PREDICTED ENERGY ASSESSMENT

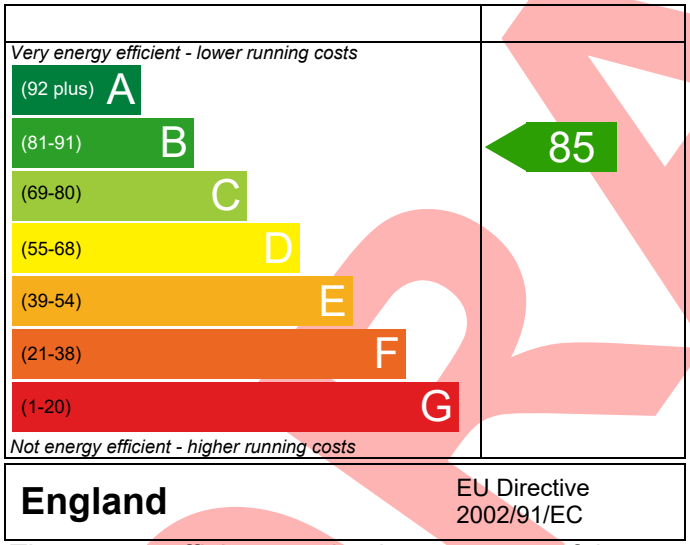
Design SAP
elmhurst energy

Dwelling type:	House, Detached
Date of assessment:	09/11/2022
Produced by:	S J Roberts Construction Limited
Total floor area:	95.2 m²

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.

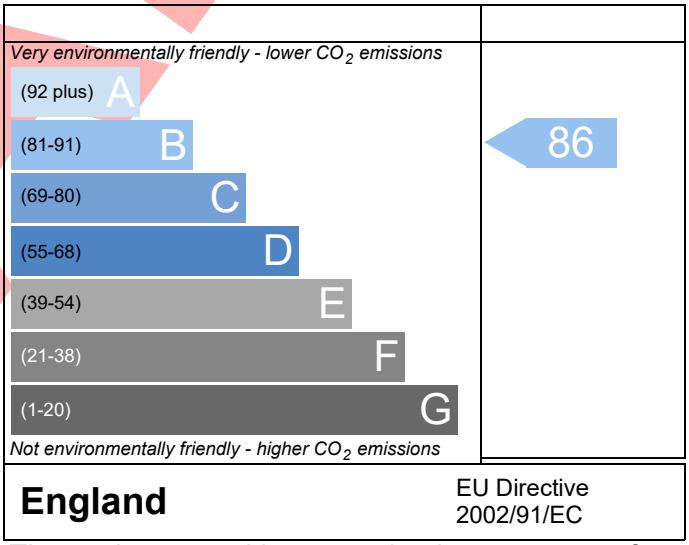
Energy Efficiency Rating



England EU Directive 2002/91/EC

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



England EU Directive 2002/91/EC

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

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	HOUSE TYPE B2	**Issued on Date**	09/11/2022
Assessment Reference	GRANT ASHP	**Prop Type Ref**	
Property			

SAP Rating	85 B	**DER**	16.31	**TER**	27.86
Environmental	86 B	**% DER<TER**	41.45		
CO_2 Emissions (t/year)	1.44	**DFEE**	54.44	**TFEE**	60.89
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.59		

Assessor Details	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com	**Assessor ID**	K559-0001
Client			

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)	27.86	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	16.31	$kgCO_2/m^2$	Pass
	-11.55 (-41.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	60.89	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.44	$kWh/m^2/yr$	
	-6.5 (-10.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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Main heating system	Heat pump with radiators or underfloor - Electric Grant AERONA3 HPID6R32		
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 2.02 kWh/day Permitted by DBSCG 2.56		Pass
Primary pipework insulated	Yes		Pass

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	Cylinderstat		Pass
	Independent timer for DHW		Pass

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power	0.1300 0.1600 0.1600		
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Midlands)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	8.47 m², No overhang		
Windows facing East	6.26 m², No overhang		
Windows facing South	1.44 m², No overhang		
Windows facing West	3.32 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		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K	

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

Design SAP
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Property Reference	HOUSE TYPE B2	**Issued on Date**	09/11/2022
Assessment Reference	GRANT ASHP	**Prop Type Ref**	
Property			

SAP Rating	85 B	**DER**	16.31	**TER**	27.86
Environmental	86 B	**% DER<TER**	41.45		
CO_2 Emissions (t/year)	1.44	**DFEE**	54.44	**TFEE**	60.89
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.59		

Assessor Details	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com	**Assessor ID**	K559-0001
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Detached House, total floor area 95 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 27.86 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.31 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	OK

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

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Grant AERONA3 HPID6R32

Secondary heating system: None

5 Cylinder insulation
Hot water storage: Measured cylinder loss: 2.02 kWh/day
Permitted by DBSCG 2.56 OK
Primary pipework insulated: Yes OK

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

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

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

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power: 0.1300 0.1600 0.1600
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North: 8.47 m², No overhang
Windows facing East: 6.26 m², No overhang
Windows facing South: 1.44 m², No overhang
Windows facing West: 3.32 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 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	47.6000 (1b)	x	2.4600 (2b)	=	117.0960	(1b) - (3b)
First floor	47.6000 (1c)	x	2.6500 (2c)	=	126.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.2360	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.2250	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2081	(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	0.2654	0.2602	0.2550	0.2289	0.2237	0.1977	0.1977	0.1925	0.2081	0.2237	0.2341	0.2445	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.5154	0.5102	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
upvc window (Uw = 1.40)			16.1600	1.3258	21.4242			(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148			(27)
external door			2.1600	1.2000	2.5920			(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680			(28a)
BRICK TF	152.1200	21.6500	130.4700	0.2300	30.0081			(29a)
CEILING	47.6000		47.6000	0.1400	6.6640			(30)
Total net area of external elements Aum(A, m2)			242.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8711			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.3702	(36)
Total fabric heat loss (33) + (36) =	85.2413	(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	41.3668	40.9492	40.5315	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	(38)
Heat transfer coeff	126.6081	126.1905	125.7728	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	(39)

Average = Sum(39)m / 12 = 125.5790 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3299	1.3255	1.3211	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	(40)
HLP (average)												1.3191	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6904 (42)
Average daily hot water use (litres/day)	98.0976 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)										Total = Sum(45)m =		1543.4579	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.0200 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0908 (55)
Total storage loss

	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (56)

If cylinder contains dedicated solar storage

	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (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

	217.1008	191.5112	201.5009	181.1481	177.8929	159.4907	153.6845	167.9355	167.4183	187.8149	197.9464	212.0515 (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

	217.1008	191.5112	201.5009	181.1481	177.8929	159.4907	153.6845	167.9355	167.4183	187.8149	197.9464	212.0515 (64)

Total per year (kWh/year) = Sum(64)m = 2215.4959 (64)

Heat gains from water heating, kWh/month

	98.8696	87.7788	93.6827	86.0546	85.8330	78.8535	77.7837	82.5222	81.4894	89.1320	91.6400	97.1907 (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	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	(66)

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

	22.2442	19.7571	16.0675	12.1641	9.0928	7.6766	8.2948	10.7819	14.4714	18.3748	21.4461	22.8624	(67)

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

	248.3263	250.9031	244.4095	230.5855	213.1351	196.7342	185.7774	183.2005	189.6941	203.5182	220.9685	237.3695	(68)

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

	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	(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)

	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)

Water heating gains (Table 5)

	132.8892	130.6232	125.9175	119.5202	115.3669	109.5188	104.5480	110.9169	113.1798	119.8011	127.2778	130.6327	(72)

Total internal gains

	466.8161	464.6398	449.7510	425.6263	400.9512	377.2859	361.9766	368.2557	380.7017	405.0505	433.0489	454.2209	(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	8.4700	10.6334	0.7200	0.7000	0.7700	31.4571	(74)
East	2.9300	19.6403	0.7200	0.7000	0.7700	20.0992	(76)
South	1.4400	46.7521	0.7200	0.7000	0.7700	23.5140	(78)
West	3.3200	19.6403	0.7200	0.7000	0.7700	22.7745	(80)
East	3.3300	19.6403	0.7200	0.7000	0.7700	22.8431	(76)

Solar gains	120.6880	227.1822	362.9204	528.2965	657.2198	679.5948	644.0361	544.8152	420.2950	265.6396	148.6197	100.5848	(83)
Total gains	587.5040	691.8219	812.6714	953.9228	1058.1710	1056.8807	1006.0127	913.0708	800.9967	670.6901	581.6686	554.8057	(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	20.8869	20.9560	21.0256	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	
alpha	2.3925	2.3971	2.4017	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	
util living area	0.9658	0.9488	0.9150	0.8469	0.7398	0.6044	0.4814	0.5342	0.7331	0.8905	0.9513	0.9700	(86)
Tweekday	18.4202	18.5323	18.7227	18.9575	19.1533	19.2752	19.3205	19.3128	19.2195	18.9646	18.6583	18.4140	
Tweekend	20.3415	20.3903	20.4747	20.5810	20.6745	20.7374	20.7650	20.7588	20.7046	20.5817	20.4433	20.3347	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9837	20.0569	20.1892	20.3457	20.4976	20.5967	20.6373	20.6278	20.5388	20.3545	20.1308	19.9732	(87)
Th 2	19.8175	19.8209	19.8243	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	(88)
util rest of house	0.9603	0.9406	0.9010	0.8206	0.6930	0.5273	0.3741	0.4266	0.6669	0.8659	0.9421	0.9651	(89)
Tweekday	18.4202	18.5323	18.7227	18.9575	19.1533	19.2752	19.3205	19.3128	19.2195	18.9646	18.6583	18.4140	
Tweekend	18.4202	18.5323	18.7227	18.9575	19.1533	19.2752	19.3205	19.3128	19.2195	18.9646	18.6583	18.4140	
MIT 2	18.4202	18.5323	18.7227	18.9575	19.1533	19.2752	19.3205	19.3128	19.2195	18.9646	18.6583	18.4140	(90)

Living area fraction fLA = Living area / (4) = 0.1863 (91)

MIT	18.7116	18.8164	18.9959	19.2162	19.4038	19.5214	19.5659	19.5579	19.4653	19.2236	18.9327	18.7046	(92)

Temperature adjustment 0.0000

adjusted MIT	18.7116	18.8164	18.9959	19.2162	19.4038	19.5214	19.5659	19.5579	19.4653	19.2236	18.9327	18.7046	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9540	0.9322	0.8892	0.8045	0.6735	0.5046	0.3476	0.3987	0.6426	0.8502	0.9334	0.9593	(94)
Useful gains	560.4541	644.8878	722.6095	767.4686	712.7232	533.2932	349.7284	364.0376	514.7381	570.2226	542.9066	532.2528	(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

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	1824.6226	1756.1194	1571.6507	1293.3910	965.8693	617.0260	371.8511	395.9166	672.6789	1081.1895	1483.5291	1818.5123	(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													
	940.5413	746.7476	631.6867	378.6641	188.3407	0.0000	0.0000	0.0000	0.0000	380.1594	677.2482	956.9770	(98)
Space heating												4900.3650	(98)
Space heating per m2											(98) / (4) =	51.4744	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												341.9649	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												1433.0023	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	940.5413	746.7476	631.6867	378.6641	188.3407	0.0000	0.0000	0.0000	0.0000	380.1594	677.2482	956.9770	(98)
Space heating efficiency (main heating system 1)													
	341.9649	341.9649	341.9649	341.9649	341.9649	0.0000	0.0000	0.0000	0.0000	341.9649	341.9649	341.9649	(210)
Space heating fuel (main heating system)													
	275.0403	218.3697	184.7227	110.7319	55.0760	0.0000	0.0000	0.0000	0.0000	111.1691	198.0461	279.8466	(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													
	217.1008	191.5112	201.5009	181.1481	177.8929	159.4907	153.6845	167.9355	167.4183	187.8149	197.9464	212.0515	(64)
Efficiency of water heater												199.4400	(216)
(217)m	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	(217)
Fuel for water heating, kWh/month													
	108.8552	96.0245	101.0334	90.8284	89.1962	79.9693	77.0580	84.2035	83.9442	94.1711	99.2511	106.3234	(219)
Water heating fuel used												1110.8584	(219)
Annual totals kWh/year													
Space heating fuel - main system												1433.0023	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.8050, total flow = 37.0000, SFP = 0.1839)													
mechanical ventilation fans (SFP = 0.1839)												54.5776	(230a)
Total electricity for the above, kWh/year												54.5776	(231)
Electricity for lighting (calculated in Appendix L)												392.8386	(232)
Total delivered energy for all uses												2991.2769	(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	1433.0023	0.5190	743.7282	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1110.8584	0.5190	576.5355	(264)
Space and water heating			1320.2637	(265)
Pumps and fans	54.5776	0.5190	28.3258	(267)
Energy for lighting	392.8386	0.5190	203.8833	(268)
Total CO2, kg/year			1552.4727	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.3100	(273)

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

DER		16.3100	ZC1
Total Floor Area	TFA	95.2000	
Assumed number of occupants	N	2.6904	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4572	ZC2
CO2 emissions from cooking, equation (L16)		1.9283	ZC3
Total CO2 emissions		33.6955	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		33.6955	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	47.6000 (1b)	x	2.4600 (2b)	=	117.0960	(1b) - (3b)
First floor	47.6000 (1c)	x	2.6500 (2c)	=	126.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.2360	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1233	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3733	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3453	(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	0.4403	0.4317	0.4230	0.3799	0.3712	0.3281	0.3281	0.3194	0.3453	0.3712	0.3885	0.4058	(22b)
Effective ac	0.5969	0.5932	0.5895	0.5722	0.5689	0.5538	0.5538	0.5510	0.5596	0.5689	0.5755	0.5823	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1600	1.0000	2.1600			(26)
TER Opening Type (Uw = 1.40)			19.4900	1.3258	25.8390			(27)
Heat Loss Floor 1			42.3000	0.1300	5.4990			(28a)
BRICK TF	152.1200	21.6500	130.4700	0.1800	23.4846			(29a)
CEILING	47.6000		47.6000	0.1300	6.1880			(30)
Total net area of external elements Aum(A, m2)			242.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.1706			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.9483	(36)
Total fabric heat loss (33) + (36) =	74.1189	(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	47.9146	47.6125	47.3163	45.9253	45.6651	44.4536	44.4536	44.2292	44.9202	45.6651	46.1916	46.7420	(38)
Heat transfer coeff	122.0335	121.7314	121.4353	120.0442	119.7840	118.5725	118.5725	118.3481	119.0391	119.7840	120.3105	120.8609	(39)
Average = Sum(39)m / 12 =												120.0430	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2819	1.2787	1.2756	1.2610	1.2582	1.2455	1.2455	1.2432	1.2504	1.2582	1.2638	1.2695	(40)
HLP (average)												1.2610	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6904 (42)
Average daily hot water use (litres/day)	98.0976 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)										Total = Sum(45)m =		1543.4579	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(46)

Water storage loss:	
Store volume	250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.8903 (48)
Temperature factor from Table 2b	0.5400 (49)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												1.0208	(55)
Total storage loss													
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage													
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(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													
	214.9304	189.5509	199.3305	179.0477	175.7225	157.3903	151.5141	165.7651	165.3179	185.6445	195.8460	209.8811	(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													
	214.9304	189.5509	199.3305	179.0477	175.7225	157.3903	151.5141	165.7651	165.3179	185.6445	195.8460	209.8811	(64)
								Total per year (kWh/year) = Sum(64)m =				2189.9411	(64)
Heat gains from water heating, kWh/month													
	97.1333	86.2105	91.9463	84.3743	84.0966	77.1732	76.0474	80.7858	79.8091	87.3957	89.9597	95.4544	(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	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.2442	19.7571	16.0675	12.1641	9.0928	7.6766	8.2948	10.7819	14.4714	18.3748	21.4461	22.8624	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.3263	250.9031	244.4095	230.5855	213.1351	196.7342	185.7774	183.2005	189.6941	203.5182	220.9685	237.3695	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	(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)													
	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)
Water heating gains (Table 5)													
	130.5555	128.2894	123.5838	117.1865	113.0331	107.1850	102.2142	108.5831	110.8460	117.4674	124.9440	128.2989	(72)
Total internal gains													
	467.4823	465.3060	450.4172	426.2925	401.6175	377.9521	362.6428	368.9219	381.3679	405.7167	433.7151	454.8871	(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	8.4700	10.6334	0.6300	0.7000	0.7700	27.5250	(74)
East	6.2600	19.6403	0.6300	0.7000	0.7700	37.5745	(76)
South	1.4400	46.7521	0.6300	0.7000	0.7700	20.5748	(78)
West	3.2000	19.6403	0.6300	0.7000	0.7700	19.9277	(80)

Solar gains	105.6020	198.7844	317.5553	462.2595	575.0673	594.6455	563.5316	476.7133	367.7581	232.4347	130.0423	88.0117	(83)
Total gains	573.0843	664.0904	767.9726	888.5520	976.6847	972.5976	926.1744	845.6352	749.1260	638.1514	563.7573	542.8989	(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	54.1745	54.3090	54.4414	55.0723	55.1919	55.7559	55.7559	55.8616	55.5373	55.1919	54.9504	54.7002	
alpha	4.6116	4.6206	4.6294	4.6715	4.6795	4.7171	4.7171	4.7241	4.7025	4.6795	4.6634	4.6467	
util living area													
	0.9979	0.9955	0.9878	0.9583	0.8734	0.7101	0.5463	0.6126	0.8603	0.9782	0.9958	0.9984	(86)
MIT	19.5876	19.7481	20.0334	20.4189	20.7476	20.9338	20.9847	20.9745	20.8286	20.3987	19.9263	19.5629	(87)
Th 2	19.8551	19.8576	19.8600	19.8715	19.8737	19.8838	19.8838	19.8856	19.8799	19.8737	19.8693	19.8648	(88)
util rest of house													
	0.9972	0.9940	0.9832	0.9420	0.8249	0.6128	0.4163	0.4793	0.7878	0.9668	0.9941	0.9978	(89)
MIT 2	17.9830	18.2189	18.6349	19.1917	19.6280	19.8405	19.8783	19.8754	19.7410	19.1739	18.4879	17.9536	(90)
Living area fraction										fLA = Living area / (4) =		0.1863	(91)
MIT	18.2820	18.5038	18.8955	19.4204	19.8366	20.0442	20.0845	20.0802	19.9437	19.4021	18.7560	18.2535	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2820	18.5038	18.8955	19.4204	19.8366	20.0442	20.0845	20.0802	19.9437	19.4021	18.7560	18.2535	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9912	0.9778	0.9336	0.8231	0.6280	0.4406	0.5039	0.7928	0.9600	0.9914	0.9966	(94)
Useful gains	570.5937	658.2212	750.9001	829.5491	803.8727	610.8020	408.0354	426.1370	593.8804	612.6443	558.9188	541.0520	(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													
	1706.2758	1656.0128	1505.2523	1262.9097	974.6402	645.5359	413.1668	435.5408	695.6302	1054.3521	1402.3349	1698.5145	(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													
	844.9475	670.5160	561.2381	312.0196	127.0510	0.0000	0.0000	0.0000	0.0000	328.6306	607.2596	861.1521	(98)
Space heating												4312.8144	(98)
Space heating per m2											(98) / (4) =	45.3027	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4612.6357	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	844.9475	670.5160	561.2381	312.0196	127.0510	0.0000	0.0000	0.0000	0.0000	328.6306	607.2596	861.1521	(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)													
	903.6871	717.1294	600.2546	333.7108	135.8835	0.0000	0.0000	0.0000	0.0000	351.4766	649.4755	921.0183	(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													
	214.9304	189.5509	199.3305	179.0477	175.7225	157.3903	151.5141	165.7651	165.3179	185.6445	195.8460	209.8811	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.1044	87.9024	87.4277	86.2818	83.9658	79.8000	79.8000	79.8000	79.8000	86.3218	87.6345	88.1829	(217)
Fuel for water heating, kWh/month													
	243.9497	215.6379	227.9947	207.5151	209.2786	197.2310	189.8673	207.7257	207.1653	215.0609	223.4805	238.0064	(219)
Water heating fuel used												2582.9133	(219)
Annual totals kWh/year													
Space heating fuel - main system												4612.6357	(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)												392.8386	(232)
Total delivered energy for all uses												7663.3877	(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	4612.6357	0.2160	996.3293	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2582.9133	0.2160	557.9093	(264)
Space and water heating			1554.2386	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	392.8386	0.5190	203.8833	(268)
Total CO2, kg/m2/year			1797.0468	(272)
Emissions per m2 for space and water heating			16.3260	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.1416	(272b)
Emissions per m2 for pumps and fans			0.4089	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3260 * 1.55) + 2.1416 + 0.4089, rounded to 2 d.p.			27.8600	(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	47.6000	(1b)	x 2.4600	(2b) =	117.0960	(1b) - (3b)
First floor	47.6000	(1c)	x 2.6500	(2c) =	126.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.2360	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1233	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3483	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3222	(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	0.4108	0.4028	0.3947	0.3544	0.3464	0.3061	0.3061	0.2980	0.3222	0.3464	0.3625	0.3786	(22b)
Effective ac	0.5844	0.5811	0.5779	0.5628	0.5600	0.5468	0.5468	0.5444	0.5519	0.5600	0.5657	0.5717	(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	
upvc window (Uw = 1.40)			16.1600	1.3258	21.4242			(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148			(27)
external door			2.1600	1.2000	2.5920			(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680			(28a)
BRICK TF	152.1200	21.6500	130.4700	0.2300	30.0081			(29a)
CEILING	47.6000		47.6000	0.1400	6.6640			(30)
Total net area of external elements Aum(A, m2)			242.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8711			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.3702	(36)
Total fabric heat loss (33) + (36) =	85.2413	(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	46.9075	46.6444	46.3866	45.1757	44.9491	43.8944	43.8944	43.6991	44.3007	44.9491	45.4074	45.8866	(38)
Heat transfer coeff	132.1488	131.8857	131.6279	130.4170	130.1904	129.1357	129.1357	128.9404	129.5420	130.1904	130.6487	131.1279	(39)
Average = Sum(39)m / 12 =												130.4159	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3881	1.3854	1.3826	1.3699	1.3675	1.3565	1.3565	1.3544	1.3607	1.3675	1.3724	1.3774	(40)
HLP (average)												1.3699	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6904 (42)
Average daily hot water use (litres/day)	98.0976 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)										Total = Sum(45)m =		1543.4579	(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)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(59)

Heat gains from water heating, kWh/month

	34.0050	29.7410	30.6900	26.7563	25.6733	22.1541	20.5291	23.5574	23.8387	27.7818	30.3260	32.9320 (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	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	(66)

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

	22.2442	19.7571	16.0675	12.1641	9.0928	7.6766	8.2948	10.7819	14.4714	18.3748	21.4461	22.8624 (67)

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

	248.3263	250.9031	244.4095	230.5855	213.1351	196.7342	185.7774	183.2005	189.6941	203.5182	220.9685	237.3695 (68)

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

	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521 (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)

	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171 (71)

Water heating gains (Table 5)

	45.7057	44.2574	41.2501	37.1616	34.5072	30.7696	27.5928	31.6632	33.1094	37.3411	42.1194	44.2635 (72)

Total internal gains

	379.6325	378.2740	365.0835	343.2676	320.0915	298.5368	285.0214	289.0020	300.6313	322.5904	347.8904	367.8517 (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	8.4700	10.6334	0.7200	0.7000	0.7700	31.4571	(74)
East	2.9300	19.6403	0.7200	0.7000	0.7700	20.0992	(76)
South	1.4400	46.7521	0.7200	0.7000	0.7700	23.5140	(78)
West	3.3200	19.6403	0.7200	0.7000	0.7700	22.7745	(80)
East	3.3300	19.6403	0.7200	0.7000	0.7700	22.8431	(76)

Solar gains	120.6880	227.1822	362.9204	528.2965	657.2198	679.5948	644.0361	544.8152	420.2950	265.6396	148.6197	100.5848	(83)
Total gains	500.3205	605.4562	728.0039	871.5641	977.3113	978.1316	929.0575	833.8171	720.9263	588.2300	496.5102	468.4365	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.0111	20.0510	20.0903	20.2768	20.3121	20.4780	20.4780	20.5090	20.4138	20.3121	20.2409	20.1669	
alpha	2.3341	2.3367	2.3394	2.3518	2.3541	2.3652	2.3652	2.3673	2.3609	2.3541	2.3494	2.3445	
util living area	0.9756	0.9613	0.9324	0.8716	0.7728	0.6417	0.5198	0.5770	0.7737	0.9154	0.9650	0.9790	(86)
MIT	18.0203	18.3256	18.8642	19.5729	20.2051	20.6518	20.8506	20.8037	20.4122	19.5768	18.6706	17.9655	(87)
Th 2	19.7725	19.7746	19.7767	19.7865	19.7883	19.7969	19.7969	19.7985	19.7936	19.7883	19.7846	19.7807	(88)
util rest of house	0.9715	0.9548	0.9205	0.8478	0.7276	0.5631	0.4056	0.4641	0.7104	0.8947	0.9580	0.9754	(89)
MIT 2	17.0704	17.3737	17.9055	18.5992	19.1916	19.5862	19.7338	19.7087	19.3994	18.6192	17.7258	17.0215	(90)
Living area fraction									fLA = Living area / (4) =			0.1863	(91)
MIT	17.2474	17.5511	18.0842	18.7806	19.3804	19.7848	19.9419	19.9128	19.5881	18.7976	17.9019	17.1974	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.2474	17.5511	18.0842	18.7806	19.3804	19.7848	19.9419	19.9128	19.5881	18.7976	17.9019	17.1974	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9592	0.9383	0.8987	0.8233	0.7098	0.5623	0.4206	0.4761	0.6975	0.8723	0.9426	0.9644	(94)
Useful gains	479.9080	568.0809	654.2848	717.5906	693.7382	549.9704	390.7836	396.9751	502.8807	513.0933	467.9940	451.7685	(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	1710.9855	1668.4962	1524.7993	1288.6009	999.9169	669.5432	431.5569	452.9357	710.9403	1067.2506	1411.2506	1704.3209	(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	915.9217	739.4791	647.6628	411.1274	227.7970	0.0000	0.0000	0.0000	0.0000	412.2930	679.1447	931.8991	(98)
Space heating												4965.3246	(98)
Space heating per m2											(98) / (4) =	52.1568	(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	1213.8756	955.6042	979.9469	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7118	0.7744	0.7353	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	864.0898	740.0057	720.5449	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1245.5672	1186.0205	1076.4900	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)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling kWh
              0.0000     0.0000     0.0000     0.0000     0.0000   274.6637   331.8350   264.8231     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                          871.3218 (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    68.6659    82.9588    66.2058     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          217.8305 (107)
Space cooling per m2                                                                                                                     2.2881 (108)
Energy for space heating                                                                                                                52.1568 (99)
Energy for space cooling                                                                                                                 2.2881 (108)
Total                                                                                                                                   54.4449 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   54.4 (109)
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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	47.6000 (1b)	x	2.4600 (2b)	=	117.0960	(1b) - (3b)
First floor	47.6000 (1c)	x	2.6500 (2c)	=	126.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.2360	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1233	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3733	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3453	(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	0.4403	0.4317	0.4230	0.3799	0.3712	0.3281	0.3281	0.3194	0.3453	0.3712	0.3885	0.4058	(22b)
Effective ac	0.5969	0.5932	0.5895	0.5722	0.5689	0.5538	0.5538	0.5510	0.5596	0.5689	0.5755	0.5823	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1600	1.0000	2.1600			(26)
TER Opening Type (Uw = 1.40)			19.4900	1.3258	25.8390			(27)
Heat Loss Floor 1			42.3000	0.1300	5.4990			(28a)
BRICK TF	152.1200	21.6500	130.4700	0.1800	23.4846			(29a)
CEILING	47.6000		47.6000	0.1300	6.1880			(30)
Total net area of external elements Aum(A, m2)			242.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.1706			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.9483	(36)
Total fabric heat loss (33) + (36) =	74.1189	(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	47.9146	47.6125	47.3163	45.9253	45.6651	44.4536	44.4536	44.2292	44.9202	45.6651	46.1916	46.7420	(38)
Heat transfer coeff	122.0335	121.7314	121.4353	120.0442	119.7840	118.5725	118.5725	118.3481	119.0391	119.7840	120.3105	120.8609	(39)
Average = Sum(39)m / 12 =												120.0430	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2819	1.2787	1.2756	1.2610	1.2582	1.2455	1.2455	1.2432	1.2504	1.2582	1.2638	1.2695	(40)
HLP (average)												1.2610	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6904 (42)
Average daily hot water use (litres/day)	98.0976 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)										Total = Sum(45)m =		1543.4579	(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													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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													
	34.0050	29.7410	30.6900	26.7563	25.6733	22.1541	20.5291	23.5574	23.8387	27.7818	30.3260	32.9320	(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	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.2442	19.7571	16.0675	12.1641	9.0928	7.6766	8.2948	10.7819	14.4714	18.3748	21.4461	22.8624	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.3263	250.9031	244.4095	230.5855	213.1351	196.7342	185.7774	183.2005	189.6941	203.5182	220.9685	237.3695	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	(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)													
	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)
Water heating gains (Table 5)													
	45.7057	44.2574	41.2501	37.1616	34.5072	30.7696	27.5928	31.6632	33.1094	37.3411	42.1194	44.2635	(72)
Total internal gains													
	379.6325	378.2740	365.0835	343.2676	320.0915	298.5368	285.0214	289.0020	300.6313	322.5904	347.8904	367.8517	(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	8.4700	10.6334	0.6300	0.7000	0.7700	27.5250	(74)
East	6.2600	19.6403	0.6300	0.7000	0.7700	37.5745	(76)
South	1.4400	46.7521	0.6300	0.7000	0.7700	20.5748	(78)
West	3.2000	19.6403	0.6300	0.7000	0.7700	19.9277	(80)

Solar gains	105.6020	198.7844	317.5553	462.2595	575.0673	594.6455	563.5316	476.7133	367.7581	232.4347	130.0423	88.0117	(83)
Total gains	485.2345	577.0584	682.6389	805.5271	895.1588	893.1822	848.5530	765.7152	668.3894	555.0251	477.9327	455.8634	(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	54.1745	54.3090	54.4414	55.0723	55.1919	55.7559	55.7559	55.8616	55.5373	55.1919	54.9504	54.7002	
alpha	4.6116	4.6206	4.6294	4.6715	4.6795	4.7171	4.7171	4.7241	4.7025	4.6795	4.6634	4.6467	
util living area													
	0.9990	0.9975	0.9923	0.9706	0.9007	0.7519	0.5894	0.6632	0.8978	0.9873	0.9979	0.9992	(86)
MIT	19.5037	19.6657	19.9551	20.3515	20.7023	20.9154	20.9791	20.9645	20.7856	20.3249	19.8447	19.4794	(87)
Th 2	19.8551	19.8576	19.8600	19.8715	19.8737	19.8838	19.8838	19.8856	19.8799	19.8737	19.8693	19.8648	(88)
util rest of house													
	0.9986	0.9966	0.9894	0.9584	0.8587	0.6562	0.4525	0.5250	0.8364	0.9802	0.9970	0.9990	(89)
MIT 2	18.4932	18.6568	18.9467	19.3445	19.6702	19.8446	19.8785	19.8754	19.7549	19.3253	18.8451	18.4765	(90)
Living area fraction									fLA = Living area / (4) =			0.1863	(91)
MIT	18.6815	18.8448	19.1346	19.5321	19.8625	20.0441	20.0836	20.0783	19.9470	19.5116	19.0313	18.6634	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6815	18.8448	19.1346	19.5321	19.8625	20.0441	20.0836	20.0783	19.9470	19.5116	19.0313	18.6634	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9955	0.9868	0.9536	0.8582	0.6714	0.4783	0.5508	0.8409	0.9769	0.9960	0.9986	(94)
Useful gains	484.2993	574.4485	673.6258	768.1699	768.2369	599.6687	405.8384	421.7532	562.0557	542.2267	476.0402	455.2096	(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													
	1755.0215	1697.5214	1534.2868	1276.3243	977.7359	645.5196	413.0593	435.3256	696.0171	1067.4657	1435.4655	1748.0608	(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													
	945.4174	754.7050	640.3318	365.8712	155.8673	0.0000	0.0000	0.0000	0.0000	390.7778	690.7863	961.8812	(98)
Space heating												4905.6379	(98)
Space heating per m2											(98) / (4) =	51.5298	(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	1114.5812	877.4362	899.4456	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8364	0.9019	0.8649	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	932.2892	791.3419	777.9153	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1146.2758	1091.9243	996.8903	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	154.0704	223.6333	162.9174	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											540.6212	(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	38.5176	55.9083	40.7294	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											135.1553	(107)
Space cooling per m2											1.4197	(108)
Energy for space heating											51.5298	(99)
Energy for space cooling											1.4197	(108)
Total											52.9495	(109)
Target Fabric Energy Efficiency (TFEE)											60.9	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.6000 (1b)	x	2.4600 (2b)	=	117.0960	(1b) - (3b)
First floor	47.6000 (1c)	x	2.6500 (2c)	=	126.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.2360	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							0 * 10	=	0.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)	
Pressure test		Yes		
Measured/design AP50		4.5000		
Infiltration rate		0.2250	(18)	
Number of sides sheltered		1	(19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2081	(21)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.5000	4.4000	3.9000	3.8000	3.4000	3.3000	3.3000	3.5000	3.8000	3.9000	4.1000	(22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250	(22a)
Adj infilt rate	0.2341	0.2341	0.2289	0.2029	0.1977	0.1769	0.1717	0.1717	0.1821	0.1977	0.2029	0.2133	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
upvc window (Uw = 1.40)			16.1600	1.3258	21.4242			(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148			(27)
external door			2.1600	1.2000	2.5920			(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680			(28a)
BRICK TF	152.1200	21.6500	130.4700	0.2300	30.0081			(29a)
CEILING	47.6000		47.6000	0.1400	6.6640			(30)
Total net area of external elements Aum(A, m2)			242.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8711			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3702	(36)
Total fabric heat loss					(33) + (36) =		85.2413	(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	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	(38)
Heat transfer coeff	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	(39)
Average = Sum(39)m / 12 =												125.3752	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	(40)
HLP (average)												1.3170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6904	(42)
Average daily hot water use (litres/day)	98.0976	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)										Total = Sum(45)m =		1543.4579	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(46)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.0200 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0908 (55)
Total storage loss

	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (56)

If cylinder contains dedicated solar storage

	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (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

	217.1008	191.5112	201.5009	181.1481	177.8929	159.4907	153.6845	167.9355	167.4183	187.8149	197.9464	212.0515 (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

	217.1008	191.5112	201.5009	181.1481	177.8929	159.4907	153.6845	167.9355	167.4183	187.8149	197.9464	212.0515 (64)

Total per year (kWh/year) = Sum(64)m = 2215.4959 (64)
RHI water heating demand 2215 (64)
Heat gains from water heating, kWh/month

	98.8696	87.7788	93.6827	86.0546	85.8330	78.8535	77.7837	82.5222	81.4894	89.1320	91.6400	97.1907 (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	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	(66)

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

	55.6104	49.3926	40.1688	30.4104	22.7321	19.1914	20.7370	26.9547	36.1786	45.9370	53.6153	57.1560	(67)

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

	370.6362	374.4823	364.7904	344.1574	318.1121	293.6331	277.2797	273.4336	283.1255	303.7584	329.8038	354.2828	(68)

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

	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	(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)

	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)

Water heating gains (Table 5)

	132.8892	130.6232	125.9175	119.5202	115.3669	109.5188	104.5480	110.9169	113.1798	119.8011	127.2778	130.6327	(72)

Total internal gains

	666.7774	662.1396	638.5182	601.7296	563.8526	529.9848	510.2062	518.9467	540.1254	577.1381	618.3384	649.7129	(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	8.4700	11.3201	0.7200	0.7000	0.7700	33.4887	(74)
East	2.9300	21.0039	0.7200	0.7000	0.7700	21.4947	(76)
South	1.4400	49.0238	0.7200	0.7000	0.7700	24.6566	(78)
West	3.2200	21.0039	0.7200	0.7000	0.7700	24.3558	(80)
East	3.3300	21.0039	0.7200	0.7000	0.7700	24.4292	(76)

Solar gains	128.4250	245.7114	394.1628	585.9470	686.7730	767.0737	700.9713	605.5456	472.4343	295.1594	178.0867	118.2680	(83)
Total gains	795.2024	907.8511	1032.6810	1187.6766	1250.6256	1297.0584	1211.1775	1124.4924	1012.5597	872.2975	796.4251	767.9809	(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	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	
alpha	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	
util living area	0.9373	0.9148	0.8688	0.7845	0.6773	0.5144	0.4153	0.4492	0.6544	0.8337	0.9113	0.9421	(86)
Tweekday	18.5537	18.6473	18.8314	19.0373	19.1942	19.2984	19.3261	19.3227	19.2491	19.0333	18.7660	18.5318	
Tweekend	20.3977	20.4401	20.5239	20.6201	20.6965	20.7527	20.7704	20.7674	20.7227	20.6154	20.4928	20.3879	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.0705	20.1339	20.2653	20.4068	20.5316	20.6202	20.6456	20.6410	20.5670	20.4064	20.2080	20.0552	(87)
Th 2	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	(88)
util rest of house	0.9280	0.9025	0.8493	0.7520	0.6266	0.4378	0.3178	0.3488	0.5850	0.8013	0.8962	0.9334	(89)
Tweekday	18.5537	18.6473	18.8314	19.0373	19.1942	19.2984	19.3261	19.3227	19.2491	19.0333	18.7660	18.5318	
Tweekend	18.5537	18.6473	18.8314	19.0373	19.1942	19.2984	19.3261	19.3227	19.2491	19.0333	18.7660	18.5318	
MIT 2	18.5537	18.6473	18.8314	19.0373	19.1942	19.2984	19.3261	19.3227	19.2491	19.0333	18.7660	18.5318	(90)

Living area fraction fLA = Living area / (4) = 0.1863 (91)

MIT	18.8363	18.9243	19.0986	19.2925	19.4434	19.5447	19.5720	19.5683	19.4947	19.2892	19.0347	18.8157	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8363	18.9243	19.0986	19.2925	19.4434	19.5447	19.5720	19.5683	19.4947	19.2892	19.0347	18.8157	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9185	0.8912	0.8352	0.7351	0.6079	0.4177	0.2949	0.3246	0.5625	0.7836	0.8839	0.9244	(94)
Useful gains	730.4297	809.0561	862.4465	873.0723	760.3098	541.7797	357.2079	365.0245	569.5998	683.5523	703.9427	709.9377	(95)
Ext temp.	4.3000	4.8000	6.6000	9.0000	11.8000	14.8000	16.6000	16.5000	14.0000	10.5000	7.1000	4.2000	(96)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W													
	1822.4954	1770.8360	1567.0099	1290.4197	958.2898	594.8669	372.6130	384.6935	688.8971	1101.9452	1496.3164	1832.4484	(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													
	812.4969	646.3160	524.1951	300.4902	147.2971	0.0000	0.0000	0.0000	0.0000	311.2843	570.5090	835.1480	(98)
Space heating												4147.7368	(98)
RHI space heating demand												4148	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.6000	(1b)	x 2.4600	(2b) =	117.0960	(1b) - (3b)
First floor	47.6000	(1c)	x 2.6500	(2c) =	126.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.2360	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							0 * 10 =		0.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000	/ (5) =	0.0000	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.2250	(18)
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2081	(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	0.2654	0.2602	0.2550	0.2289	0.2237	0.1977	0.1977	0.1925	0.2081	0.2237	0.2341	0.2445	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.5154	0.5102	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
upvc window (Uw = 1.40)			16.1600	1.3258	21.4242			(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148			(27)
external door			2.1600	1.2000	2.5920			(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680			(28a)
BRICK TF	152.1200	21.6500	130.4700	0.2300	30.0081			(29a)
CEILING	47.6000		47.6000	0.1400	6.6640			(30)
Total net area of external elements Aum(A, m2)			242.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8711			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3702	(36)
Total fabric heat loss					(33) + (36) =		85.2413	(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	41.3668	40.9492	40.5315	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	(38)
Heat transfer coeff	126.6081	126.1905	125.7728	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	(39)
Average = Sum(39)m / 12 =												125.5790	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3299	1.3255	1.3211	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	(40)
HLP (average)												1.3191	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6904	(42)
Average daily hot water use (litres/day)	98.0976	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)										Total = Sum(45)m =		1543.4579	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(46)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.0200 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0908 (55)
Total storage loss

	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (56)

If cylinder contains dedicated solar storage

	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (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

	217.1008	191.5112	201.5009	181.1481	177.8929	159.4907	153.6845	167.9355	167.4183	187.8149	197.9464	212.0515 (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

	217.1008	191.5112	201.5009	181.1481	177.8929	159.4907	153.6845	167.9355	167.4183	187.8149	197.9464	212.0515 (64)

Total per year (kWh/year) = Sum(64)m = 2215.4959 (64)

Heat gains from water heating, kWh/month

	98.8696	87.7788	93.6827	86.0546	85.8330	78.8535	77.7837	82.5222	81.4894	89.1320	91.6400	97.1907 (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	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	(66)

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

	55.6104	49.3926	40.1688	30.4104	22.7321	19.1914	20.7370	26.9547	36.1786	45.9370	53.6153	57.1560 (67)

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

	370.6362	374.4823	364.7904	344.1574	318.1121	293.6331	277.2797	273.4336	283.1255	303.7584	329.8038	354.2828 (68)

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

	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330 (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)

	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171 (71)

Water heating gains (Table 5)

	132.8892	130.6232	125.9175	119.5202	115.3669	109.5188	104.5480	110.9169	113.1798	119.8011	127.2778	130.6327 (72)

Total internal gains

	666.7774	662.1396	638.5182	601.7296	563.8526	529.9848	510.2062	518.9467	540.1254	577.1381	618.3384	649.7129 (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	8.4700	10.6334	0.7200	0.7000	0.7700	31.4571	(74)
East	2.9300	19.6403	0.7200	0.7000	0.7700	20.0992	(76)
South	1.4400	46.7521	0.7200	0.7000	0.7700	23.5140	(78)
West	3.3200	19.6403	0.7200	0.7000	0.7700	22.7745	(80)
East	3.3300	19.6403	0.7200	0.7000	0.7700	22.8431	(76)

Solar gains	120.6880	227.1822	362.9204	528.2965	657.2198	679.5948	644.0361	544.8152	420.2950	265.6396	148.6197	100.5848	(83)
Total gains	787.4653	889.3218	1001.4386	1130.0261	1221.0724	1209.5796	1154.2423	1063.7619	960.4204	842.7777	766.9581	750.2977	(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	20.8869	20.9560	21.0256	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	
alpha	2.3925	2.3971	2.4017	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	
util living area	0.9388	0.9174	0.8771	0.8017	0.6899	0.5529	0.4320	0.4772	0.6687	0.8401	0.9172	0.9446	(86)
Tweekday	18.5288	18.6322	18.8055	19.0148	19.1848	19.2879	19.3248	19.3192	19.2459	19.0298	18.7522	18.5225	
Tweekend	20.3905	20.4359	20.5133	20.6091	20.6916	20.7460	20.7691	20.7645	20.7204	20.6135	20.4864	20.3836	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.0594	20.1274	20.2488	20.3896	20.5240	20.6099	20.6437	20.6365	20.5634	20.4035	20.1980	20.0487	(87)
Th 2	19.8175	19.8209	19.8243	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	(88)
util rest of house	0.9296	0.9052	0.8586	0.7709	0.6402	0.4770	0.3318	0.3755	0.5986	0.8081	0.9029	0.9363	(89)
Tweekday	18.5288	18.6322	18.8055	19.0148	19.1848	19.2879	19.3248	19.3192	19.2459	19.0298	18.7522	18.5225	
Tweekend	18.5288	18.6322	18.8055	19.0148	19.1848	19.2879	19.3248	19.3192	19.2459	19.0298	18.7522	18.5225	
MIT 2	18.5288	18.6322	18.8055	19.0148	19.1848	19.2879	19.3248	19.3192	19.2459	19.0298	18.7522	18.5225	(90)

Living area fraction fLA = Living area / (4) = 0.1863 (91)

MIT	18.8140	18.9109	19.0744	19.2710	19.4344	19.5343	19.5706	19.5647	19.4914	19.2858	19.0216	18.8069	(92)

Temperature adjustment 0.0000

adjusted MIT	18.8140	18.9109	19.0744	19.2710	19.4344	19.5343	19.5706	19.5647	19.4914	19.2858	19.0216	18.8069	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9202	0.8940	0.8448	0.7542	0.6215	0.4560	0.3080	0.3504	0.5755	0.7904	0.8910	0.9276	(94)
Useful gains	724.6618	795.0666	846.0154	852.2256	758.9317	551.5944	355.4871	372.7526	552.7092	666.1646	683.3652	695.9556	(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

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	1837.5924	1768.0366	1581.5200	1300.2702	969.6994	618.6369	372.4368	396.7759	675.9508	1088.9800	1494.6745	1831.3468	(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													
	828.0203	653.8359	547.2155	322.5921	156.8112	0.0000	0.0000	0.0000	0.0000	314.5747	584.1427	844.7311	(98)
Space heating												4251.9234	(98)
Space heating per m2											(98) / (4) =	44.6631	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												341.9649	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												1243.3800	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	828.0203	653.8359	547.2155	322.5921	156.8112	0.0000	0.0000	0.0000	0.0000	314.5747	584.1427	844.7311	(98)
Space heating efficiency (main heating system 1)													
	341.9649	341.9649	341.9649	341.9649	341.9649	0.0000	0.0000	0.0000	0.0000	341.9649	341.9649	341.9649	(210)
Space heating fuel (main heating system)													
	242.1361	191.1997	160.0209	94.3349	45.8559	0.0000	0.0000	0.0000	0.0000	91.9903	170.8195	247.0227	(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													
	217.1008	191.5112	201.5009	181.1481	177.8929	159.4907	153.6845	167.9355	167.4183	187.8149	197.9464	212.0515	(64)
Efficiency of water heater												199.4400	(216)
(217)m	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	(217)
Fuel for water heating, kWh/month													
	108.8552	96.0245	101.0334	90.8284	89.1962	79.9693	77.0580	84.2035	83.9442	94.1711	99.2511	106.3234	(219)
Water heating fuel used												1110.8584	(219)
Annual totals kWh/year													
Space heating fuel - main system												1243.3800	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.8050, total flow = 37.0000, SFP = 0.1839)													
mechanical ventilation fans (SFP = 0.1839)												54.5776	(230a)
Total electricity for the above, kWh/year												54.5776	(231)
Electricity for lighting (calculated in Appendix L)												392.8386	(232)
Total delivered energy for all uses												2801.6546	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1243.3800	13.1900	164.0018	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1110.8584	13.1900	146.5222	(247)
Mechanical ventilation fans	54.5776	13.1900	7.1988	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	392.8386	13.1900	51.8154	(250)
Additional standing charges			0.0000	(251)
Total energy cost			369.5382	(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] =	1.1070	(257)
SAP value		84.5569	
SAP rating (Section 12)		85	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1243.3800	0.5190	645.3142	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1110.8584	0.5190	576.5355	(264)
Space and water heating			1221.8497	(265)
Pumps and fans	54.5776	0.5190	28.3258	(267)
Energy for lighting	392.8386	0.5190	203.8833	(268)
Total kg/year			1454.0587	(272)
CO2 emissions per m2			15.2700	(273)
EI value			86.1024	
EI rating			86	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.75) / 3.4196 = 4.696, stars = 4
Main heating environmental impact	0.519 × (1 + 0.29 × 0.75) / 3.4196 = 0.1848, stars = 5
Water heating energy efficiency	13.19 / 1.9944 = 6.614, stars = 3
Water heating environmental impact	0.519 / 1.9944 = 0.2602, stars = 4

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	47.6000	(1b)	x 2.4600	(2b) =	117.0960	(1b) - (3b)
First floor	47.6000	(1c)	x 2.6500	(2c) =	126.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.2360	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							0 * 10 =		0.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000	/ (5) =	0.0000	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.2250	(18)
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2081	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.5000	4.4000	3.9000	3.8000	3.4000	3.3000	3.3000	3.5000	3.8000	3.9000	4.1000	(22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250	(22a)
Adj infilt rate	0.2341	0.2341	0.2289	0.2029	0.1977	0.1769	0.1717	0.1717	0.1821	0.1977	0.2029	0.2133	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
upvc window (Uw = 1.40)			16.1600	1.3258	21.4242			(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148			(27)
external door			2.1600	1.2000	2.5920			(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680			(28a)
BRICK TF	152.1200	21.6500	130.4700	0.2300	30.0081			(29a)
CEILING	47.6000		47.6000	0.1400	6.6640			(30)
Total net area of external elements Aum(A, m2)			242.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8711			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3702	(36)
Total fabric heat loss					(33) + (36) =		85.2413	(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	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	(38)
Heat transfer coeff	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	(39)

Average = Sum(39)m / 12 = 125.3752 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	(40)
HLP (average)												1.3170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6904 (42)
Average daily hot water use (litres/day) 98.0976 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)										Total = Sum(45)m =		1543.4579	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(46)

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

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.0200 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0908 (55)
Total storage loss

	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (56)

If cylinder contains dedicated solar storage

	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (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

	217.1008	191.5112	201.5009	181.1481	177.8929	159.4907	153.6845	167.9355	167.4183	187.8149	197.9464	212.0515 (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

	217.1008	191.5112	201.5009	181.1481	177.8929	159.4907	153.6845	167.9355	167.4183	187.8149	197.9464	212.0515 (64)

Total per year (kWh/year) = Sum(64)m = 2215.4959 (64)

Heat gains from water heating, kWh/month

	98.8696	87.7788	93.6827	86.0546	85.8330	78.8535	77.7837	82.5222	81.4894	89.1320	91.6400	97.1907 (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	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	(66)

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

	55.6104	49.3926	40.1688	30.4104	22.7321	19.1914	20.7370	26.9547	36.1786	45.9370	53.6153	57.1560 (67)

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

	370.6362	374.4823	364.7904	344.1574	318.1121	293.6331	277.2797	273.4336	283.1255	303.7584	329.8038	354.2828 (68)

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

	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330 (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)

	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171 (71)

Water heating gains (Table 5)

	132.8892	130.6232	125.9175	119.5202	115.3669	109.5188	104.5480	110.9169	113.1798	119.8011	127.2778	130.6327 (72)

Total internal gains

	666.7774	662.1396	638.5182	601.7296	563.8526	529.9848	510.2062	518.9467	540.1254	577.1381	618.3384	649.7129 (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	8.4700	11.3201	0.7200	0.7000	0.7700	33.4887	(74)
East	2.9300	21.0039	0.7200	0.7000	0.7700	21.4947	(76)
South	1.4400	49.0238	0.7200	0.7000	0.7700	24.6566	(78)
West	3.3200	21.0039	0.7200	0.7000	0.7700	24.3558	(80)
East	3.3300	21.0039	0.7200	0.7000	0.7700	24.4292	(76)

Solar gains	128.4250	245.7114	394.1628	585.9470	686.7730	767.0737	700.9713	605.5456	472.4343	295.1594	178.0867	118.2680 (83)
Total gains	795.2024	907.8511	1032.6810	1187.6766	1250.6256	1297.0584	1211.1775	1124.4924	1012.5597	872.2975	796.4251	767.9809 (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	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	
alpha	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	
util living area	0.9373	0.9148	0.8688	0.7845	0.6773	0.5144	0.4153	0.4492	0.6544	0.8337	0.9113	0.9421	(86)
Tweekday	18.5537	18.6473	18.8314	19.0373	19.1942	19.2984	19.3261	19.3227	19.2491	19.0333	18.7660	18.5318	
Tweekend	20.3977	20.4401	20.5239	20.6201	20.6965	20.7527	20.7704	20.7674	20.7227	20.6154	20.4928	20.3879	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.0705	20.1339	20.2653	20.4068	20.5316	20.6202	20.6456	20.6410	20.5670	20.4064	20.2080	20.0552	(87)
Th 2	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	(88)
util rest of house	0.9280	0.9025	0.8493	0.7520	0.6266	0.4378	0.3178	0.3488	0.5850	0.8013	0.8962	0.9334	(89)
Tweekday	18.5537	18.6473	18.8314	19.0373	19.1942	19.2984	19.3261	19.3227	19.2491	19.0333	18.7660	18.5318	
Tweekend	18.5537	18.6473	18.8314	19.0373	19.1942	19.2984	19.3261	19.3227	19.2491	19.0333	18.7660	18.5318	
MIT 2	18.5537	18.6473	18.8314	19.0373	19.1942	19.2984	19.3261	19.3227	19.2491	19.0333	18.7660	18.5318	(90)

Living area fraction fLA = Living area / (4) = 0.1863 (91)

MIT	18.8363	18.9243	19.0986	19.2925	19.4434	19.5447	19.5720	19.5683	19.4947	19.2892	19.0347	18.8157	(92)

Temperature adjustment 0.0000

adjusted MIT	18.8363	18.9243	19.0986	19.2925	19.4434	19.5447	19.5720	19.5683	19.4947	19.2892	19.0347	18.8157	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9185	0.8912	0.8352	0.7351	0.6079	0.4177	0.2949	0.3246	0.5625	0.7836	0.8839	0.9244	(94)
Useful gains	730.4297	809.0561	862.4465	873.0723	760.3098	541.7797	357.2079	365.0245	569.5998	683.5523	703.9427	709.9377	(95)
Ext temp.	4.3000	4.8000	6.6000	9.0000	11.8000	14.8000	16.6000	16.5000	14.0000	10.5000	7.1000	4.2000	(96)

Heat loss rate W

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

	1822.4954	1770.8360	1567.0099	1290.4197	958.2898	594.8669	372.6130	384.6935	688.8971	1101.9452	1496.3164	1832.4484	(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													
	812.4969	646.3160	524.1951	300.4902	147.2971	0.0000	0.0000	0.0000	0.0000	311.2843	570.5090	835.1480	(98)
Space heating												4147.7368	(98)
Space heating per m2											(98) / (4) =	43.5687	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												341.9353	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												1213.0179	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	812.4969	646.3160	524.1951	300.4902	147.2971	0.0000	0.0000	0.0000	0.0000	311.2843	570.5090	835.1480	(98)
Space heating efficiency (main heating system 1)													
	341.9353	341.9353	341.9353	341.9353	341.9353	0.0000	0.0000	0.0000	0.0000	341.9353	341.9353	341.9353	(210)
Space heating fuel (main heating system)													
	237.6171	189.0170	153.3024	87.8792	43.0775	0.0000	0.0000	0.0000	0.0000	91.0360	166.8471	244.2415	(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													
	217.1008	191.5112	201.5009	181.1481	177.8929	159.4907	153.6845	167.9355	167.4183	187.8149	197.9464	212.0515	(64)
Efficiency of water heater												199.4400	(216)
(217)m	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	(217)
Fuel for water heating, kWh/month													
	108.8552	96.0245	101.0334	90.8284	89.1962	79.9693	77.0580	84.2035	83.9442	94.1711	99.2511	106.3234	(219)
Water heating fuel used												1110.8584	(219)
Annual totals kWh/year													
Space heating fuel - main system												1213.0179	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.8050, total flow = 37.0000, SFP = 0.1839)													
mechanical ventilation fans (SFP = 0.1839)												54.5776	(230a)
Total electricity for the above, kWh/year												54.5776	(231)
Electricity for lighting (calculated in Appendix L)												392.8386	(232)
Total delivered energy for all uses												2771.2924	(238)

10a. Fuel costs - using BEDF prices (506)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1213.0179	20.4300	247.8195	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1110.8584	20.4300	226.9484	(247)
Mechanical ventilation fans	54.5776	20.4300	11.1502	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	392.8386	20.4300	80.2569	(250)
Additional standing charges			0.0000	(251)
Total energy cost			566.1750	(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	1213.0179	0.5190	629.5563	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1110.8584	0.5190	576.5355	(264)
Space and water heating			1206.0918	(265)
Pumps and fans	54.5776	0.5190	28.3258	(267)
Energy for lighting	392.8386	0.5190	203.8833	(268)
Total kg/year			1438.3008	(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	1213.0179	3.0700	3723.9648	(261)
Space heating - secondary	0.0000	3.0700	0.0000	(263)
Water heating (other fuel)	1110.8584	3.0700	3410.3352	(264)
Space and water heating			7134.3000	(265)
Pumps and fans	54.5776	3.0700	167.5531	(267)
Energy for lighting	392.8386	3.0700	1206.0147	(268)
Primary energy kWh/year			8507.8677	(272)
Primary energy kWh/m2/year			89.3684	(273)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 86

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.3	-£ 88	-223 kg (15.5%)
U Solar photovoltaic panels	+ 9.5	-£ 388	-985 kg (81.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£88	2.34 kg/m²	B 87	B 88
Solar photovoltaic panels	£388	10.34 kg/m²	A 96	A 97
Total Savings	£475	12.68 kg/m²		

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 506 TEST (30 Sep 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£566	£478	£88
Space heating	£259	£259	-£0
Water heating	£227	£139	£88
Lighting	£80	£80	£0
Generated (PV)	-£0	-£388	£388
Total cost of fuels	£566	£90	£476
Total cost of uses	£566	£90	£476
Delivered energy	29 kWh/m²	5 kWh/m²	24 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.2 tonnes	1.2 tonnes
CO2 emissions per m²	15 kg/m²	2 kg/m²	13 kg/m²
Primary energy	89 kWh/m²	14 kWh/m²	75 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.6000	(1b)	x 2.4600	(2b) =	117.0960	(1b) - (3b)
First floor	47.6000	(1c)	x 2.6500	(2c) =	126.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.2360	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							0 * 10 =		0.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.2250	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2081	(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	0.2654	0.2602	0.2550	0.2289	0.2237	0.1977	0.1977	0.1925	0.2081	0.2237	0.2341	0.2445	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.5154	0.5102	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
upvc window (Uw = 1.40)			16.1600	1.3258	21.4242			(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148			(27)
external door			2.1600	1.2000	2.5920			(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680			(28a)
BRICK TF	152.1200	21.6500	130.4700	0.2300	30.0081			(29a)
CEILING	47.6000		47.6000	0.1400	6.6640			(30)
Total net area of external elements Aum(A, m2)			242.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8711			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3702	(36)
Total fabric heat loss					(33) + (36) =		85.2413	(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	41.3668	40.9492	40.5315	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	(38)
Heat transfer coeff	126.6081	126.1905	125.7728	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	(39)
Average = Sum(39)m / 12 =												125.5790	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3299	1.3255	1.3211	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	(40)
HLP (average)												1.3191	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6904	(42)
Average daily hot water use (litres/day)	98.0976	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)										Total = Sum(45)m =		1543.4579	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(46)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Water storage loss:

Store volume	250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	2.0200	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	1.0908	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	(56)
If cylinder contains dedicated solar storage	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	217.1008	191.5112	200.1052	174.3945	165.0986	146.8840	140.6576	155.8391	162.0155	186.4192	197.9464	212.0515	(62)

Aperture area of solar collector	3.0000	(H1)
Zero-loss collector efficiency	0.7000	(H2)
Collector heat loss coefficient	1.8000	(H3)
Collector 2nd order heat loss coefficient	0.0050	(H3a)
Collector effective heat loss coefficient	1.8063	(H3b)
Collector performance ratio	2.5804	(H4)
Annual solar radiation per m2	1079.5246	(H5)
Overshading factor	0.8000	(H6)
Solar energy available	1813.6014	(H7)
Adjustment factor for showers	1.0000	(H7a)
Solar-to-load ratio	1.1750	(H8)
Utilisation factor	0.5730	(H9)
Collector performance factor	0.8793	(H10)
Dedicated solar storage volume	75.0000	(H11)
Effective solar volume	75.0000	(H13)
Daily hot water demand	98.0976	(H14)
Volume ratio Veff/V	0.7645	(H15)
Solar storage volume factor	0.9463	(H16)
Solar input	-864.7400	(H17)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar input	-25.0757	-41.8442	-71.2655	-95.5098	-117.9943	-116.0071	-114.4741	-100.0166	-78.3330	-53.4922	-29.7434	-20.9841	(63)

Solar input (sum of months) = Sum(63)m = -864.7400 (63)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from w/h	192.0250	149.6670	128.8397	78.8848	47.1043	30.8769	26.1835	55.8225	83.6824	132.9269	168.2030	191.0674	(64)

Total per year (kWh/year) = Sum(64)m = 1285.2835 (64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat gains from water heating, kWh/month	98.8696	87.7788	92.5661	80.6517	75.5975	68.7681	67.3621	72.8450	77.1671	88.0155	91.6400	97.1907	(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	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.6104	49.3926	40.1688	30.4104	22.7321	19.1914	20.7370	26.9547	36.1786	45.9370	53.6153	57.1560	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.6362	374.4823	364.7904	344.1574	318.1121	293.6331	277.2797	273.4336	283.1255	303.7584	329.8038	354.2828	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	(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)	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)
Water heating gains (Table 5)	132.8892	130.6232	124.4167	112.0162	101.6096	95.5113	90.5405	97.9099	107.1766	118.3003	127.2778	130.6327	(72)
Total internal gains	666.7774	662.1396	637.0174	594.2256	550.0953	515.9773	496.1987	505.9398	534.1222	575.6373	618.3384	649.7129	(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	8.4700	10.6334	0.7200	0.7000	0.7700	31.4571	(74)
East	2.9300	19.6403	0.7200	0.7000	0.7700	20.0992	(76)
South	1.4400	46.7521	0.7200	0.7000	0.7700	23.5140	(78)
West	3.3200	19.6403	0.7200	0.7000	0.7700	22.7745	(80)
East	3.3300	19.6403	0.7200	0.7000	0.7700	22.8431	(76)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	120.6880	227.1822	362.9204	528.2965	657.2198	679.5948	644.0361	544.8152	420.2950	265.6396	148.6197	100.5848	(83)
Total gains	787.4653	889.3218	999.9378	1122.5221	1207.3150	1195.5721	1140.2348	1050.7550	954.4172	841.2769	766.9581	750.2977	(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	20.8869	20.9560	21.0256	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	
alpha	2.3925	2.3971	2.4017	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	
util living area	0.9388	0.9174	0.8775	0.8036	0.6940	0.5573	0.4363	0.4817	0.6710	0.8405	0.9172	0.9446	(86)
Tweekday	18.5288	18.6322	18.8048	19.0126	19.1824	19.2869	19.3245	19.3188	19.2451	19.0293	18.7522	18.5225	
Tweekend	20.3905	20.4359	20.5130	20.6080	20.6903	20.7453	20.7688	20.7641	20.7199	20.6132	20.4864	20.3836	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.0594	20.1274	20.2484	20.3879	20.5220	20.6088	20.6431	20.6359	20.5626	20.4031	20.1980	20.0487	(87)
Th 2	19.8175	19.8209	19.8243	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	(88)
util rest of house	0.9296	0.9052	0.8590	0.7730	0.6445	0.4812	0.3354	0.3795	0.6010	0.8086	0.9029	0.9363	(89)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Tweekday	18.5288	18.6322	18.8048	19.0126	19.1824	19.2869	19.3245	19.3188	19.2451	19.0293	18.7522	18.5225	
Tweekend	18.5288	18.6322	18.8048	19.0126	19.1824	19.2869	19.3245	19.3188	19.2451	19.0293	18.7522	18.5225	
MIT 2	18.5288	18.6322	18.8048	19.0126	19.1824	19.2869	19.3245	19.3188	19.2451	19.0293	18.7522	18.5225	(90)
Living area fraction										fLA = Living area / (4) =		0.1863	(91)
MIT	18.8140	18.9109	19.0738	19.2689	19.4321	19.5333	19.5702	19.5642	19.4906	19.2853	19.0216	18.8069	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8140	18.9109	19.0738	19.2689	19.4321	19.5333	19.5702	19.5642	19.4906	19.2853	19.0216	18.8069	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9202	0.8940	0.8452	0.7563	0.6257	0.4601	0.3114	0.3541	0.5778	0.7910	0.8910	0.9276	(94)
Useful gains	724.6618	795.0666	845.1052	848.9247	755.4255	550.1303	355.0275	372.1241	551.4851	665.4120	683.3652	695.9556	(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	1837.5924	1768.0366	1581.4470	1300.0019	969.4086	618.5077	372.3898	396.7136	675.8450	1088.9187	1494.6745	1831.3468	(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	828.0203	653.8359	547.8384	324.7756	159.2034	0.0000	0.0000	0.0000	0.0000	315.0889	584.1427	844.7311	(98)
Space heating												4257.6363	(98)
Space heating per m2											(98) / (4) =	44.7231	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												341.9649	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												1245.0506	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	828.0203	653.8359	547.8384	324.7756	159.2034	0.0000	0.0000	0.0000	0.0000	315.0889	584.1427	844.7311	(98)
Space heating efficiency (main heating system 1)	341.9649	341.9649	341.9649	341.9649	341.9649	0.0000	0.0000	0.0000	0.0000	341.9649	341.9649	341.9649	(210)
Space heating fuel (main heating system)	242.1361	191.1997	160.2031	94.9734	46.5555	0.0000	0.0000	0.0000	0.0000	92.1407	170.8195	247.0227	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	192.0250	149.6670	128.8397	78.8848	47.1043	30.8769	26.1835	55.8225	83.6824	132.9269	168.2030	191.0674	(64)
Efficiency of water heater												199.4400	(216)
(217)m	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	(217)
Fuel for water heating, kWh/month	96.2821	75.0436	64.6008	39.5531	23.6183	15.4818	13.1285	27.9896	41.9587	66.6501	84.3376	95.8019	(219)
Water heating fuel used												644.4462	(219)
Annual totals kWh/year													
Space heating fuel - main system												1245.0506	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.8050, total flow = 37.0000, SFP = 0.1839)													
mechanical ventilation fans (SFP = 0.1839)												54.5776	(230a)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												104.5776	(231)
Electricity for lighting (calculated in Appendix L)												392.8386	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)
Total delivered energy for all uses												659.6737	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1245.0506	13.1900	164.2222	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	644.4462	13.1900	85.0025	(247)
Mechanical ventilation fans	54.5776	13.1900	7.1988	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	392.8386	13.1900	51.8154	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			87.0110	(255)

11a. SAP rating - Individual heating systems

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.2607	(257)
SAP value		96.3638	
SAP rating (Section 12)		96	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1245.0506	0.5190	646.1813	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	644.4462	0.5190	334.4676	(264)
Space and water heating			980.6489	(265)
Pumps and fans	104.5776	0.5190	54.2758	(267)
Energy for lighting	392.8386	0.5190	203.8833	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			342.3706	(272)
CO2 emissions per m2			3.6000	(273)
EI value			96.7277	
EI rating			97	(274)
EI band			A	

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.6000 (1b)	x	2.4600 (2b)	=	117.0960	(1b) - (3b)
First floor	47.6000 (1c)	x	2.6500 (2c)	=	126.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.2360	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.2250	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2081	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.5000	4.4000	3.9000	3.8000	3.4000	3.3000	3.3000	3.5000	3.8000	3.9000	4.1000	(22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250	(22a)
Adj infilt rate	0.2341	0.2341	0.2289	0.2029	0.1977	0.1769	0.1717	0.1717	0.1821	0.1977	0.2029	0.2133	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
upvc window (Uw = 1.40)			16.1600	1.3258	21.4242			(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148			(27)
external door			2.1600	1.2000	2.5920			(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680			(28a)
BRICK TF	152.1200	21.6500	130.4700	0.2300	30.0081			(29a)
CEILING	47.6000		47.6000	0.1400	6.6640			(30)
Total net area of external elements Aum(A, m2)			242.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8711			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.3702	(36)
Total fabric heat loss (33) + (36) =	85.2413	(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	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	40.1339	(38)
Heat transfer coeff	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	125.3752	(39)

Average = Sum(39)m / 12 = 125.3752 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	1.3170	(40)
HLP (average)												1.3170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6904 (42)
Average daily hot water use (litres/day)	98.0976 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)										Total = Sum(45)m =		1543.4579	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(46)

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

Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0908	(55)
Total storage loss													
	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	(56)
If cylinder contains dedicated solar storage													
	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	217.1008	191.5112	200.1052	174.3945	165.0986	146.8840	140.6576	155.8391	162.0155	186.4192	197.9464	212.0515	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1185.6484	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1991.8893	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2905	(H8)
Utilisation factor												0.5392	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.0976	(H14)
Volume ratio Veff/V												0.7645	(H15)
Solar storage volume factor												0.9463	(H16)
Solar input												-893.7371	(H17)
Solar input	-25.0655	-42.4775	-72.5740	-99.2829	-115.5881	-122.7844	-116.8179	-104.1919	-82.5374	-55.7631	-33.4717	-23.1828	(63)
									Solar input (sum of months) = Sum(63)m =			-893.7371	(63)
Output from w/h													
	192.0353	149.0338	127.5312	75.1116	49.5104	24.0997	23.8397	51.6472	79.4781	130.6561	164.4748	188.8687	(64)
									Total per year (kWh/year) = Sum(64)m =			1256.2864	(64)
Heat gains from water heating, kWh/month													
	98.8696	87.7788	92.5661	80.6517	75.5975	68.7681	67.3621	72.8450	77.1671	88.0155	91.6400	97.1907	(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	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	55.6104	49.3926	40.1688	30.4104	22.7321	19.1914	20.7370	26.9547	36.1786	45.9370	53.6153	57.1560	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	370.6362	374.4823	364.7904	344.1574	318.1121	293.6331	277.2797	273.4336	283.1255	303.7584	329.8038	354.2828	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	(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)													
	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)
Water heating gains (Table 5)													
	132.8892	130.6232	124.4167	112.0162	101.6096	95.5113	90.5405	97.9099	107.1766	118.3003	127.2778	130.6327	(72)
Total internal gains													
	666.7774	662.1396	637.0174	594.2256	550.0953	515.9773	496.1987	505.9398	534.1222	575.6373	618.3384	649.7129	(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	8.4700	11.3201	0.7200	0.7000	0.7700	33.4887	(74)
East	2.9300	21.0039	0.7200	0.7000	0.7700	21.4947	(76)
South	1.4400	49.0238	0.7200	0.7000	0.7700	24.6566	(78)
West	3.2200	21.0039	0.7200	0.7000	0.7700	24.3558	(80)
East	3.3300	21.0039	0.7200	0.7000	0.7700	24.4292	(76)

Solar gains	128.4250	245.7114	394.1628	585.9470	686.7730	767.0737	700.9713	605.5456	472.4343	295.1594	178.0867	118.2680	(83)
Total gains	795.2024	907.8511	1031.1802	1180.1726	1236.8683	1283.0510	1197.1700	1111.4854	1006.5565	870.7967	796.4251	767.9809	(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	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922	21.0922		
alpha	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061	2.4061		
util living area														
	0.9373	0.9148	0.8691	0.7864	0.6814	0.5185	0.4193	0.4533	0.6566	0.8342	0.9113	0.9421		(86)
Tweekday	18.5537	18.6473	18.8308	19.0352	19.1919	19.2976	19.3258	19.3223	19.2483	19.0328	18.7660	18.5318		
Tweekend	20.3977	20.4401	20.5237	20.6191	20.6952	20.7522	20.7701	20.7670	20.7222	20.6152	20.4928	20.3879		
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0		
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0		
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0		
MIT	20.0705	20.1339	20.2648	20.4052	20.5297	20.6194	20.6452	20.6404	20.5662	20.4060	20.2080	20.0552		(87)
Th 2	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276	19.8276		(88)
util rest of house														
	0.9280	0.9025	0.8496	0.7541	0.6307	0.4417	0.3211	0.3523	0.5873	0.8018	0.8962	0.9334		(89)

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

Tweekday	18.5537	18.6473	18.8308	19.0352	19.1919	19.2976	19.3258	19.3223	19.2483	19.0328	18.7660	18.5318	
Tweekend	18.5537	18.6473	18.8308	19.0352	19.1919	19.2976	19.3258	19.3223	19.2483	19.0328	18.7660	18.5318	
MIT 2	18.5537	18.6473	18.8308	19.0352	19.1919	19.2976	19.3258	19.3223	19.2483	19.0328	18.7660	18.5318	(90)
Living area fraction										fLA = Living area / (4) =		0.1863	(91)
MIT	18.8363	18.9243	19.0980	19.2905	19.4412	19.5439	19.5717	19.5679	19.4939	19.2887	19.0347	18.8157	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8363	18.9243	19.0980	19.2905	19.4412	19.5439	19.5717	19.5679	19.4939	19.2887	19.0347	18.8157	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9185	0.8912	0.8355	0.7372	0.6120	0.4214	0.2980	0.3280	0.5648	0.7841	0.8839	0.9244	(94)
Useful gains	730.4297	809.0561	861.5662	870.0032	757.0187	540.6492	356.8053	364.5250	568.4537	682.8181	703.9427	709.9377	(95)
Ext temp.	4.3000	4.8000	6.6000	9.0000	11.8000	14.8000	16.6000	16.5000	14.0000	10.5000	7.1000	4.2000	(96)
Heat loss rate W	1822.4954	1770.8360	1566.9393	1290.1700	958.0165	594.7662	372.5717	384.6432	688.7981	1101.8854	1496.3164	1832.4484	(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	812.4969	646.3160	524.7976	302.5201	149.5424	0.0000	0.0000	0.0000	0.0000	311.7860	570.5090	835.1480	(98)
Space heating												4153.1160	(98)
Space heating per m2											(98) / (4) =	43.6252	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												341.9353	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												1214.5910	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	812.4969	646.3160	524.7976	302.5201	149.5424	0.0000	0.0000	0.0000	0.0000	311.7860	570.5090	835.1480	(98)
Space heating efficiency (main heating system 1)	341.9353	341.9353	341.9353	341.9353	341.9353	0.0000	0.0000	0.0000	0.0000	341.9353	341.9353	341.9353	(210)
Space heating fuel (main heating system)	237.6171	189.0170	153.4786	88.4729	43.7341	0.0000	0.0000	0.0000	0.0000	91.1827	166.8471	244.2415	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	192.0353	149.0338	127.5312	75.1116	49.5104	24.0997	23.8397	51.6472	79.4781	130.6561	164.4748	188.8687	(64)
Efficiency of water heater												199.4400	(216)
(217)m	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	(217)
Fuel for water heating, kWh/month	96.2872	74.7261	63.9446	37.6612	24.8247	12.0837	11.9533	25.8961	39.8506	65.5115	82.4683	94.6995	(219)
Water heating fuel used												629.9070	(219)
Annual totals kWh/year													
Space heating fuel - main system												1214.5910	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.8050, total flow = 37.0000, SFP = 0.1839)													
mechanical ventilation fans (SFP = 0.1839)												54.5776	(230a)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												104.5776	(231)
Electricity for lighting (calculated in Appendix L)												392.8386	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1186 * 0.80) =										-1897.0374		-1897.0374	(233)
Total delivered energy for all uses												444.8768	(238)

10a. Fuel costs - using BEDF prices (506)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1214.5910	20.4300	248.1409	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	629.9070	20.4300	128.6900	(247)
Mechanical ventilation fans	54.5776	20.4300	11.1502	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	50.0000	20.4300	10.2150	(249)
Energy for lighting	392.8386	20.4300	80.2569	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1897.0374	20.4300	-387.5647	(252)
Total energy cost			90.8883	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1214.5910	0.5190	630.3727	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	629.9070	0.5190	326.9217	(264)
Space and water heating			957.2945	(265)
Pumps and fans	104.5776	0.5190	54.2758	(267)
Energy for lighting	392.8386	0.5190	203.8833	(268)
Energy saving/generation technologies				
PV Unit	-1897.0374	0.5190	-984.5624	(269)
Total kg/year			230.8910	(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	1214.5910	3.0700	3728.7945	(261)
Space heating - secondary	0.0000	3.0700	0.0000	(263)
Water heating (other fuel)	629.9070	3.0700	1933.8143	(264)
Space and water heating			5662.6088	(265)
Pumps and fans	104.5776	3.0700	321.0531	(267)
Energy for lighting	392.8386	3.0700	1206.0147	(268)
Energy saving/generation technologies				
PV Unit	-1897.0374	3.0700	-5823.9049	(269)
Primary energy kWh/year			1365.7717	(272)
Primary energy kWh/m2/year			14.3463	(273)

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

Design SAP
elmhurst energy

Property Reference	HOUSE TYPE B2	**Issued on Date**	09/11/2022
Assessment Reference	GRANT ASHP	**Prop Type Ref**	
Property			

SAP Rating	85 B	**DER**	16.31	**TER**	27.86
Environmental	86 B	**% DER<TER**	41.45		
CO_2 Emissions (t/year)	1.44	**DFEE**	54.44	**TFEE**	60.89
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.59		

Assessor Details	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com	**Assessor ID**	K559-0001
Client			

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)	27.86	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	16.31	$kgCO_2/m^2$	Pass
	-11.55 (-41.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	60.89	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.44	$kWh/m^2/yr$	
	-6.5 (-10.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Heat pump with radiators or underfloor - Electric Grant AERONA3 HPID6R32	
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 2.02 kWh/day Permitted by DBSCG 2.56	Pass
Primary pipework insulated	Yes	Pass

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	Cylinderstat	Pass
	Independent timer for DHW	Pass

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)		
Specific fan power	0.1300 0.1600 0.1600	
Maximum	0.7	Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Midlands)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	8.47 m², No overhang
Windows facing East	6.26 m², No overhang
Windows facing South	1.44 m², No overhang
Windows facing West	3.32 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		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	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)

Design SAP
elmhurst energy

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Assessor Details	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com	**Assessor ID**	K559-0001
Client			

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

Orientation	North
Property Tenure	Rented (social)
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	29.77 m	47.60 m²	2.46 m
1st Storey:	29.77 m	47.60 m²	2.65 m

7.0 Living Area	17.74	m²
8.0 Thermal Mass Parameter	Simple calculation - Low	
Thermal Mass	100.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
BRICK TF	Timber Frame	0.23	152.12	130.47

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
CEILING	External Plane Roof	0.14	47.60	47.60

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Heat Loss Floor 1	Ground Floor - Solid		0.16	42.30

12.0 Opening Types

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

Design SAP
elmhurst energy

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
upvc window	Manufacturer	Window	Double Low-E Hard 0.15			0.72		0.70	1.40
FRENCH DOOR	Manufacturer	Window	Double Low-E Hard 0.15			0.72		0.70	1.40
external door	Manufacturer	Solid Door							1.20
REAR DOOR	Manufacturer	Half Glazed Door	Double Low-E Hard 0.15			0.72		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
FRONT WINDOW	Window	[1] BRICK TF	North	None	0.00					8.47	
REAR WINDOW	Window	[1] BRICK TF	South	None	0.00					1.44	
GABLE WINDOW	Window	[1] BRICK TF	East	None	0.00					2.93	
FRONT DOOR	Solid Door	[1] BRICK TF	North							2.16	
FRENCH DOOR	Window	[1] BRICK TF	East	None	0.00					3.33	
BAY GABLE	Window	[1] BRICK TF	West	None	0.00					3.32	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	15.85	0.141	Yes	TRADA
Independently assessed	E3 Sill	14.82	0.027	Yes	TRADA
Independently assessed	E4 Jamb	37.22	0.038	Yes	TRADA
Independently assessed	E5 Ground floor (normal)	29.77	0.131	Yes	TRADA
Independently assessed	E6 Intermediate floor within a dwelling	29.77	0.094	Yes	TRADA
Independently assessed	E10 Eaves (insulation at ceiling level)	18.10	0.060	No	TRADA
Independently assessed	E12 Gable (insulation at ceiling level)	13.08	0.062	No	TRADA
Independently assessed	E16 Corner (normal)	20.44	0.058	Yes	TRADA
Independently assessed	E17 Corner (inverted – internal area greater than external area)	10.22	-0.045	No	TRADA

Y-value	0.055	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation -

	decentralised
MV Reference Number	500275
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count
0.13	In Room Fan Kitchen	1
0.16	Through Wall Fan Other Wet Room	2
0.16	In Room Fan Other Wet Room	1

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	26	
Total number of L.E.L. fittings	26	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	Yes	
Light and motion sensor	Yes	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Description	ASHP	
Percentage of Heat	100	%
Database Ref. No.	103763	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	360.0	
In Summer	332.4	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in Concrete	
Flow Temperature	36° - 45°C	
25.0 Main Heating 2	None	

Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
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	901	
Immersion Only Heating Hot Water	No	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	250.00	L
Loss	2.02	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£88	B 87	
	Typical Cost	**Typical savings per year**	**Ratings after improvement SAP rating**	**Environmental Impact**
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£388	A 96	