excess emissions =4.88 kgCO□/m² (18.7%)

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)42.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.8 kWh/m²/yrOK
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2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.20 (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: 5.00 (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

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7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
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

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							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	
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	0.2000	2.2940	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1883	3.8286	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) =		27.6236			(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)							6.1912	(36)
Total fabric heat loss					(33) + (36) =		33.8148	(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	59.9133	59.7788	59.6471	59.0281	58.9123	58.3732	58.3732	58.2734	58.5809	58.9123	59.1466	59.3915	(39)
Average = Sum(39)m / 12 =												59.0276	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1136	1.1111	1.1087	1.0972	1.0950	1.0850	1.0850	1.0831	1.0889	1.0950	1.0994	1.1039	(40)
HLP (average)												1.0972	(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)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)

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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

	14.0045	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)

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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	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)

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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	55.9240	56.0498	56.1736	56.7626	56.8742	57.3995	57.3995	57.4978	57.1960	56.8742	56.6489	56.4153	
alpha	4.7283	4.7367	4.7449	4.7842	4.7916	4.8266	4.8266	4.8332	4.8131	4.7916	4.7766	4.7610	
util living area	0.9903	0.9715	0.9085	0.7458	0.5423	0.3753	0.2727	0.3197	0.5581	0.8751	0.9782	0.9929	(86)
MIT	19.8822	20.1519	20.5277	20.8520	20.9706	20.9959	20.9993	20.9986	20.9758	20.7309	20.2262	19.8307	(87)
Th 2	19.9897	19.9918	19.9937	20.0031	20.0049	20.0131	20.0131	20.0146	20.0099	20.0049	20.0013	19.9976	(88)
util rest of house	0.9875	0.9640	0.8873	0.7031	0.4892	0.3184	0.2117	0.2517	0.4849	0.8377	0.9711	0.9909	(89)
MIT 2	18.5190	18.9074	19.4299	19.8491	19.9799	20.0106	20.0129	20.0141	19.9932	19.7189	19.0255	18.4501	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	19.3298	19.6476	20.0828	20.4456	20.5692	20.5967	20.5996	20.5996	20.5777	20.3208	19.7397	19.2713	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3298	19.6476	20.0828	20.4456	20.5692	20.5967	20.5996	20.5996	20.5777	20.3208	19.7397	19.2713	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9609	0.8894	0.7227	0.5196	0.3521	0.2480	0.2921	0.5275	0.8506	0.9689	0.9890	(94)
Useful gains	414.5409	513.9994	605.3792	617.4114	510.2979	348.5435	233.2588	244.2702	370.1679	459.4414	415.0954	386.6713	(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	900.4836	881.5965	810.1768	681.5149	522.5034	350.0458	233.4693	244.7269	379.4671	572.6770	747.5934	895.1058	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	361.5414	247.0252	152.3694	46.1546	9.0808	0.0000	0.0000	0.0000	0.0000	84.2472	239.3985	378.2752	(98)
Space heating												1518.0925	(98)
Space heating per m2										(98) / (4) =		28.2173	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	1518.0925	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	361.5414	247.0252	152.3694	46.1546	9.0808	0.0000	0.0000	0.0000	0.0000	84.2472	239.3985	378.2752	(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)													
	361.5414	247.0252	152.3694	46.1546	9.0808	0.0000	0.0000	0.0000	0.0000	84.2472	239.3985	378.2752	(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												1518.0925	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												247.3239	(232)
Total delivered energy for all uses												3211.2618	(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	1518.0925	0.5190	787.8900	(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			1538.2838	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	247.3239	0.5190	128.3611	(268)
Total CO2, kg/year			1666.6449	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			30.9800	(273)

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

DER		30.9800	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		51.2982	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		51.2982	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		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	
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	0.2000	2.2940	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1883	3.8286	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) =		27.6236			(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)		6.1912 (36)
Total fabric heat loss	(33) + (36) =	33.8148 (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	59.9133	59.7788	59.6471	59.0281	58.9123	58.3732	58.3732	58.2734	58.5809	58.9123	59.1466	59.3915	(39)
Average = Sum(39)m / 12 =												59.0276	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1136	1.1111	1.1087	1.0972	1.0950	1.0850	1.0850	1.0831	1.0889	1.0950	1.0994	1.1039	(40)
HLP (average)												1.0972	(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	53.5224	53.6428	53.7613	54.3250	54.4318	54.9345	54.9345	55.0286	54.7398	54.4318	54.2162	53.9926	
alpha	4.5682	4.5762	4.5841	4.6217	4.6288	4.6623	4.6623	4.6686	4.6493	4.6288	4.6144	4.5995	
util living area	0.9926	0.9764	0.9193	0.7631	0.5591	0.3883	0.2826	0.3334	0.5823	0.8934	0.9832	0.9947	(86)
MIT	19.7636	20.0485	20.4535	20.8188	20.9615	20.9943	20.9990	20.9978	20.9669	20.6738	20.1253	19.7107	(87)
Th 2	19.9897	19.9918	19.9937	20.0031	20.0049	20.0131	20.0131	20.0146	20.0099	20.0049	20.0013	19.9976	(88)
util rest of house	0.9905	0.9702	0.9003	0.7219	0.5054	0.3297	0.2195	0.2627	0.5078	0.8602	0.9777	0.9933	(89)
MIT 2	18.8716	19.1536	19.5422	19.8719	19.9821	20.0107	20.0128	20.0140	19.9937	19.7622	19.2398	18.8254	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	19.4021	19.6859	20.0843	20.4351	20.5647	20.5957	20.5994	20.5992	20.5726	20.3044	19.7665	19.3520	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4021	19.6859	20.0843	20.4351	20.5647	20.5957	20.5994	20.5992	20.5726	20.3044	19.7665	19.3520	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9890	0.9680	0.9022	0.7404	0.5360	0.3644	0.2570	0.3048	0.5509	0.8712	0.9762	0.9920	(94)
Useful gains	374.9272	478.0964	578.3220	604.5289	506.6984	347.9224	233.1473	244.0295	366.7323	437.4906	379.1127	347.1643	(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	904.8189	883.8813	810.2607	680.8961	522.2379	349.9887	233.4571	244.7012	379.1696	571.7087	749.1813	899.8974	(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	394.2394	272.6874	172.5624	54.9844	11.5614	0.0000	0.0000	0.0000	0.0000	99.8583	266.4494	411.2334	(98)
Space heating												1683.5762	(98)
Space heating per m2											(98) / (4) =	31.2932	(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	548.7083	431.9618	442.8778	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9849	0.9929	0.9876	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	540.4360	428.8984	437.3908	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	463.2122	519.1382	421.1426	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1403.4930 (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	115.8030	129.7846	105.2856	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												350.8732 (107)
Space cooling per m2												6.5218 (108)
Energy for space heating												31.2932 (99)
Energy for space cooling												6.5218 (108)
Total												37.8150 (109)
Dwelling Fabric Energy Efficiency (DFEE)												37.8 (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							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	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	0.2837	0.2684	0.2684	0.2607	0.2607	0.2377	0.2454	0.2300	0.2224	0.2377	0.2300	0.2607	(22b)
Effective ac	0.5403	0.5360	0.5360	0.5340	0.5340	0.5283	0.5301	0.5265	0.5247	0.5283	0.5265	0.5340	(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	0.2000	2.2940	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1883	3.8286	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) =		27.6236			(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)		6.1912 (36)
Total fabric heat loss	(33) + (36) =	33.8148 (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	24.4586	24.2669	24.2669	24.1751	24.1751	23.9155	23.9994	23.8343	23.7558	23.9155	23.8343	24.1751	(38)
Heat transfer coeff	58.2734	58.0817	58.0817	57.9899	57.9899	57.7303	57.8142	57.6491	57.5706	57.7303	57.6491	57.9899	(39)
Average = Sum(39)m / 12 =												57.8792	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0831	1.0796	1.0796	1.0779	1.0779	1.0731	1.0746	1.0715	1.0701	1.0731	1.0715	1.0779	(40)
HLP (average)												1.0758	(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)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	57.4978	57.6875	57.6875	57.7789	57.7789	58.0387	57.9545	58.1204	58.1997	58.0387	58.1204	57.7789	
alpha	4.8332	4.8458	4.8458	4.8519	4.8519	4.8692	4.8636	4.8747	4.8800	4.8692	4.8747	4.8519	
util living area	0.9574	0.9189	0.8045	0.5998	0.3971	0.2281	0.1335	0.1635	0.3733	0.7025	0.9124	0.9663	(86)
MIT	20.3099	20.5043	20.7824	20.9513	20.9941	20.9997	21.0000	21.0000	20.9968	20.9198	20.6041	20.2590	(87)
Th 2	20.0146	20.0175	20.0175	20.0189	20.0189	20.0229	20.0216	20.0241	20.0253	20.0229	20.0241	20.0189	(88)
util rest of house	0.9465	0.9002	0.7687	0.5513	0.3463	0.1787	0.0813	0.1065	0.3081	0.6434	0.8886	0.9573	(89)
MIT 2	19.1482	19.4176	19.7785	19.9737	20.0148	20.0228	20.0216	20.0241	20.0237	19.9511	19.5648	19.0808	(90)

Living area fraction fLA = Living area / (4) = 0.5948 (91)

MIT	19.8391	20.0640	20.3756	20.5552	20.5973	20.6039	20.6035	20.6046	20.6025	20.5273	20.1830	19.7816	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8391	20.0640	20.3756	20.5552	20.5973	20.6039	20.6035	20.6046	20.6025	20.5273	20.1830	19.7816	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9442	0.9012	0.7823	0.5782	0.3763	0.2081	0.1124	0.1404	0.3469	0.6749	0.8929	0.9547	(94)
Useful gains	537.4248	596.5230	630.1520	568.1898	409.2682	236.8269	121.6122	138.6120	292.6386	459.1748	510.1534	508.3929	(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	835.5907	811.0534	724.6059	588.8966	411.5696	236.9170	121.6149	138.6203	293.7530	492.2816	679.2772	828.1866	(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	221.8354	144.1645	70.2737	14.9089	1.7122	0.0000	0.0000	0.0000	0.0000	24.6315	121.7692	237.9265	(98)

Space heating 837.2218 (98)
RHI space heating demand 837 (98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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							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	
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	0.2000	2.2940	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1883	3.8286	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) =		27.6236			(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)		6.1912 (36)
Total fabric heat loss	(33) + (36) =	33.8148 (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	59.9133	59.7788	59.6471	59.0281	58.9123	58.3732	58.3732	58.2734	58.5809	58.9123	59.1466	59.3915	(39)
Average = Sum(39)m / 12 =												59.0276	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1136	1.1111	1.1087	1.0972	1.0950	1.0850	1.0850	1.0831	1.0889	1.0950	1.0994	1.1039	(40)
HLP (average)												1.0972	(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)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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)

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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	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)

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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	55.9240	56.0498	56.1736	56.7626	56.8742	57.3995	57.3995	57.4978	57.1960	56.8742	56.6489	56.4153	
alpha	4.7283	4.7367	4.7449	4.7842	4.7916	4.8266	4.8266	4.8332	4.8131	4.7916	4.7766	4.7610	
util living area	0.9720	0.9389	0.8539	0.6815	0.4929	0.3408	0.2467	0.2856	0.4911	0.7989	0.9458	0.9779	(86)
MIT	20.1131	20.3532	20.6609	20.8996	20.9803	20.9973	20.9996	20.9991	20.9859	20.8275	20.4224	20.0618	(87)
Th 2	19.9897	19.9918	19.9937	20.0031	20.0049	20.0131	20.0131	20.0146	20.0099	20.0049	20.0013	19.9976	(88)
util rest of house	0.9649	0.9248	0.8255	0.6375	0.4432	0.2888	0.1915	0.2247	0.4242	0.7521	0.9307	0.9722	(89)
MIT 2	18.8494	19.1871	19.6014	19.9014	19.9884	20.0115	20.0129	20.0143	20.0004	19.8309	19.2980	18.7824	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	19.6010	19.8807	20.2316	20.4951	20.5784	20.5979	20.5998	20.6001	20.5866	20.4237	19.9668	19.5434	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6010	19.8807	20.2316	20.4951	20.5784	20.5979	20.5998	20.6001	20.5866	20.4237	19.9668	19.5434	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9616	0.9231	0.8327	0.6597	0.4721	0.3197	0.2244	0.2609	0.4635	0.7728	0.9301	0.9690	(94)
Useful gains	531.5227	614.1965	670.8343	640.7978	514.8833	349.1318	233.3463	244.4769	374.5950	505.8275	512.6391	504.0454	(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	916.7338	895.5278	819.0476	684.4379	523.0463	350.1147	233.4801	244.7520	379.9899	578.7342	761.0273	911.2653	(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	286.5970	189.0547	110.2707	31.4209	6.0733	0.0000	0.0000	0.0000	0.0000	54.2426	178.8395	302.9716	(98)
Space heating												1159.4703	(98)
Space heating per m2										(98) / (4) =		21.5515	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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												1159.4703	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	286.5970	189.0547	110.2707	31.4209	6.0733	0.0000	0.0000	0.0000	0.0000	54.2426	178.8395	302.9716	(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)													
	286.5970	189.0547	110.2707	31.4209	6.0733	0.0000	0.0000	0.0000	0.0000	54.2426	178.8395	302.9716	(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												1159.4703	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												247.3239	(232)
Total delivered energy for all uses												2852.6396	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1159.4703	13.1900	152.9341	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1445.8455	13.1900	190.7070	(247)
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			376.2632	(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] =	1.5995	(257)
SAP value		77.6870	
SAP rating (Section 12)		78	(258)
SAP band		C	

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	1159.4703	0.5190	601.7651	(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			1352.1589	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	247.3239	0.5190	128.3611	(268)
Total kg/year			1480.5200	(272)
CO2 emissions per m2			27.5200	(273)
EI value			79.9201	
EI rating			80	(274)
EI band			C	

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

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							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	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	0.2837	0.2684	0.2684	0.2607	0.2607	0.2377	0.2454	0.2300	0.2224	0.2377	0.2300	0.2607	(22b)
Effective ac	0.5403	0.5360	0.5360	0.5340	0.5340	0.5283	0.5301	0.5265	0.5247	0.5283	0.5265	0.5340	(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	0.2000	2.2940	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1883	3.8286	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) =		27.6236			(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)							6.1912	(36)
Total fabric heat loss					(33) + (36) =		33.8148	(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	24.4586	24.2669	24.2669	24.1751	24.1751	23.9155	23.9994	23.8343	23.7558	23.9155	23.8343	24.1751	(38)
Heat transfer coeff	58.2734	58.0817	58.0817	57.9899	57.9899	57.7303	57.8142	57.6491	57.5706	57.7303	57.6491	57.9899	(39)
Average = Sum(39)m / 12 =												57.8792	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0831	1.0796	1.0796	1.0779	1.0779	1.0731	1.0746	1.0715	1.0701	1.0731	1.0715	1.0779	(40)
HLP (average)												1.0758	(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)

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

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, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.4978	57.6875	57.6875	57.7789	57.7789	58.0387	57.9545	58.1204	58.1997	58.0387	58.1204	57.7789	
alpha	4.8332	4.8458	4.8458	4.8519	4.8519	4.8692	4.8636	4.8747	4.8800	4.8692	4.8747	4.8519	
util living area													
	0.9574	0.9189	0.8045	0.5998	0.3971	0.2281	0.1335	0.1635	0.3733	0.7025	0.9124	0.9663	(86)
MIT	20.3099	20.5043	20.7824	20.9513	20.9941	20.9997	21.0000	21.0000	20.9968	20.9198	20.6041	20.2590	(87)
Th 2	20.0146	20.0175	20.0175	20.0189	20.0189	20.0229	20.0216	20.0241	20.0253	20.0229	20.0241	20.0189	(88)
util rest of house													
	0.9465	0.9002	0.7687	0.5513	0.3463	0.1787	0.0813	0.1065	0.3081	0.6434	0.8886	0.9573	(89)
MIT 2	19.1482	19.4176	19.7785	19.9737	20.0148	20.0228	20.0216	20.0241	20.0237	19.9511	19.5648	19.0808	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	19.8391	20.0640	20.3756	20.5552	20.5973	20.6039	20.6035	20.6046	20.6025	20.5273	20.1830	19.7816	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8391	20.0640	20.3756	20.5552	20.5973	20.6039	20.6035	20.6046	20.6025	20.5273	20.1830	19.7816	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9442	0.9012	0.7823	0.5782	0.3763	0.2081	0.1124	0.1404	0.3469	0.6749	0.8929	0.9547	(94)
Useful gains	537.4248	596.5230	630.1520	568.1898	409.2682	236.8269	121.6122	138.6120	292.6386	459.1748	510.1534	508.3929	(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													
	835.5907	811.0534	724.6059	588.8966	411.5696	236.9170	121.6149	138.6203	293.7530	492.2816	679.2772	828.1866	(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													
	221.8354	144.1645	70.2737	14.9089	1.7122	0.0000	0.0000	0.0000	0.0000	24.6315	121.7692	237.9265	(98)
Space heating												837.2218	(98)
Space heating per m2											(98) / (4) =	15.5617	(99)

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

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												837.2218	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	221.8354	144.1645	70.2737	14.9089	1.7122	0.0000	0.0000	0.0000	0.0000	24.6315	121.7692	237.9265	(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)													
	221.8354	144.1645	70.2737	14.9089	1.7122	0.0000	0.0000	0.0000	0.0000	24.6315	121.7692	237.9265	(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												837.2218	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												247.3239	(232)
Total delivered energy for all uses												2530.3911	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	837.2218	18.7000	156.5605	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1445.8455	18.7000	270.3731	(247)
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			473.1831	(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	837.2218	0.5190	434.5181	(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			1184.9119	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	247.3239	0.5190	128.3611	(268)
Total kg/year			1313.2730	(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	837.2218	3.0700	2570.2708	(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			7009.0166	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	247.3239	3.0700	759.2842	(268)
Primary energy kWh/year			7768.3008	(272)
Primary energy kWh/m2/year			144.3922	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	C 78
Current environmental impact rating:	C 80

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

(For testing purposes):

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

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

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

Potential energy efficiency rating: C 78
Potential environmental impact rating: C 80

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	£473	£473	£0
Space heating	£157	£157	£0
Water heating	£270	£270	£0
Lighting	£46	£46	£0
Total cost of fuels	£473	£473	£0
Total cost of uses	£473	£473	£0
Delivered energy	47 kWh/m²	47 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.3 tonnes	0.0 tonnes
CO2 emissions per m²	24 kg/m²	24 kg/m²	0 kg/m²
Primary energy	144 kWh/m²	144 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	33.81	(37)
Summer heat loss coefficient	305.45	(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	4.22	3.99	3.62	(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	20.66	22.32	21.85	(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	001 - Lean	**Prop Type Ref**	
Property	Flat 2:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	78 C	**DER**	30.98	**TER**	26.10
Environmental	80 C	**% DER<TER**	-18.69		
CO_2 Emissions (t/year)	1.31	**DFEE**	37.82	**TFEE**	42.89
General Requirements Compliance	Fail	**% DFEE<TFEE**	11.83		

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)	30.98	$kgCO_2/m^2$	
Excess emissions	4.88 (18.7%)	$kgCO_2/m^2$	Fail

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.89	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	37.82	$kWh/m^2/yr$	
	-5.1 (-11.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.20 (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	5.00 (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

Not applicable

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	5.00 (design value)	
Maximum	10.0	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Window U-value	0.84	W/m²K

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	001 - Lean	**Prop Type Ref**	
Property	Flat 2:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	78 C	**DER**	30.98	**TER**	26.10
Environmental	80 C	**% DER<TER**	-18.69		
CO_2 Emissions (t/year)	1.31	**DFEE**	37.82	**TFEE**	42.89
General Requirements Compliance	Fail	**% DFEE<TFEE**	11.83		

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)	0.20	9.00	34.55	11.47
Wall to hall	Timber Frame	Timber framed wall (two layers of plasterboard)	0.20	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
Table K1 - Approved	E2 Other lintels (including other steel lintels)	9.83	0.300	No
Table K1 - Approved	E3 Sill	1.80	0.040	No
Table K1 - Approved	E4 Jamb	16.86	0.050	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	22.25	0.070	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	0.107	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	5.00	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	No

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				2
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