PREDICTED ENERGY ASSESSMENT

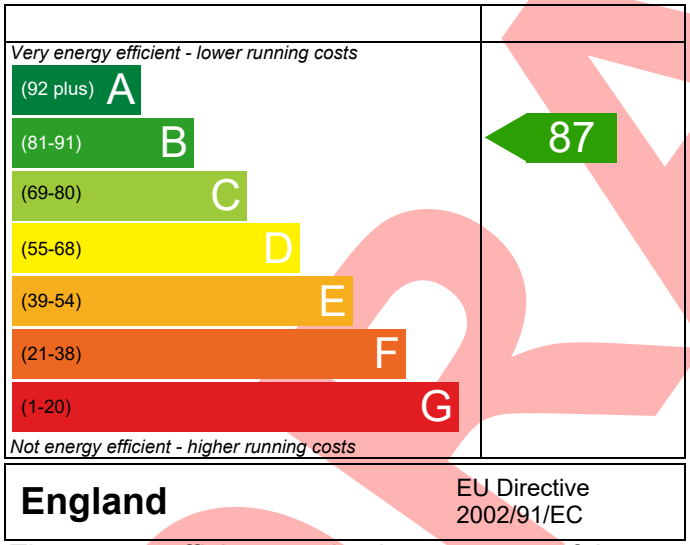
Design SAP
elmhurst energy

Dwelling type:	House, Semi-Detached
Date of assessment:	20/09/2021
Produced by:	S J Roberts Construction Limited
Total floor area:	72.26 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.

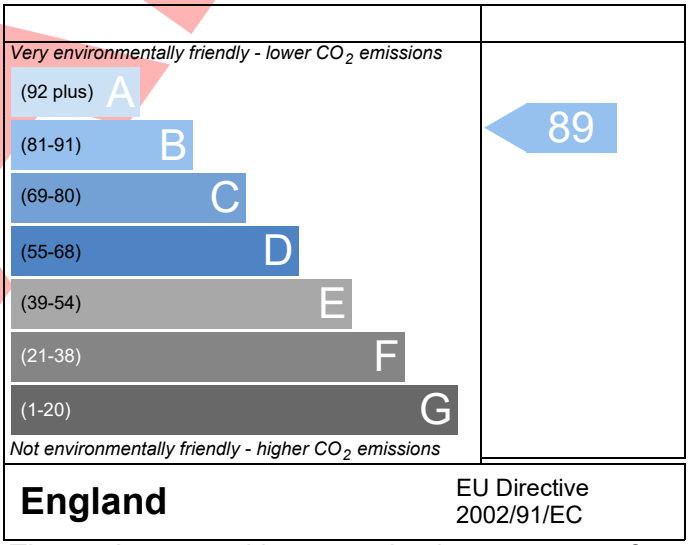
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO_2) Rating



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

This report has 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 A1	Issued on Date	20/09/2021
Assessment Reference	GRANT ASHP	Prop Type Ref	
Property			

SAP Rating	87 B	DER	15.17	TER	27.00
Environmental	89 B	% DER<TER	43.82		
CO_2 Emissions (t/year)	0.99	DFEE	46.78	TFEE	51.30
General Requirements Compliance	Pass	% DFEE<TFEE	8.80		

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)	27.00	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.17	$kgCO_2/m^2$	Pass
	-11.83 (-43.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.30	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.78	$kWh/m^2/yr$	
	-4.5 (-8.8%)	$kWh/m^2/yr$	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	1.37 (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: 1.61 kWh/day Permitted by DBSCG 2.10		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)	Slight		Pass

Based on:

Overshading	Average		
Windows facing North	4.46 m², No overhang		
Windows facing East	0.82 m², No overhang		
Windows facing South	7.15 m², No overhang		
Air change rate	5.00 ach		
Blinds/curtains	None		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	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 A1	**Issued on Date**	20/09/2021
Assessment Reference	GRANT ASHP	**Prop Type Ref**	
Property			

SAP Rating	87 B	**DER**	15.17	**TER**	27.00
Environmental	89 B	**% DER<TER**	43.82		
CO_2 Emissions (t/year)	0.99	**DFEE**	46.78	**TFEE**	51.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.80		

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

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 72 m²

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

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 27.00 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.17 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.8 kWh/m²/yrOK

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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	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

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

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

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

Secondary heating system: None

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5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG 2.10 OK
Primary pipework insulated: Yes OK

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

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

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

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

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9 Summertime temperature
Overheating risk (Midlands): Slight OK
Based on:
Overshading: Average
Windows facing North: 4.46 m², No overhang
Windows facing East: 0.82 m², No overhang
Windows facing South: 7.15 m², No overhang
Air change rate: 5.00 ach
Blinds/curtains: None

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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	36.1300 (1b)	x	2.3900 (2b)	=	86.3507	(1b) - (3b)
First floor	36.1300 (1c)	x	2.7100 (2c)	=	97.9123	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	184.2630	(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		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1913	(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	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247	(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)			9.1000	1.3258	12.0644			(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			36.1300	0.1600	5.7808			(28a)
BRICK TF	86.7500	14.5900	72.1600	0.2300	16.5968			(29a)
CEILING	36.1300		36.1300	0.1400	5.0582			(30)
Total net area of external elements Aum(A, m2)			159.0100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.5070			(33)
Party Wall 1			41.7000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7350	(36)
Total fabric heat loss					(33) + (36) =		57.2420	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	(38)
Heat transfer coeff	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	(39)
Average = Sum(39)m / 12 =												87.6454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	(40)
HLP (average)												1.2129	(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												2.2997	(42)
Average daily hot water use (litres/day)												88.8183	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.7001	94.1474	90.5947	87.0419	83.4892	79.9365	79.9365	83.4892	87.0419	90.5947	94.1474	97.7001	(44)
Energy conte	144.8865	126.7186	130.7623	114.0017	109.3874	94.3930	87.4690	100.3719	101.5707	118.3708	129.2110	140.3148	(45)
Energy content (annual)										Total = Sum(45)m =		1397.4578	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	21.7330	19.0078	19.6143	17.1003	16.4081	14.1589	13.1203	15.0558	15.2356	17.7556	19.3817	21.0472	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	195.1003	172.0730	180.9761	162.5957	159.6012	142.9870	137.6828	150.5857	150.1647	168.5846	177.8050	190.5286	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	195.1003	172.0730	180.9761	162.5957	159.6012	142.9870	137.6828	150.5857	150.1647	168.5846	177.8050	190.5286	(64)
								Total per year (kWh/year) = Sum(64)m =				1988.6848	(64)
Heat gains from water heating, kWh/month													
	88.3458	78.4175	83.6495	76.7808	76.5423	70.2609	69.2545	73.5447	72.6475	79.5293	81.8379	86.8257	(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	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.5813	16.5037	13.4217	10.1611	7.5955	6.4125	6.9289	9.0065	12.0885	15.3491	17.9146	19.0977	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	202.5132	204.6147	199.3191	188.0454	173.8144	160.4392	151.5038	149.4023	154.6979	165.9716	180.2027	193.5778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	(71)
Water heating gains (Table 5)													
	118.7443	116.6927	112.4321	106.6400	102.8795	97.5845	93.0840	98.8504	100.8992	106.8943	113.6637	116.7012	(72)
Total internal gains													
	397.3346	395.3068	382.6687	362.3422	341.7852	321.9320	309.0125	314.7550	325.1814	345.7108	369.2768	386.8725	(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	4.4600	10.6334	0.7200	0.7000	0.7700	16.5642	(74)
East	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(76)
South	3.8200	46.7521	0.7200	0.7000	0.7700	62.3775	(78)
South	3.3300	46.7521	0.7200	0.7000	0.7700	54.3762	(78)

Solar gains	138.9429	233.8712	315.4820	388.1171	435.6457	433.8249	417.6321	381.3592	340.1872	256.9786	165.8408	119.3204	(83)
Total gains	536.2775	629.1781	698.1507	750.4593	777.4309	755.7569	726.6446	696.1142	665.3686	602.6894	535.1175	506.1929	(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	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	
alpha	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	
util living area													
	0.9484	0.9236	0.8872	0.8268	0.7332	0.6037	0.4744	0.5074	0.6815	0.8448	0.9258	0.9548	(86)
Tweekday	18.6786	18.7869	18.9409	19.1205	19.2803	19.3870	19.4280	19.4233	19.3556	19.1559	18.8820	18.6490	
Tweekend	20.4209	20.4698	20.5396	20.6223	20.6985	20.7534	20.7784	20.7748	20.7352	20.6370	20.5117	20.4075	
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	20.1062	20.1798	20.2894	20.4102	20.5347	20.6213	20.6579	20.6525	20.5865	20.4398	20.2375	20.0856	(87)
Th 2	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	(88)
util rest of house													
	0.9408	0.9126	0.8705	0.7997	0.6882	0.5309	0.3747	0.4087	0.6157	0.8148	0.9132	0.9480	(89)
Tweekday	18.6786	18.7869	18.9409	19.1205	19.2803	19.3870	19.4280	19.4233	19.3556	19.1559	18.8820	18.6490	
Tweekend	18.6786	18.7869	18.9409	19.1205	19.2803	19.3870	19.4280	19.4233	19.3556	19.1559	18.8820	18.6490	
MIT 2	18.6786	18.7869	18.9409	19.1205	19.2803	19.3870	19.4280	19.4233	19.3556	19.1559	18.8820	18.6490	(90)
Living area fraction									fLA = Living area / (4) =			0.1882	(91)
MIT	18.9473	19.0491	19.1947	19.3633	19.5164	19.6193	19.6595	19.6546	19.5872	19.3976	19.1371	18.9194	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9473	19.0491	19.1947	19.3633	19.5164	19.6193	19.6595	19.6546	19.5872	19.3976	19.1371	18.9194	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9328	0.9024	0.8578	0.7841	0.6699	0.5093	0.3497	0.3833	0.5934	0.7982	0.9024	0.9407	(94)
Useful gains	500.2131	567.7584	598.8503	588.4034	520.7623	384.9175	254.1025	266.7892	394.8247	481.0549	482.9062	476.1566	(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

	1283.7680	1240.1020	1112.6320	917.0570	685.0702	439.9158	268.1478	285.2538	480.9307	771.0656	1054.9966	1290.0878	(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													
	582.9649	451.8149	382.2535	236.6306	122.2451	0.0000	0.0000	0.0000	0.0000	215.7680	411.9051	605.5649	(98)
Space heating												3009.1470	(98)
Space heating per m2											(98) / (4) =	41.6433	(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 %)												270.5523	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												1112.2237	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	582.9649	451.8149	382.2535	236.6306	122.2451	0.0000	0.0000	0.0000	0.0000	215.7680	411.9051	605.5649	(98)
Space heating efficiency (main heating system 1)													
	270.5523	270.5523	270.5523	270.5523	270.5523	0.0000	0.0000	0.0000	0.0000	270.5523	270.5523	270.5523	(210)
Space heating fuel (main heating system)													
	215.4722	166.9972	141.2864	87.4621	45.1836	0.0000	0.0000	0.0000	0.0000	79.7509	152.2460	223.8254	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	195.1003	172.0730	180.9761	162.5957	159.6012	142.9870	137.6828	150.5857	150.1647	168.5846	177.8050	190.5286	(64)
Efficiency of water heater												315.7800	(216)
(217)m	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	(217)
Fuel for water heating, kWh/month													
	61.7836	54.4914	57.3108	51.4902	50.5419	45.2806	43.6009	47.6869	47.5536	53.3867	56.3066	60.3359	(219)
Water heating fuel used												629.7691	(219)
Annual totals kWh/year													
Space heating fuel - main system												1112.2237	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.3330, total flow = 29.0000, SFP = 0.1839)													
mechanical ventilation fans (SFP = 0.1839)												41.3401	(230a)
Total electricity for the above, kWh/year												41.3401	(231)
Electricity for lighting (calculated in Appendix L)												328.1509	(232)
Total delivered energy for all uses												2111.4838	(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	1112.2237	0.5190	577.2441	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	629.7691	0.5190	326.8502	(264)
Space and water heating			904.0943	(265)
Pumps and fans	41.3401	0.5190	21.4555	(267)
Energy for lighting	328.1509	0.5190	170.3103	(268)
Total CO2, kg/year			1095.8601	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1700	(273)

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

DER		15.1700	ZC1
Total Floor Area	TFA	72.2600	
Assumed number of occupants	N	2.2997	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6074	ZC2
CO2 emissions from cooking, equation (L16)		2.4106	ZC3
Total CO2 emissions		34.1880	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.1880	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	36.1300 (1b)	x	2.3900 (2b)	=	86.3507	(1b) - (3b)
First floor	36.1300 (1c)	x	2.7100 (2c)	=	97.9123	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	184.2630	(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) =	0.1628	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4128	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3509	(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	0.4474	0.4386	0.4298	0.3860	0.3772	0.3333	0.3333	0.3246	0.3509	0.3772	0.3948	0.4123	(22b)
Effective ac	0.6001	0.5962	0.5924	0.5745	0.5711	0.5556	0.5556	0.5527	0.5616	0.5711	0.5779	0.5850	(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)			12.4300	1.3258	16.4792			(27)
Heat Loss Floor 1			36.1300	0.1300	4.6969			(28a)
BRICK TF	86.7500	14.5900	72.1600	0.1800	12.9888			(29a)
CEILING	36.1300		36.1300	0.1300	4.6969			(30)
Total net area of external elements Aum(A, m2)			159.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.0218			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2648	(36)
Total fabric heat loss (33) + (36) =	50.2866	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	36.4887	36.2524	36.0208	34.9329	34.7293	33.7818	33.7818	33.6063	34.1468	34.7293	35.1411	35.5716	(38)
Heat transfer coeff	86.7753	86.5390	86.3073	85.2194	85.0159	84.0683	84.0683	83.8929	84.4333	85.0159	85.4277	85.8581	(39)
Average = Sum(39)m / 12 =												85.2185	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2009	1.1976	1.1944	1.1793	1.1765	1.1634	1.1634	1.1610	1.1685	1.1765	1.1822	1.1882	(40)
HLP (average)												1.1793	(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	2.2997	(42)
Average daily hot water use (litres/day)	88.8183	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.7001	94.1474	90.5947	87.0419	83.4892	79.9365	79.9365	83.4892	87.0419	90.5947	94.1474	97.7001	(44)
Energy conte	144.8865	126.7186	130.7623	114.0017	109.3874	94.3930	87.4690	100.3719	101.5707	118.3708	129.2110	140.3148	(45)
Energy content (annual)										Total = Sum(45)m =		1397.4578	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7330	19.0078	19.6143	17.1003	16.4081	14.1589	13.1203	15.0558	15.2356	17.7556	19.3817	21.0472	(46)

Water storage loss:		
Store volume	180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5520	(48)
Temperature factor from Table 2b	0.5400	(49)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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													
	194.1292	171.1959	180.0050	161.6559	158.6300	142.0472	136.7116	149.6146	149.2249	167.6135	176.8652	189.5575	(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													
	194.1292	171.1959	180.0050	161.6559	158.6300	142.0472	136.7116	149.6146	149.2249	167.6135	176.8652	189.5575	(64)
								Total per year (kWh/year) = Sum(64)m =				1977.2505	(64)
Heat gains from water heating, kWh/month													
	87.5689	77.7157	82.8726	76.0289	75.7654	69.5090	68.4776	72.7678	71.8956	78.7524	81.0860	86.0488	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.5813	16.5037	13.4217	10.1611	7.5955	6.4125	6.9289	9.0065	12.0885	15.3491	17.9146	19.0977	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	202.5132	204.6147	199.3191	188.0454	173.8144	160.4392	151.5038	149.4023	154.6979	165.9716	180.2027	193.5778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	(71)
Water heating gains (Table 5)													
	117.7001	115.6484	111.3879	105.5957	101.8353	96.5403	92.0397	97.8062	99.8550	105.8501	112.6195	115.6570	(72)
Total internal gains													
	399.2904	397.2626	384.6245	364.2980	343.7410	323.8878	310.9682	316.7108	327.1372	347.6665	371.2325	388.8283	(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	4.4600	10.6334	0.6300	0.7000	0.7700	14.4937	(74)
East	0.8200	19.6403	0.6300	0.7000	0.7700	4.9219	(76)
South	7.1500	46.7521	0.6300	0.7000	0.7700	102.1595	(78)

Solar gains	121.5751	204.6373	276.0468	339.6024	381.1900	379.5968	365.4281	333.6893	297.6638	224.8563	145.1107	104.4054	(83)
Total gains	520.8654	601.8999	660.6712	703.9004	724.9309	703.4846	676.3963	650.4001	624.8010	572.5228	516.3432	493.2336	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.8282	57.9861	58.1417	58.8839	59.0249	59.6902	59.6902	59.8150	59.4322	59.0249	58.7404	58.4459	
alpha	4.8552	4.8657	4.8761	4.9256	4.9350	4.9793	4.9793	4.9877	4.9621	4.9350	4.9160	4.8964	
util living area													
	0.9955	0.9904	0.9785	0.9460	0.8654	0.7056	0.5343	0.5747	0.8019	0.9553	0.9905	0.9966	(86)
MIT	19.8016	19.9728	20.2200	20.5278	20.7888	20.9460	20.9889	20.9842	20.8943	20.5638	20.1265	19.7727	(87)
Th 2	19.9193	19.9219	19.9245	19.9366	19.9388	19.9494	19.9494	19.9513	19.9453	19.9388	19.9342	19.9295	(88)
util rest of house													
	0.9941	0.9872	0.9712	0.9264	0.8169	0.6126	0.4132	0.4530	0.7217	0.9351	0.9868	0.9954	(89)
MIT 2	18.3395	18.5899	18.9482	19.3905	19.7338	19.9137	19.9454	19.9450	19.8645	19.4490	18.8236	18.3046	(90)
Living area fraction									fLA = Living area / (4) =			0.1882	(91)
MIT	18.6147	18.8502	19.1876	19.6045	19.9323	20.1080	20.1418	20.1406	20.0583	19.6588	19.0688	18.5809	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6147	18.8502	19.1876	19.6045	19.9323	20.1080	20.1418	20.1406	20.0583	19.6588	19.0688	18.5809	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9914	0.9827	0.9644	0.9188	0.8166	0.6277	0.4360	0.4758	0.7314	0.9283	0.9825	0.9933	(94)
Useful gains	516.3910	591.5161	637.1595	646.7787	591.9478	441.5628	294.9294	309.4714	456.9670	531.4518	507.2942	489.9051	(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													
	1242.1591	1207.2357	1095.0303	912.2319	699.8803	463.0488	297.7526	313.8115	503.0779	770.1433	1022.4678	1234.7153	(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													
	539.9714	413.7636	340.6559	191.1263	80.3017	0.0000	0.0000	0.0000	0.0000	177.5865	370.9250	554.1387	(98)
Space heating												2668.4691	(98)
Space heating per m2											(98) / (4) =	36.9287	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2853.9777	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	539.9714	413.7636	340.6559	191.1263	80.3017	0.0000	0.0000	0.0000	0.0000	177.5865	370.9250	554.1387	(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)													
	577.5096	442.5279	364.3378	204.4132	85.8842	0.0000	0.0000	0.0000	0.0000	189.9321	396.7112	592.6617	(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													
	194.1292	171.1959	180.0050	161.6559	158.6300	142.0472	136.7116	149.6146	149.2249	167.6135	176.8652	189.5575	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.4009	87.0827	86.4906	85.2614	83.1022	79.8000	79.8000	79.8000	79.8000	84.9681	86.7446	87.5092	(217)
Fuel for water heating, kWh/month													
	222.1134	196.5900	208.1208	189.6004	190.8856	178.0040	171.3179	187.4870	186.9986	197.2664	203.8918	216.6142	(219)
Water heating fuel used												2348.8901	(219)
Annual totals kWh/year													
Space heating fuel - main system												2853.9777	(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)												328.1509	(232)
Total delivered energy for all uses												5606.0187	(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	2853.9777	0.2160	616.4592	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2348.8901	0.2160	507.3603	(264)
Space and water heating			1123.8195	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	328.1509	0.5190	170.3103	(268)
Total CO2, kg/m2/year			1333.0548	(272)
Emissions per m2 for space and water heating			15.5524	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.3569	(272b)
Emissions per m2 for pumps and fans			0.5387	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5524 * 1.55) + 2.3569 + 0.5387, rounded to 2 d.p.			27.0000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	36.1300 (1b)	x	2.3900 (2b)	=	86.3507	(1b) - (3b)
First floor	36.1300 (1c)	x	2.7100 (2c)	=	97.9123	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	184.2630	(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) =	0.1628	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3878	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3296	(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	0.4203	0.4120	0.4038	0.3626	0.3544	0.3132	0.3132	0.3049	0.3296	0.3544	0.3708	0.3873	(22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5688	0.5750	(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)			9.1000	1.3258	12.0644			(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			36.1300	0.1600	5.7808			(28a)
BRICK TF	86.7500	14.5900	72.1600	0.2300	16.5968			(29a)
CEILING	36.1300		36.1300	0.1400	5.0582			(30)
Total net area of external elements Aum(A, m2)			159.0100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.5070			(33)
Party Wall 1			41.7000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7350	(36)
Total fabric heat loss (33) + (36) =	57.2420	(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	35.7740	35.5654	35.3610	34.4009	34.2212	33.3850	33.3850	33.2301	33.7071	34.2212	34.5846	34.9646	(38)
Heat transfer coeff	93.0159	92.8074	92.6030	91.6428	91.4632	90.6269	90.6269	90.4721	90.9490	91.4632	91.8266	92.2065	(39)
Average = Sum(39)m / 12 =												91.6420	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2872	1.2844	1.2815	1.2682	1.2658	1.2542	1.2542	1.2520	1.2586	1.2658	1.2708	1.2760	(40)
HLP (average)												1.2682	(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	2.2997 (42)
Average daily hot water use (litres/day)	88.8183 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.7001	94.1474	90.5947	87.0419	83.4892	79.9365	79.9365	83.4892	87.0419	90.5947	94.1474	97.7001	(44)
Energy conte	144.8865	126.7186	130.7623	114.0017	109.3874	94.3930	87.4690	100.3719	101.5707	118.3708	129.2110	140.3148	(45)
Energy content (annual)										Total = Sum(45)m =		1397.4578	(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													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	30.7884	26.9277	27.7870	24.2254	23.2448	20.0585	18.5872	21.3290	21.5838	25.1538	27.4573	29.8169	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.5813	16.5037	13.4217	10.1611	7.5955	6.4125	6.9289	9.0065	12.0885	15.3491	17.9146	19.0977	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	202.5132	204.6147	199.3191	188.0454	173.8144	160.4392	151.5038	149.4023	154.6979	165.9716	180.2027	193.5778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	(71)
Water heating gains (Table 5)													
	41.3822	40.0710	37.3481	33.6463	31.2430	27.8590	24.9827	28.6681	29.9775	33.8089	38.1352	40.0765	(72)
Total internal gains													
	319.9725	318.6852	307.5847	289.3486	270.1487	252.2065	240.9112	244.5726	254.2596	272.6254	293.7483	310.2477	(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	4.4600	10.6334	0.7200	0.7000	0.7700	16.5642	(74)
East	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(76)
South	3.8200	46.7521	0.7200	0.7000	0.7700	62.3775	(78)
South	3.3300	46.7521	0.7200	0.7000	0.7700	54.3762	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	138.9429	233.8712	315.4820	388.1171	435.6457	433.8249	417.6321	381.3592	340.1872	256.9786	165.8408	119.3204	(83)
Total gains	458.9154	552.5564	623.0667	677.4657	705.7944	686.0314	658.5433	625.9318	594.4468	529.6040	459.5890	429.5682	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.5793	21.6278	21.6756	21.9027	21.9457	22.1482	22.1482	22.1861	22.0697	21.9457	21.8588	21.7688	
alpha	2.4386	2.4419	2.4450	2.4602	2.4630	2.4765	2.4765	2.4791	2.4713	2.4630	2.4573	2.4513	
util living area													
	0.9634	0.9426	0.9117	0.8585	0.7741	0.6505	0.5220	0.5581	0.7309	0.8794	0.9464	0.9685	(86)
MIT	18.3773	18.7005	19.1682	19.7477	20.2768	20.6808	20.8687	20.8403	20.5400	19.8459	19.0032	18.3158	(87)
Th 2	19.8508	19.8531	19.8553	19.8658	19.8678	19.8769	19.8769	19.8786	19.8734	19.8678	19.8638	19.8597	(88)
util rest of house													
	0.9576	0.9337	0.8975	0.8341	0.7311	0.5762	0.4142	0.4528	0.6666	0.8535	0.9366	0.9635	(89)
MIT 2	17.4741	17.7934	18.2532	18.8211	19.3186	19.6790	19.8191	19.8038	19.5664	18.9272	18.1039	17.4195	(90)
Living area fraction									fLA = Living area / (4) =			0.1882	(91)
MIT	17.6441	17.9642	18.4254	18.9955	19.4990	19.8676	20.0167	19.9989	19.7496	19.1001	18.2731	17.5882	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6441	17.9642	18.4254	18.9955	19.4990	19.8676	20.0167	19.9989	19.7496	19.1001	18.2731	17.5882	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9424	0.9144	0.8751	0.8115	0.7150	0.5755	0.4287	0.4651	0.6584	0.8316	0.9182	0.9496	(94)
Useful gains	432.4962	505.2545	545.2315	549.7546	504.6417	394.8340	282.3486	291.1435	391.4015	440.4146	421.9844	407.9394	(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													
	1241.2151	1212.4497	1104.3279	925.1762	713.3188	477.3828	309.6426	325.5987	513.8276	777.4488	1025.9909	1234.4793	(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													
	601.6868	475.2351	415.9677	270.3036	155.2558	0.0000	0.0000	0.0000	0.0000	250.7534	434.8847	614.9457	(98)
Space heating												3219.0328	(98)
Space heating per m2										(98) / (4) =		44.5479	(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	851.8932	670.6393	687.5878	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7268	0.7923	0.7711	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	619.1523	531.3350	530.1650	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	887.5123	853.6639	817.0097	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)

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Space cooling kWh
              0.0000     0.0000     0.0000     0.0000     0.0000   193.2192   239.8127   213.4124     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                          646.4443 (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    48.3048    59.9532    53.3531     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          161.6111 (107)
Space cooling per m2                                                                                                                     2.2365 (108)
Energy for space heating                                                                                                                44.5479 (99)
Energy for space cooling                                                                                                                 2.2365 (108)
Total                                                                                                                                   46.7844 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   46.8 (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	36.1300 (1b)	x	2.3900 (2b)	=	86.3507	(1b) - (3b)
First floor	36.1300 (1c)	x	2.7100 (2c)	=	97.9123	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	184.2630	(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) =	0.1628	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4128	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3509	(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	0.4474	0.4386	0.4298	0.3860	0.3772	0.3333	0.3333	0.3246	0.3509	0.3772	0.3948	0.4123	(22b)
Effective ac	0.6001	0.5962	0.5924	0.5745	0.5711	0.5556	0.5556	0.5527	0.5616	0.5711	0.5779	0.5850	(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)			12.4300	1.3258	16.4792			(27)
Heat Loss Floor 1			36.1300	0.1300	4.6969			(28a)
BRICK TF	86.7500	14.5900	72.1600	0.1800	12.9888			(29a)
CEILING	36.1300		36.1300	0.1300	4.6969			(30)
Total net area of external elements Aum(A, m2)			159.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.0218			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2648	(36)
Total fabric heat loss					(33) + (36) =		50.2866	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	36.4887	36.2524	36.0208	34.9329	34.7293	33.7818	33.7818	33.6063	34.1468	34.7293	35.1411	35.5716	(38)
Heat transfer coeff	86.7753	86.5390	86.3073	85.2194	85.0159	84.0683	84.0683	83.8929	84.4333	85.0159	85.4277	85.8581	(39)
Average = Sum(39)m / 12 =												85.2185	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2009	1.1976	1.1944	1.1793	1.1765	1.1634	1.1634	1.1610	1.1685	1.1765	1.1822	1.1882	(40)
HLP (average)												1.1793	(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												2.2997	(42)
Average daily hot water use (litres/day)												88.8183	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.7001	94.1474	90.5947	87.0419	83.4892	79.9365	79.9365	83.4892	87.0419	90.5947	94.1474	97.7001	(44)
Energy conte	144.8865	126.7186	130.7623	114.0017	109.3874	94.3930	87.4690	100.3719	101.5707	118.3708	129.2110	140.3148	(45)
Energy content (annual)										Total = Sum(45)m =		1397.4578	(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													
	30.7884	26.9277	27.7870	24.2254	23.2448	20.0585	18.5872	21.3290	21.5838	25.1538	27.4573	29.8169	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	114.9859	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.5813	16.5037	13.4217	10.1611	7.5955	6.4125	6.9289	9.0065	12.0885	15.3491	17.9146	19.0977	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	202.5132	204.6147	199.3191	188.0454	173.8144	160.4392	151.5038	149.4023	154.6979	165.9716	180.2027	193.5778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	34.4986	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	(71)
Water heating gains (Table 5)													
	41.3822	40.0710	37.3481	33.6463	31.2430	27.8590	24.9827	28.6681	29.9775	33.8089	38.1352	40.0765	(72)
Total internal gains													
	319.9725	318.6852	307.5847	289.3486	270.1487	252.2065	240.9112	244.5726	254.2596	272.6254	293.7483	310.2477	(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	4.4600	10.6334	0.6300	0.7000	0.7700	14.4937	(74)
East	0.8200	19.6403	0.6300	0.7000	0.7700	4.9219	(76)
South	7.1500	46.7521	0.6300	0.7000	0.7700	102.1595	(78)

Solar gains	121.5751	204.6373	276.0468	339.6024	381.1900	379.5968	365.4281	333.6893	297.6638	224.8563	145.1107	104.4054	(83)
Total gains	441.5475	523.3225	583.6314	628.9511	651.3387	631.8033	606.3393	578.2619	551.9234	497.4817	438.8589	414.6531	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.8282	57.9861	58.1417	58.8839	59.0249	59.6902	59.6902	59.8150	59.4322	59.0249	58.7404	58.4459	
alpha	4.8552	4.8657	4.8761	4.9256	4.9350	4.9793	4.9793	4.9877	4.9621	4.9350	4.9160	4.8964	
util living area													
	0.9978	0.9947	0.9869	0.9639	0.9009	0.7596	0.5886	0.6349	0.8539	0.9735	0.9953	0.9984	(86)
MIT	19.7012	19.8754	20.1291	20.4507	20.7364	20.9246	20.9832	20.9757	20.8559	20.4828	20.0301	19.6726	(87)
Th 2	19.9193	19.9219	19.9245	19.9366	19.9388	19.9494	19.9494	19.9513	19.9453	19.9388	19.9342	19.9295	(88)
util rest of house													
	0.9971	0.9928	0.9822	0.9497	0.8602	0.6684	0.4589	0.5059	0.7826	0.9603	0.9933	0.9979	(89)
MIT 2	18.7409	18.9163	19.1697	19.4929	19.7576	19.9138	19.9450	19.9443	19.8655	19.5298	19.0808	18.7204	(90)
Living area fraction									fLA = Living area / (4) =			0.1882	(91)
MIT	18.9216	19.0969	19.3503	19.6731	19.9418	20.1040	20.1404	20.1385	20.0519	19.7092	19.2595	18.8996	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9216	19.0969	19.3503	19.6731	19.9418	20.1040	20.1404	20.1385	20.0519	19.7092	19.2595	18.8996	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9909	0.9788	0.9453	0.8604	0.6832	0.4835	0.5303	0.7910	0.9566	0.9916	0.9971	(94)
Useful gains	439.8319	518.5667	571.2652	594.5517	560.3821	431.6276	293.1919	306.6643	436.5778	475.8907	435.1689	413.4553	(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													
	1268.7938	1228.5807	1109.0753	918.0811	700.6825	462.7163	297.6379	313.6299	502.5385	774.4268	1038.7568	1262.0814	(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													
	616.7476	477.1294	400.1307	232.9412	104.3835	0.0000	0.0000	0.0000	0.0000	222.1108	434.5833	631.3778	(98)
Space heating												3119.4044	(98)
Space heating per m2											(98) / (4) =	43.1692	(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	790.2425	622.1058	637.5859	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8497	0.9158	0.8974	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	671.5016	569.7468	572.1853	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	824.1287	792.6462	761.2916	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	109.8915	165.8372	140.6951	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												416.4238	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	27.4729	41.4593	35.1738	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												104.1060 (107)
Space cooling per m2												1.4407 (108)
Energy for space heating												43.1692 (99)
Energy for space cooling												1.4407 (108)
Total												44.6099 (109)
Target Fabric Energy Efficiency (TFEE)												51.3 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	36.1300 (1b)	x	2.3900 (2b)	=	86.3507	(1b) - (3b)
First floor	36.1300 (1c)	x	2.7100 (2c)	=	97.9123	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	184.2630	(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		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1913	(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	0.2152	0.2152	0.2104	0.1865	0.1817	0.1626	0.1578	0.1578	0.1673	0.1817	0.1865	0.1960	(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)			9.1000	1.3258	12.0644			(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			36.1300	0.1600	5.7808			(28a)
BRICK TF	86.7500	14.5900	72.1600	0.2300	16.5968			(29a)
CEILING	36.1300		36.1300	0.1400	5.0582			(30)
Total net area of external elements Aum(A, m2)			159.0100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.5070			(33)
Party Wall 1			41.7000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7350	(36)
Total fabric heat loss					(33) + (36) =		57.2420	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	(38)
Heat transfer coeff	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	(39)
Average = Sum(39)m / 12 =												87.6454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	(40)
HLP (average)												1.2129	(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												2.2997	(42)
Average daily hot water use (litres/day)												88.8183	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.7001	94.1474	90.5947	87.0419	83.4892	79.9365	79.9365	83.4892	87.0419	90.5947	94.1474	97.7001	(44)
Energy conte	144.8865	126.7186	130.7623	114.0017	109.3874	94.3930	87.4690	100.3719	101.5707	118.3708	129.2110	140.3148	(45)
Energy content (annual)										Total = Sum(45)m =		1397.4578	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.7330	19.0078	19.6143	17.1003	16.4081	14.1589	13.1203	15.0558	15.2356	17.7556	19.3817	21.0472	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	195.1003	172.0730	180.9761	162.5957	159.6012	142.9870	137.6828	150.5857	150.1647	168.5846	177.8050	190.5286	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	195.1003	172.0730	180.9761	162.5957	159.6012	142.9870	137.6828	150.5857	150.1647	168.5846	177.8050	190.5286	(64)
									Total per year (kWh/year) = Sum(64)m =			1988.6848	(64)
RHI water heating demand												1989	(64)
Heat gains from water heating, kWh/month													
	88.3458	78.4175	83.6495	76.7808	76.5423	70.2609	69.2545	73.5447	72.6475	79.5293	81.8379	86.8257	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.4532	41.2593	33.5543	25.4028	18.9889	16.0312	17.3223	22.5162	30.2211	38.3727	44.7866	47.7442	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	302.2585	305.3950	297.4912	280.6648	259.4244	239.4615	226.1251	222.9886	230.8925	247.7189	268.9592	288.9221	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	(71)
Water heating gains (Table 5)													
	118.7443	116.6927	112.4321	106.6400	102.8795	97.5845	93.0840	98.8504	100.8992	106.8943	113.6637	116.7012	(72)
Total internal gains													
	564.5484	560.4394	540.5700	509.7999	478.3852	450.1697	433.6237	441.4475	459.1052	490.0782	524.5019	550.4600	(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	4.4600	11.3201	0.7200	0.7000	0.7700	17.6340	(74)
East	0.8200	21.0039	0.7200	0.7000	0.7700	6.0156	(76)
South	3.8200	49.0238	0.7200	0.7000	0.7700	65.4085	(78)
South	3.3300	49.0238	0.7200	0.7000	0.7700	57.0184	(78)

Solar gains	146.0764	249.5629	337.9229	425.4926	451.3749	486.2894	451.1007	419.4983	377.3422	281.6019	196.2460	138.6839	(83)
Total gains	710.6249	810.0023	878.4929	935.2925	929.7601	936.4591	884.7244	860.9459	836.4474	771.6801	720.7478	689.1439	(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	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	
alpha	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	
util living area													
	0.9101	0.8793	0.8313	0.7571	0.6638	0.5081	0.4040	0.4212	0.5991	0.7763	0.8714	0.9161	(86)
Tweekday	18.7970	18.8904	19.0401	19.1968	19.3208	19.4091	19.4332	19.4315	19.3799	19.2189	18.9933	18.7763	
Tweekend	20.4749	20.5176	20.5864	20.6600	20.7204	20.7679	20.7833	20.7819	20.7504	20.6687	20.5635	20.4654	
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	20.1896	20.2538	20.3617	20.4691	20.5685	20.6436	20.6656	20.6635	20.6103	20.4888	20.3185	20.1750	(87)
Th 2	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	(88)
util rest of house													
	0.8981	0.8638	0.8092	0.7243	0.6153	0.4364	0.3144	0.3311	0.5331	0.7398	0.8522	0.9048	(89)
Tweekday	18.7970	18.8904	19.0401	19.1968	19.3208	19.4091	19.4332	19.4315	19.3799	19.2189	18.9933	18.7763	
Tweekend	18.7970	18.8904	19.0401	19.1968	19.3208	19.4091	19.4332	19.4315	19.3799	19.2189	18.9933	18.7763	
MIT 2	18.7970	18.8904	19.0401	19.1968	19.3208	19.4091	19.4332	19.4315	19.3799	19.2189	18.9933	18.7763	(90)
Living area fraction									fLA = Living area / (4) =			0.1882	(91)
MIT	19.0591	19.1470	19.2888	19.4363	19.5557	19.6414	19.6652	19.6634	19.6115	19.4579	19.2427	19.0396	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0591	19.1470	19.2888	19.4363	19.5557	19.6414	19.6652	19.6634	19.6115	19.4579	19.2427	19.0396	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8872	0.8514	0.7950	0.7084	0.5979	0.4174	0.2931	0.3093	0.5132	0.7226	0.8386	0.8943	(94)
Useful gains	630.4363	689.6104	698.3835	662.5904	555.8580	390.8782	259.3024	266.3241	429.2425	557.6253	604.4304	616.2926	(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												
	1293.5693	1257.4464	1112.1151	914.6898	679.7472	424.3285	268.6486	277.2571	491.8215	785.1184	1064.2490	1300.6180 (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												
	493.3709	381.5858	307.8163	181.5115	92.1736	0.0000	0.0000	0.0000	0.0000	169.2549	331.0694	509.1381 (98)
Space heating												2465.9206 (98)
RHI space heating demand												2466 (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	36.1300	(1b)	x 2.3900	(2b) =	86.3507	(1b) - (3b)
First floor	36.1300	(1c)	x 2.7100	(2c) =	97.9123	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	184.2630	(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		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1913	(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	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247	(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)			9.1000	1.3258	12.0644			(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			36.1300	0.1600	5.7808			(28a)
BRICK TF	86.7500	14.5900	72.1600	0.2300	16.5968			(29a)
CEILING	36.1300		36.1300	0.1400	5.0582			(30)
Total net area of external elements Aum(A, m2)			159.0100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.5070			(33)
Party Wall 1			41.7000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7350	(36)
Total fabric heat loss						(33) + (36) =	57.2420	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	(38)
Heat transfer coeff	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	(39)
Average = Sum(39)m / 12 =												87.6454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	(40)
HLP (average)												1.2129	(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												2.2997	(42)
Average daily hot water use (litres/day)												88.8183	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.7001	94.1474	90.5947	87.0419	83.4892	79.9365	79.9365	83.4892	87.0419	90.5947	94.1474	97.7001	(44)
Energy conte	144.8865	126.7186	130.7623	114.0017	109.3874	94.3930	87.4690	100.3719	101.5707	118.3708	129.2110	140.3148	(45)
Energy content (annual)										Total = Sum(45)m =		1397.4578	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	21.7330	19.0078	19.6143	17.1003	16.4081	14.1589	13.1203	15.0558	15.2356	17.7556	19.3817	21.0472	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	195.1003	172.0730	180.9761	162.5957	159.6012	142.9870	137.6828	150.5857	150.1647	168.5846	177.8050	190.5286	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	195.1003	172.0730	180.9761	162.5957	159.6012	142.9870	137.6828	150.5857	150.1647	168.5846	177.8050	190.5286	(64)
									Total per year (kWh/year) = Sum(64)m =			1988.6848	(64)
Heat gains from water heating, kWh/month													
	88.3458	78.4175	83.6495	76.7808	76.5423	70.2609	69.2545	73.5447	72.6475	79.5293	81.8379	86.8257	(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	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.4532	41.2593	33.5543	25.4028	18.9889	16.0312	17.3223	22.5162	30.2211	38.3727	44.7866	47.7442	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	302.2585	305.3950	297.4912	280.6648	259.4244	239.4615	226.1251	222.9886	230.8925	247.7189	268.9592	288.9221	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	(71)
Water heating gains (Table 5)													
	118.7443	116.6927	112.4321	106.6400	102.8795	97.5845	93.0840	98.8504	100.8992	106.8943	113.6637	116.7012	(72)
Total internal gains													
	564.5484	560.4394	540.5700	509.7999	478.3852	450.1697	433.6237	441.4475	459.1052	490.0782	524.5019	550.4600	(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	4.4600	10.6334	0.7200	0.7000	0.7700	16.5642	(74)
East	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(76)
South	3.8200	46.7521	0.7200	0.7000	0.7700	62.3775	(78)
South	3.3300	46.7521	0.7200	0.7000	0.7700	54.3762	(78)

Solar gains	138.9429	233.8712	315.4820	388.1171	435.6457	433.8249	417.6321	381.3592	340.1872	256.9786	165.8408	119.3204	(83)
Total gains	703.4914	794.3106	856.0520	897.9170	914.0309	883.9946	851.2558	822.8067	799.2924	747.0568	690.3426	669.7804	(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	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	
alpha	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	
util living area													
	0.9118	0.8821	0.8400	0.7732	0.6743	0.5426	0.4173	0.4452	0.6112	0.7836	0.8807	0.9206	(86)
Tweekday	18.7925	18.8882	19.0235	19.1789	19.3137	19.4007	19.4323	19.4291	19.3779	19.2155	18.9766	18.7637	
Tweekend	20.4728	20.5165	20.5786	20.6511	20.7166	20.7626	20.7825	20.7799	20.7489	20.6668	20.5557	20.4597	
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	20.1864	20.2522	20.3496	20.4553	20.5627	20.6353	20.6643	20.6604	20.6079	20.4858	20.3063	20.1661	(87)
Th 2	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	(88)
util rest of house													
	0.8999	0.8668	0.8188	0.7417	0.6266	0.4714	0.3256	0.3537	0.5441	0.7473	0.8626	0.9098	(89)
Tweekday	18.7925	18.8882	19.0235	19.1789	19.3137	19.4007	19.4323	19.4291	19.3779	19.2155	18.9766	18.7637	
Tweekend	18.7925	18.8882	19.0235	19.1789	19.3137	19.4007	19.4323	19.4291	19.3779	19.2155	18.9766	18.7637	
MIT 2	18.7925	18.8882	19.0235	19.1789	19.3137	19.4007	19.4323	19.4291	19.3779	19.2155	18.9766	18.7637	(90)
Living area fraction									fLA = Living area / (4) =			0.1882	(91)
MIT	19.0549	19.1449	19.2731	19.4191	19.5488	19.6331	19.6642	19.6608	19.6094	19.4545	19.2269	19.0277	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0549	19.1449	19.2731	19.4191	19.5488	19.6331	19.6642	19.6608	19.6094	19.4545	19.2269	19.0277	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8891	0.8544	0.8047	0.7259	0.6092	0.4518	0.3036	0.3313	0.5236	0.7300	0.8493	0.8995	(94)
Useful gains	625.4933	678.6760	688.8947	651.7561	556.7972	399.3685	258.4251	272.5872	418.4899	545.3238	586.3166	602.4757	(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

	1293.1957	1248.5014	1119.5003	921.9539	687.9099	441.1237	268.5635	285.7970	482.8765	776.0599	1062.8646	1299.5754 (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												
	496.7706	382.9226	320.3706	194.5424	97.5479	0.0000	0.0000	0.0000	0.0000	171.6677	343.1146	518.6422 (98)
Space heating												2525.5786 (98)
Space heating per m2											(98) / (4) =	34.9513 (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 %)												270.5523	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												933.4900	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	496.7706	382.9226	320.3706	194.5424	97.5479	0.0000	0.0000	0.0000	0.0000	171.6677	343.1146	518.6422	(98)
Space heating efficiency (main heating system 1)													
	270.5523	270.5523	270.5523	270.5523	270.5523	0.0000	0.0000	0.0000	0.0000	270.5523	270.5523	270.5523	(210)
Space heating fuel (main heating system)													
	183.6135	141.5337	118.4136	71.9056	36.0551	0.0000	0.0000	0.0000	0.0000	63.4508	126.8201	191.6976	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	195.1003	172.0730	180.9761	162.5957	159.6012	142.9870	137.6828	150.5857	150.1647	168.5846	177.8050	190.5286	(64)
Efficiency of water heater												315.7800	(216)
(217)m	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	(217)
Fuel for water heating, kWh/month													
	61.7836	54.4914	57.3108	51.4902	50.5419	45.2806	43.6009	47.6869	47.5536	53.3867	56.3066	60.3359	(219)
Water heating fuel used												629.7691	(219)
Annual totals kWh/year													
Space heating fuel - main system												933.4900	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.3330, total flow = 29.0000, SFP = 0.1839)													
mechanical ventilation fans (SFP = 0.1839)												41.3401	(230a)
Total electricity for the above, kWh/year												41.3401	(231)
Electricity for lighting (calculated in Appendix L)												328.1509	(232)
Total delivered energy for all uses												1932.7501	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	933.4900	13.1900	123.1273	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	629.7691	13.1900	83.0665	(247)
Mechanical ventilation fans	41.3401	13.1900	5.4528	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	328.1509	13.1900	43.2831	(250)
Additional standing charges			0.0000	(251)
Total energy cost			254.9297	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9131	(257)
SAP value		87.2622	
SAP rating (Section 12)		87	(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	933.4900	0.5190	484.4813	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	629.7691	0.5190	326.8502	(264)
Space and water heating			811.3314	(265)
Pumps and fans	41.3401	0.5190	21.4555	(267)
Energy for lighting	328.1509	0.5190	170.3103	(268)
Total kg/year			1003.0973	(272)
CO2 emissions per m2			13.8800	(273)
EI value			88.5370	
EI rating			89	(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) / 2.7055 = 5.936, stars = 3
Main heating environmental impact	0.519 × (1 + 0.29 × 0.75) / 2.7055 = 0.2336, stars = 4
Water heating energy efficiency	13.19 / 3.1578 = 4.177, stars = 4
Water heating environmental impact	0.519 / 3.1578 = 0.1644, stars = 5

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	36.1300	(1b)	x 2.3900	(2b) =	86.3507	(1b) - (3b)
First floor	36.1300	(1c)	x 2.7100	(2c) =	97.9123	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	184.2630	(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		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1913	(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	0.2152	0.2152	0.2104	0.1865	0.1817	0.1626	0.1578	0.1578	0.1673	0.1817	0.1865	0.1960	(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)			9.1000	1.3258	12.0644			(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			36.1300	0.1600	5.7808			(28a)
BRICK TF	86.7500	14.5900	72.1600	0.2300	16.5968			(29a)
CEILING	36.1300		36.1300	0.1400	5.0582			(30)
Total net area of external elements Aum(A, m2)			159.0100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.5070			(33)
Party Wall 1			41.7000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7350	(36)
Total fabric heat loss						(33) + (36) =	57.2420	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	(38)
Heat transfer coeff	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	(39)
Average = Sum(39)m / 12 =												87.6454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	(40)
HLP (average)												1.2129	(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												2.2997	(42)
Average daily hot water use (litres/day)												88.8183	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.7001	94.1474	90.5947	87.0419	83.4892	79.9365	79.9365	83.4892	87.0419	90.5947	94.1474	97.7001	(44)
Energy conte	144.8865	126.7186	130.7623	114.0017	109.3874	94.3930	87.4690	100.3719	101.5707	118.3708	129.2110	140.3148	(45)
Energy content (annual)										Total = Sum(45)m =		1397.4578	(45)
Distribution loss (46)m = 0.15 x (45)m													

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

	21.7330	19.0078	19.6143	17.1003	16.4081	14.1589	13.1203	15.0558	15.2356	17.7556	19.3817	21.0472	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	195.1003	172.0730	180.9761	162.5957	159.6012	142.9870	137.6828	150.5857	150.1647	168.5846	177.8050	190.5286	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	195.1003	172.0730	180.9761	162.5957	159.6012	142.9870	137.6828	150.5857	150.1647	168.5846	177.8050	190.5286	(64)
									Total per year (kWh/year) = Sum(64)m =			1988.6848	(64)
Heat gains from water heating, kWh/month													
	88.3458	78.4175	83.6495	76.7808	76.5423	70.2609	69.2545	73.5447	72.6475	79.5293	81.8379	86.8257	(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	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.4532	41.2593	33.5543	25.4028	18.9889	16.0312	17.3223	22.5162	30.2211	38.3727	44.7866	47.7442	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	302.2585	305.3950	297.4912	280.6648	259.4244	239.4615	226.1251	222.9886	230.8925	247.7189	268.9592	288.9221	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	(71)
Water heating gains (Table 5)													
	118.7443	116.6927	112.4321	106.6400	102.8795	97.5845	93.0840	98.8504	100.8992	106.8943	113.6637	116.7012	(72)
Total internal gains													
	564.5484	560.4394	540.5700	509.7999	478.3852	450.1697	433.6237	441.4475	459.1052	490.0782	524.5019	550.4600	(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	4.4600	11.3201	0.7200	0.7000	0.7700	17.6340	(74)
East	0.8200	21.0039	0.7200	0.7000	0.7700	6.0156	(76)
South	3.8200	49.0238	0.7200	0.7000	0.7700	65.4085	(78)
South	3.3300	49.0238	0.7200	0.7000	0.7700	57.0184	(78)

Solar gains	146.0764	249.5629	337.9229	425.4926	451.3749	486.2894	451.1007	419.4983	377.3422	281.6019	196.2460	138.6839	(83)
Total gains	710.6249	810.0023	878.4929	935.2925	929.7601	936.4591	884.7244	860.9459	836.4474	771.6801	720.7478	689.1439	(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	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	
alpha	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	
util living area													
	0.9101	0.8793	0.8313	0.7571	0.6638	0.5081	0.4040	0.4212	0.5991	0.7763	0.8714	0.9161	(86)
Tweekday	18.7970	18.8904	19.0401	19.1968	19.3208	19.4091	19.4332	19.4315	19.3799	19.2189	18.9933	18.7763	
Tweekend	20.4749	20.5176	20.5864	20.6600	20.7204	20.7679	20.7833	20.7819	20.7504	20.6687	20.5635	20.4654	
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	20.1896	20.2538	20.3617	20.4691	20.5685	20.6436	20.6656	20.6635	20.6103	20.4888	20.3185	20.1750	(87)
Th 2	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	(88)
util rest of house													
	0.8981	0.8638	0.8092	0.7243	0.6153	0.4364	0.3144	0.3311	0.5331	0.7398	0.8522	0.9048	(89)
Tweekday	18.7970	18.8904	19.0401	19.1968	19.3208	19.4091	19.4332	19.4315	19.3799	19.2189	18.9933	18.7763	
Tweekend	18.7970	18.8904	19.0401	19.1968	19.3208	19.4091	19.4332	19.4315	19.3799	19.2189	18.9933	18.7763	
MIT 2	18.7970	18.8904	19.0401	19.1968	19.3208	19.4091	19.4332	19.4315	19.3799	19.2189	18.9933	18.7763	(90)
Living area fraction										fLA = Living area / (4) =		0.1882	(91)
MIT	19.0591	19.1470	19.2888	19.4363	19.5557	19.6414	19.6652	19.6634	19.6115	19.4579	19.2427	19.0396	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0591	19.1470	19.2888	19.4363	19.5557	19.6414	19.6652	19.6634	19.6115	19.4579	19.2427	19.0396	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8872	0.8514	0.7950	0.7084	0.5979	0.4174	0.2931	0.3093	0.5132	0.7226	0.8386	0.8943	(94)
Useful gains	630.4363	689.6104	698.3835	662.5904	555.8580	390.8782	259.3024	266.3241	429.2425	557.6253	604.4304	616.2926	(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

	1293.5693	1257.4464	1112.1151	914.6898	679.7472	424.3285	268.6486	277.2571	491.8215	785.1184	1064.2490	1300.6180 (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												
	493.3709	381.5858	307.8163	181.5115	92.1736	0.0000	0.0000	0.0000	0.0000	169.2549	331.0694	509.1381 (98)
Space heating												2465.9206 (98)
Space heating per m2											(98) / (4) =	34.1257 (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 %)												270.5523	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												911.4395	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	493.3709	381.5858	307.8163	181.5115	92.1736	0.0000	0.0000	0.0000	0.0000	169.2549	331.0694	509.1381	(98)
Space heating efficiency (main heating system 1)													
	270.5523	270.5523	270.5523	270.5523	270.5523	0.0000	0.0000	0.0000	0.0000	270.5523	270.5523	270.5523	(210)
Space heating fuel (main heating system)													
	182.3569	141.0396	113.7733	67.0893	34.0687	0.0000	0.0000	0.0000	0.0000	62.5590	122.3680	188.1847	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	195.1003	172.0730	180.9761	162.5957	159.6012	142.9870	137.6828	150.5857	150.1647	168.5846	177.8050	190.5286	(64)
Efficiency of water heater												315.7800	(216)
(217)m	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	(217)
Fuel for water heating, kWh/month													
	61.7836	54.4914	57.3108	51.4902	50.5419	45.2806	43.6009	47.6869	47.5536	53.3867	56.3066	60.3359	(219)
Water heating fuel used												629.7691	(219)
Annual totals kWh/year													
Space heating fuel - main system												911.4395	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.3330, total flow = 29.0000, SFP = 0.1839)													
mechanical ventilation fans (SFP = 0.1839)												41.3401	(230a)
Total electricity for the above, kWh/year												41.3401	(231)
Electricity for lighting (calculated in Appendix L)												328.1509	(232)
Total delivered energy for all uses												1910.6996	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	911.4395	20.4300	186.2071	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	629.7691	20.4300	128.6618	(247)
Mechanical ventilation fans	41.3401	20.4300	8.4458	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	328.1509	20.4300	67.0412	(250)
Additional standing charges			0.0000	(251)
Total energy cost			390.3559	(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	911.4395	0.5190	473.0371	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	629.7691	0.5190	326.8502	(264)
Space and water heating			799.8873	(265)
Pumps and fans	41.3401	0.5190	21.4555	(267)
Energy for lighting	328.1509	0.5190	170.3103	(268)
Total kg/year			991.6531	(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	911.4395	3.0700	2798.1192	(261)
Space heating - secondary	0.0000	3.0700	0.0000	(263)
Water heating (other fuel)	629.7691	3.0700	1933.3911	(264)
Space and water heating			4731.5103	(265)
Pumps and fans	41.3401	3.0700	126.9141	(267)
Energy for lighting	328.1509	3.0700	1007.4233	(268)
Primary energy kWh/year			5865.8478	(272)
Primary energy kWh/m2/year			81.1770	(273)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(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	+ 1.5	-£ 49	-124 kg (12.5%)
U Solar photovoltaic panels	+ 11.4	-£ 388	-985 kg (113.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£49	1.72 kg/m²	B 89	B 90
Solar photovoltaic panels	£388	13.63 kg/m²	A 100	A 100
Total Savings	£436	15.34 kg/m²		

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

Fuel prices for cost data on this page from database revision number 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	£390	£341	£49
Space heating	£195	£195	-£0
Water heating	£129	£79	£49
Lighting	£67	£67	£0
Generated (PV)	-£0	-£388	£388
Total cost of fuels	£390	-£47	£437
Total cost of uses	£391	-£47	£437
Delivered energy	26 kWh/m²	-3 kWh/m²	30 kWh/m²
Carbon dioxide emissions	1.0 tonnes	-0.1 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	-2 kg/m²	15 kg/m²
Primary energy	81 kWh/m²	-10 kWh/m²	91 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	36.1300	(1b)	x 2.3900	(2b) =	86.3507	(1b) - (3b)
First floor	36.1300	(1c)	x 2.7100	(2c) =	97.9123	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	184.2630	(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		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1913	(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	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247	(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)			9.1000	1.3258	12.0644			(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			36.1300	0.1600	5.7808			(28a)
BRICK TF	86.7500	14.5900	72.1600	0.2300	16.5968			(29a)
CEILING	36.1300		36.1300	0.1400	5.0582			(30)
Total net area of external elements Aum(A, m2)			159.0100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.5070			(33)
Party Wall 1			41.7000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7350	(36)
Total fabric heat loss (33) + (36) =	57.2420	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	(38)
Heat transfer coeff	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	(39)
Average = Sum(39)m / 12 =												87.6454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	(40)
HLP (average)												1.2129	(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	2.2997	(42)
Average daily hot water use (litres/day)	88.8183	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.7001	94.1474	90.5947	87.0419	83.4892	79.9365	79.9365	83.4892	87.0419	90.5947	94.1474	97.7001	(44)
Energy conte	144.8865	126.7186	130.7623	114.0017	109.3874	94.3930	87.4690	100.3719	101.5707	118.3708	129.2110	140.3148	(45)
Energy content (annual)										Total = Sum(45)m =		1397.4578	(45)

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

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	21.7330	19.0078	19.6143	17.1003	16.4081	14.1589	13.1203	15.0558	15.2356	17.7556	19.3817	21.0472	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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													
	195.1003	172.0730	179.5803	155.8421	146.8069	130.3803	124.6558	138.4893	144.7618	167.1889	177.8050	190.5286	(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												1.2978	(H8)
Utilisation factor												0.5372	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												88.8183	(H14)
Volume ratio Veff/V												0.8444	(H15)
Solar storage volume factor												0.9662	(H16)
Solar input												-827.7520	(H17)
Solar input	-24.0032	-40.0544	-68.2172	-91.4245	-112.9472	-111.0451	-109.5776	-95.7385	-74.9824	-51.2042	-28.4712	-20.0865	(63)
								Solar input (sum of months) = Sum(63)m =				-827.7520	(63)
Output from w/h													
	171.0971	132.0187	111.3632	64.4177	33.8596	19.3352	15.0782	42.7508	69.7794	115.9847	149.3338	170.4421	(64)
								Total per year (kWh/year) = Sum(64)m =				1095.4604	(64)
Heat gains from water heating, kWh/month													
	88.3458	78.4175	82.5329	71.3779	66.3069	60.1755	58.8329	63.8675	68.3252	78.4128	81.8379	86.8257	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.4532	41.2593	33.5543	25.4028	18.9889	16.0312	17.3223	22.5162	30.2211	38.3727	44.7866	47.7442	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	302.2585	305.3950	297.4912	280.6648	259.4244	239.4615	226.1251	222.9886	230.8925	247.7189	268.9592	288.9221	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	(71)
Water heating gains (Table 5)													
	118.7443	116.6927	110.9313	99.1360	89.1222	83.5771	79.0765	85.8435	94.8960	105.3935	113.6637	116.7012	(72)
Total internal gains													
	564.5484	560.4394	539.0692	502.2959	464.6278	436.1622	419.6163	428.4406	453.1020	488.5774	524.5019	550.4600	(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	4.4600	10.6334	0.7200	0.7000	0.7700	16.5642	(74)
East	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(76)
South	3.8200	46.7521	0.7200	0.7000	0.7700	62.3775	(78)
South	3.3300	46.7521	0.7200	0.7000	0.7700	54.3762	(78)

Solar gains	138.9429	233.8712	315.4820	388.1171	435.6457	433.8249	417.6321	381.3592	340.1872	256.9786	165.8408	119.3204	(83)
Total gains	703.4914	794.3106	854.5512	890.4130	900.2735	869.9871	837.2484	809.7998	793.2892	745.5560	690.3426	669.7804	(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	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	
alpha	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	
util living area													
	0.9118	0.8821	0.8405	0.7759	0.6800	0.5488	0.4231	0.4509	0.6142	0.7842	0.8807	0.9206	(86)
Tweekday	18.7925	18.8882	19.0228	19.1763	19.3108	19.3994	19.4319	19.4286	19.3771	19.2149	18.9766	18.7637	
Tweekend	20.4728	20.5165	20.5782	20.6498	20.7150	20.7617	20.7821	20.7795	20.7484	20.6665	20.5557	20.4597	
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	20.1864	20.2522	20.3491	20.4532	20.5602	20.6340	20.6637	20.6597	20.6071	20.4854	20.3063	20.1661	(87)
Th 2	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	(88)
util rest of house													
	0.8999	0.8668	0.8193	0.7446	0.6325	0.4774	0.3305	0.3587	0.5470	0.7480	0.8626	0.9098	(89)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Tweekday	18.7925	18.8882	19.0228	19.1763	19.3108	19.3994	19.4319	19.4286	19.3771	19.2149	18.9766	18.7637	
Tweekend	18.7925	18.8882	19.0228	19.1763	19.3108	19.3994	19.4319	19.4286	19.3771	19.2149	18.9766	18.7637	
MIT 2	18.7925	18.8882	19.0228	19.1763	19.3108	19.3994	19.4319	19.4286	19.3771	19.2149	18.9766	18.7637	(90)
Living area fraction										fLA = Living area / (4) =		0.1882	(91)
MIT	19.0549	19.1449	19.2724	19.4166	19.5459	19.6318	19.6638	19.6603	19.6086	19.4540	19.2269	19.0277	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0549	19.1449	19.2724	19.4166	19.5459	19.6318	19.6638	19.6603	19.6086	19.4540	19.2269	19.0277	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8891	0.8544	0.8052	0.7287	0.6149	0.4575	0.3082	0.3360	0.5264	0.7306	0.8493	0.8995	(94)
Useful gains	625.4933	678.6760	688.1168	648.8670	553.6061	398.0301	258.0278	272.1037	417.6057	544.7388	586.3166	602.4757	(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	1293.1957	1248.5014	1119.4409	921.7303	687.6583	441.0116	268.5251	285.7515	482.8036	776.0144	1062.8646	1299.5754	(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	496.7706	382.9226	320.9051	196.4616	99.7348	0.0000	0.0000	0.0000	0.0000	172.0690	343.1146	518.6422	(98)
Space heating												2530.6206	(98)
Space heating per m2											(98) / (4) =	35.0210	(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 %)	270.5523	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	935.3535	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	496.7706	382.9226	320.9051	196.4616	99.7348	0.0000	0.0000	0.0000	0.0000	172.0690	343.1146	518.6422	(98)
Space heating efficiency (main heating system 1)	270.5523	270.5523	270.5523	270.5523	270.5523	0.0000	0.0000	0.0000	0.0000	270.5523	270.5523	270.5523	(210)
Space heating fuel (main heating system)	183.6135	141.5337	118.6111	72.6150	36.8634	0.0000	0.0000	0.0000	0.0000	63.5992	126.8201	191.6976	(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	171.0971	132.0187	111.3632	64.4177	33.8596	19.3352	15.0782	42.7508	69.7794	115.9847	149.3338	170.4421	(64)
Efficiency of water heater												315.7800	(216)
(217)m	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	(217)
Fuel for water heating, kWh/month	54.1824	41.8072	35.2661	20.3995	10.7225	6.1230	4.7749	13.5382	22.0975	36.7296	47.2905	53.9749	(219)
Water heating fuel used												346.9062	(219)
Annual totals kWh/year													
Space heating fuel - main system												935.3535	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.3330, total flow = 29.0000, SFP = 0.1839)													
mechanical ventilation fans (SFP = 0.1839)												41.3401	(230a)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												91.3401	(231)
Electricity for lighting (calculated in Appendix L)												328.1509	(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												-25.4886	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	935.3535	13.1900	123.3731	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	346.9062	13.1900	45.7569	(247)
Mechanical ventilation fans	41.3401	13.1900	5.4528	(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	328.1509	13.1900	43.2831	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			-3.3619	(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] =	-0.0120	(257)
SAP value		100.1680	
SAP rating (Section 12)		100	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	935.3535	0.5190	485.4485	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	346.9062	0.5190	180.0443	(264)
Space and water heating			665.4928	(265)
Pumps and fans	91.3401	0.5190	47.4055	(267)
Energy for lighting	328.1509	0.5190	170.3103	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			-13.2286	(272)
CO2 emissions per m2			-0.1800	(273)
EI value			100.1512	
EI rating			100	(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	36.1300	(1b)	x 2.3900	(2b) =	86.3507	(1b) - (3b)
First floor	36.1300	(1c)	x 2.7100	(2c) =	97.9123	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	184.2630	(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		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1913	(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	0.2152	0.2152	0.2104	0.1865	0.1817	0.1626	0.1578	0.1578	0.1673	0.1817	0.1865	0.1960	(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)			9.1000	1.3258	12.0644			(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			36.1300	0.1600	5.7808			(28a)
BRICK TF	86.7500	14.5900	72.1600	0.2300	16.5968			(29a)
CEILING	36.1300		36.1300	0.1400	5.0582			(30)
Total net area of external elements Aum(A, m2)			159.0100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.5070			(33)
Party Wall 1			41.7000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7350	(36)
Total fabric heat loss (33) + (36) =	57.2420	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	30.4034	(38)
Heat transfer coeff	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	87.6454	(39)
Average = Sum(39)m / 12 =												87.6454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	1.2129	(40)
HLP (average)												1.2129	(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	2.2997 (42)
Average daily hot water use (litres/day)	88.8183 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.7001	94.1474	90.5947	87.0419	83.4892	79.9365	79.9365	83.4892	87.0419	90.5947	94.1474	97.7001	(44)
Energy conte	144.8865	126.7186	130.7623	114.0017	109.3874	94.3930	87.4690	100.3719	101.5707	118.3708	129.2110	140.3148	(45)
Energy content (annual)										Total = Sum(45)m =		1397.4578	(45)

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

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

	21.7330	19.0078	19.6143	17.1003	16.4081	14.1589	13.1203	15.0558	15.2356	17.7556	19.3817	21.0472	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage													
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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													
	195.1003	172.0730	179.5803	155.8421	146.8069	130.3803	124.6558	138.4893	144.7618	167.1889	177.8050	190.5286	(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												1.4254	(H8)
Utilisation factor												0.5042	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												88.8183	(H14)
Volume ratio Veff/V												0.8444	(H15)
Solar storage volume factor												0.9662	(H16)
Solar input												-853.2098	(H17)
Solar input	-23.9289	-40.5513	-69.2831	-94.7809	-110.3467	-117.2166	-111.5207	-99.4672	-78.7946	-53.2345	-31.9539	-22.1315	(63)
								Solar input (sum of months) = Sum(63)m =				-853.2098	(63)
Output from w/h													
	171.1714	131.5218	110.2973	61.0613	36.4602	13.1637	13.1351	39.0221	65.9672	113.9544	145.8512	168.3971	(64)
								Total per year (kWh/year) = Sum(64)m =				1070.0027	(64)
Heat gains from water heating, kWh/month													
	88.3458	78.4175	82.5329	71.3779	66.3069	60.1755	58.8329	63.8675	68.3252	78.4128	81.8379	86.8257	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	137.9831	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.4532	41.2593	33.5543	25.4028	18.9889	16.0312	17.3223	22.5162	30.2211	38.3727	44.7866	47.7442	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	302.2585	305.3950	297.4912	280.6648	259.4244	239.4615	226.1251	222.9886	230.8925	247.7189	268.9592	288.9221	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	51.0980	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	-91.9887	(71)
Water heating gains (Table 5)													
	118.7443	116.6927	110.9313	99.1360	89.1222	83.5771	79.0765	85.8435	94.8960	105.3935	113.6637	116.7012	(72)
Total internal gains													
	564.5484	560.4394	539.0692	502.2959	464.6278	436.1622	419.6163	428.4406	453.1020	488.5774	524.5019	550.4600	(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	4.4600	11.3201	0.7200	0.7000	0.7700	17.6340	(74)
East	0.8200	21.0039	0.7200	0.7000	0.7700	6.0156	(76)
South	3.8200	49.0238	0.7200	0.7000	0.7700	65.4085	(78)
South	3.3300	49.0238	0.7200	0.7000	0.7700	57.0184	(78)

Solar gains	146.0764	249.5629	337.9229	425.4926	451.3749	486.2894	451.1007	419.4983	377.3422	281.6019	196.2460	138.6839	(83)
Total gains	710.6249	810.0023	876.9921	927.7885	916.0028	922.4516	870.7169	847.9389	830.4442	770.1793	720.7478	689.1439	(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	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	22.9016	
alpha	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	2.5268	
util living area													
	0.9101	0.8793	0.8318	0.7598	0.6695	0.5139	0.4095	0.4266	0.6019	0.7770	0.8714	0.9161	(86)
Tweekday	18.7970	18.8904	19.0394	19.1943	19.3180	19.4081	19.4329	19.4311	19.3792	19.2184	18.9933	18.7763	
Tweekend	20.4749	20.5176	20.5861	20.6587	20.7188	20.7672	20.7830	20.7816	20.7499	20.6685	20.5635	20.4654	
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	20.1896	20.2538	20.3612	20.4671	20.5661	20.6425	20.6651	20.6629	20.6095	20.4883	20.3185	20.1750	(87)
Th 2	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	19.9097	(88)
util rest of house													
	0.8981	0.8638	0.8097	0.7272	0.6211	0.4418	0.3190	0.3356	0.5359	0.7405	0.8522	0.9048	(89)

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

Tweekday	18.7970	18.8904	19.0394	19.1943	19.3180	19.4081	19.4329	19.4311	19.3792	19.2184	18.9933	18.7763	
Tweekend	18.7970	18.8904	19.0394	19.1943	19.3180	19.4081	19.4329	19.4311	19.3792	19.2184	18.9933	18.7763	
MIT 2	18.7970	18.8904	19.0394	19.1943	19.3180	19.4081	19.4329	19.4311	19.3792	19.2184	18.9933	18.7763	(90)
Living area fraction											fLA = Living area / (4) =	0.1882	(91)
MIT	19.0591	19.1470	19.2882	19.4339	19.5529	19.6404	19.6648	19.6630	19.6107	19.4574	19.2427	19.0396	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0591	19.1470	19.2882	19.4339	19.5529	19.6404	19.6648	19.6630	19.6107	19.4574	19.2427	19.0396	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8872	0.8514	0.7955	0.7113	0.6035	0.4226	0.2974	0.3136	0.5159	0.7233	0.8386	0.8943	(94)
Useful gains	630.4363	689.6104	697.6330	659.8997	552.8388	389.8262	258.9470	265.9340	428.4101	557.0574	604.4304	616.2926	(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	1293.5693	1257.4464	1112.0577	914.4815	679.5089	424.2395	268.6141	277.2198	491.7530	785.0742	1064.2490	1300.6180	(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	493.3709	381.5858	308.3320	183.2989	94.2425	0.0000	0.0000	0.0000	0.0000	169.6445	331.0694	509.1381	(98)
Space heating												2470.6821	(98)
Space heating per m2											(98) / (4) =	34.1916	(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 %)												270.5523	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												913.1994	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	493.3709	381.5858	308.3320	183.2989	94.2425	0.0000	0.0000	0.0000	0.0000	169.6445	331.0694	509.1381	(98)
Space heating efficiency (main heating system 1)	270.5523	270.5523	270.5523	270.5523	270.5523	0.0000	0.0000	0.0000	0.0000	270.5523	270.5523	270.5523	(210)
Space heating fuel (main heating system)	182.3569	141.0396	113.9639	67.7499	34.8334	0.0000	0.0000	0.0000	0.0000	62.7030	122.3680	188.1847	(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	171.1714	131.5218	110.2973	61.0613	36.4602	13.1637	13.1351	39.0221	65.9672	113.9544	145.8512	168.3971	(64)
Efficiency of water heater												315.7800	(216)
(217)m	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	315.7800	(217)
Fuel for water heating, kWh/month	54.2059	41.6498	34.9285	19.3366	11.5461	4.1686	4.1596	12.3574	20.8902	36.0867	46.1876	53.3273	(219)
Water heating fuel used												338.8443	(219)
Annual totals kWh/year													
Space heating fuel - main system												913.1994	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.3330, total flow = 29.0000, SFP = 0.1839)													
mechanical ventilation fans (SFP = 0.1839)												41.3401	(230a)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												91.3401	(231)
Electricity for lighting (calculated in Appendix L)												328.1509	(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												-225.5026	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	913.1994	20.4300	186.5666	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	338.8443	20.4300	69.2259	(247)
Mechanical ventilation fans	41.3401	20.4300	8.4458	(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	328.1509	20.4300	67.0412	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1897.0374	20.4300	-387.5647	(252)
Total energy cost			-46.0702	(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	913.1994	0.5190	473.9505	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	338.8443	0.5190	175.8602	(264)
Space and water heating			649.8107	(265)
Pumps and fans	91.3401	0.5190	47.4055	(267)
Energy for lighting	328.1509	0.5190	170.3103	(268)
Energy saving/generation technologies				
PV Unit	-1897.0374	0.5190	-984.5624	(269)
Total kg/year			-117.0359	(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	913.1994	3.0700	2803.5222	(261)
Space heating - secondary	0.0000	3.0700	0.0000	(263)
Water heating (other fuel)	338.8443	3.0700	1040.2521	(264)
Space and water heating			3843.7744	(265)
Pumps and fans	91.3401	3.0700	280.4141	(267)
Energy for lighting	328.1509	3.0700	1007.4233	(268)
Energy saving/generation technologies				
PV Unit	-1897.0374	3.0700	-5823.9049	(269)
Primary energy kWh/year			-692.2931	(272)
Primary energy kWh/m2/year			-9.5806	(273)

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

Design SAP
elmhurst energy

Property Reference	HOUSE TYPE A1	**Issued on Date**	20/09/2021
Assessment Reference	GRANT ASHP	**Prop Type Ref**	
Property			

SAP Rating	87 B	**DER**	15.17	**TER**	27.00
Environmental	89 B	**% DER<TER**	43.82		
CO_2 Emissions (t/year)	0.99	**DFEE**	46.78	**TFEE**	51.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.80		

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)	27.00	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.17	$kgCO_2/m^2$	Pass
	-11.83 (-43.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.30	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.78	$kWh/m^2/yr$	
	-4.5 (-8.8%)	$kWh/m^2/yr$	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	1.37 (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: 1.61 kWh/day Permitted by DBSCG 2.10	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)	Slight	Pass

Based on:

Overshading	Average
Windows facing North	4.46 m², No overhang
Windows facing East	0.82 m², No overhang
Windows facing South	7.15 m², No overhang
Air change rate	5.00 ach
Blinds/curtains	None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	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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General Requirements Compliance	Pass	**% DFEE<TFEE**	8.80		

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, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.01 m	36.13 m²	2.39 m
1st Storey:	17.01 m	36.13 m²	2.71 m

7.0 Living Area	13.60	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	86.75	72.16

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall 1	Filled Cavity with Edge Sealing		0.00	41.70

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
CEILING	External Plane Roof	0.14	36.13	36.13

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Heat Loss Floor 1	Ground Floor - Solid		0.16	36.13

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					4.46	
REAR WINDOW	Window	[1] BRICK TF	South	None	0.00					3.82	
GABLE WINDOW	Window	[1] BRICK TF	East	None	0.00					0.82	
FRONT DOOR	Solid Door	[1] BRICK TF	North							2.16	
FRENCH DOOR	Window	[1] BRICK TF	South	None	0.00					3.33	

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)	9.99	0.141	Yes	TRADA
Independently assessed	E3 Sill	8.97	0.027	Yes	TRADA
Independently assessed	E4 Jamb	25.52	0.038	Yes	TRADA
Independently assessed	E5 Ground floor (normal)	17.01	0.131	Yes	TRADA
Independently assessed	E6 Intermediate floor within a dwelling	17.01	0.094	Yes	TRADA
Independently assessed	E10 Eaves (insulation at ceiling level)	6.84	0.060	No	TRADA
Independently assessed	E12 Gable (insulation at ceiling level)	10.18	0.062	No	TRADA
Independently assessed	E16 Corner (normal)	10.20	0.058	Yes	TRADA
Independently assessed	E18 Party wall between dwellings	10.20	0.034	Yes	TRADA
Independently assessed	P1 Party wall - Ground floor	8.84	0.119	No	TRADA
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.84	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.84	0.142	No	TRADA

Y-value	0.068	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	No
Night Ventilation	No
Air change rate	5.00

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	In Room Fan Other Wet Room	1
0.16	Through Wall 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	18	
Total number of L.E.L. fittings	18	
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	284.8	
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	180.00	L
Loss	1.61	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	£49	B 89	
	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 100	