

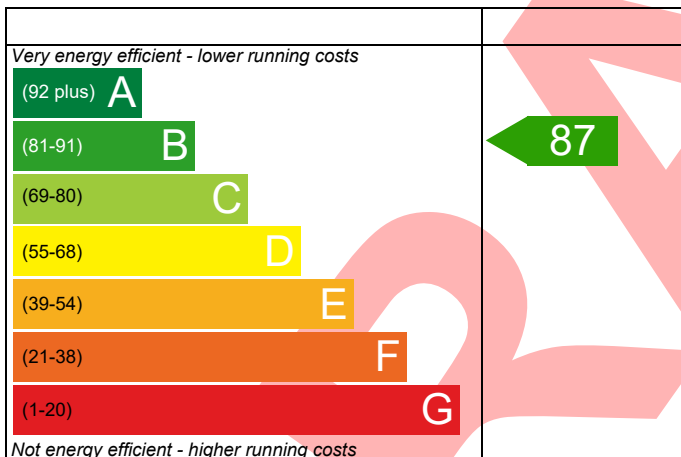
PREDICTED ENERGY ASSESSMENT

Dwelling type: Bungalow, Semi-Detached
 Date of assessment: 09/11/2022
 Produced by: S J Roberts Construction Limited
 Total floor area: 64.4 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 (CO₂) emissions.

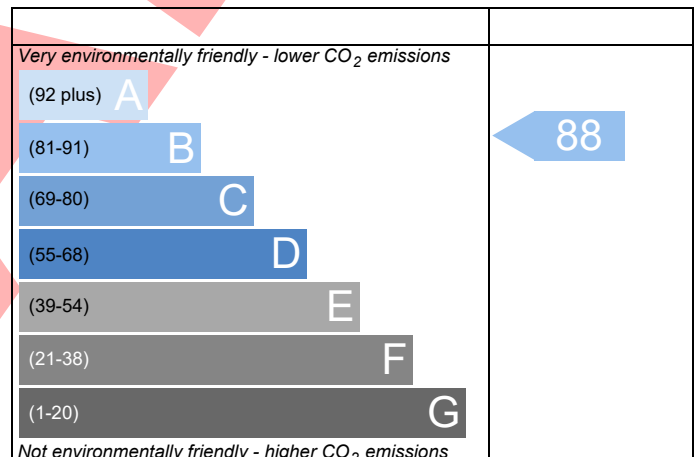
Energy Efficiency Rating



England EU Directive 2002/91/EC

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

Environmental Impact (CO₂) Rating



England EU Directive 2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) 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)

Property Reference	HOUSE TYPE D2	Issued on Date	09/11/2022
Assessment Reference	GRANT ASHP	Prop Type Ref	
Property			

SAP Rating	87 B	DER	16.49	TER	27.97
Environmental	88 B	% DER<TER	41.05		
CO ₂ Emissions (t/year)	0.95	DFEE	45.63	TFEE	51.17
General Requirements Compliance	Pass	% DFEE<TFEE	10.83		

Assessor Details	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com	Assessor ID	K559-0001
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Client	
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SUMMARY 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)	27.97	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.49	kgCO ₂ /m ²	Pass
	-11.48 (-41.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.17	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.63	kWh/m ² /yr	
	-5.6 (-10.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (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	1.36 (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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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system	Heat pump with radiators or underfloor - Electric Grant AERONA3 HPID6R32	
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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	Pass
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Primary pipework insulated	Yes	Pass
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6 Controls

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

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

Continuous extract system (decentralised)		
Specific fan power	0.1300 0.1600	

Maximum	0.7	Pass
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Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Midlands)	Slight	Pass
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Based on:

Overshading	Average
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Windows facing North	3.00 m ² , No overhang
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Windows facing East	0.72 m ² , No overhang
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Windows facing South	5.94 m ² , No overhang
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Air change rate	5.00 ach
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Blinds/curtains	None
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Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m ² K	Pass

Air permeability and pressure testing

3 Air permeability

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

Party wall U-value	0.00	W/m ² K
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	HOUSE TYPE D2		Issued on Date	09/11/2022	
Assessment Reference	GRANT ASHP	Prop Type Ref			
Property					
SAP Rating	87 B	DER	16.49	TER	27.97
Environmental	88 B	% DER<TER	41.05		
CO ₂ Emissions (t/year)	0.95	DFEE	45.63	TFEE	51.17
General Requirements Compliance	Pass	% DFEE<TFEE	10.83		
Assessor Details	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com			Assessor ID	K559-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached Bungalow, total floor area 64 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) 27.97 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.49 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.36 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

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

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Midlands): Slight OK

Based on:

Overshading: Average
Windows facing North: 3.00 m², No overhang
Windows facing East: 0.72 m², No overhang
Windows facing South: 5.94 m², No overhang
Air change rate: 5.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	64.4000 (1b)	x 2.4000 (2b)	= 154.5600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.5600 (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	0.0000 (18)
Number of sides sheltered				1	1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2081 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2654	0.2602	0.2550	0.2289	0.2237	0.1977	0.1977	0.1925	0.2081	0.2237	0.2341	0.2445 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5154	0.5102	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
upvc window (Uw = 1.40)			5.8600	1.3258	7.7689		(27)
FRENCH DOOR (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
external door			2.1400	1.2000	2.5680		(26)
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)
BRICK TF	56.7400	11.8000	44.9400	0.2300	10.3362		(29a)
CEILING	64.4000		64.4000	0.1400	9.0160		(30)
Total net area of external elements Aum(A, m2)			157.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.5078	(33)
Party Wall 1			16.1300	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)							9.6614 (36)
Total fabric heat loss						(33) + (36) =	50.1692 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	26.2858	26.0204	25.7550	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024 (38)
Heat transfer coeff	76.4550	76.1896	75.9242	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716 (39)
Average = Sum(39)m / 12 =												75.8011 (39)
HLP	1.1872	1.1831	1.1789	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750 (40)
HLP (average)												1.1770 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.1029 (42)
Average daily hot water use (litres/day)												84.1444 (43)
Daily hot water use	92.5589	89.1931	85.8273	82.4615	79.0958	75.7300	75.7300	79.0958	82.4615	85.8273	89.1931	92.5589 (44)
Energy conte	137.2621	120.0503	123.8812	108.0026	103.6311	89.4257	82.8661	95.0901	96.2257	112.1418	122.4116	132.9310 (45)
Energy content (annual)												Total = Sum(45)m = 1323.9193 (45)
Distribution loss (46)m = 0.15 x (45)m	20.5893	18.0075	18.5822	16.2004	15.5447	13.4139	12.4299	14.2635	14.4339	16.8213	18.3617	19.9397 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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												
	187.4759	165.4047	174.0950	156.5966	153.8449	138.0197	133.0799	145.3039	144.8197	162.3556	171.0056	183.1448 (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												
	187.4759	165.4047	174.0950	156.5966	153.8449	138.0197	133.0799	145.3039	144.8197	162.3556	171.0056	183.1448 (64)
	Total per year (kWh/year) = Sum(64)m =											1915.1463 (64)
Heat gains from water heating, kWh/month												
	85.8107	76.2003	81.3615	74.7861	74.6284	68.6093	67.7240	71.7885	70.8703	77.4582	79.5770	84.3706 (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	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	17.3302	15.3925	12.5180	9.4769	7.0841	5.9807	6.4624	8.4000	11.2745	14.3156	16.7084	17.8118 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	183.8921	185.8004	180.9917	170.7546	157.8322	145.6868	137.5730	135.6648	140.4735	150.7106	163.6330	175.7783 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146 (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)												
	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169 (71)
Water heating gains (Table 5)												
	115.3370	113.3932	109.3569	103.8695	100.3070	95.2906	91.0269	96.4899	98.4309	104.1105	110.5237	113.4014 (72)
Total internal gains												
	371.1031	369.1299	357.4105	338.6450	319.7671	301.5020	289.6062	295.0986	304.7228	323.6805	345.4090	361.5354 (73)

6. Solar gains

[Jan]		Area	Solar flux				g		FF		Access	Gains
		m2	Table 6a	Specific data	Specific data						factor	W
			W/m2	or Table 6b	or Table 6c						Table 6d	
North		3.0000	10.6334	0.7200	0.7000			0.7000		0.7700		11.1418 (74)
East		0.7200	19.6403	0.7200	0.7000			0.7000		0.7700		4.9391 (76)
South		2.1400	46.7521	0.7200	0.7000			0.7000		0.7700		34.9445 (78)
South		3.8000	46.7521	0.7200	0.7000			0.7000		0.7700		62.0509 (78)
Solar gains	113.0763	189.8079	254.4441	310.0234	345.0486	342.2743	330.0542	303.5101	273.3873	208.1490	134.8759	97.1630 (83)
Total gains	484.1794	558.9378	611.8546	648.6684	664.8157	643.7763	619.6604	598.6087	578.1100	531.8295	480.2849	458.6983 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)												
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	23.3979	23.4794	23.5615	23.6402	23.6402	23.6402	23.6402	23.6402	23.6402	23.6402	23.6402	23.6402
alpha	2.5599	2.5653	2.5708	2.5760	2.5760	2.5760	2.5760	2.5760	2.5760	2.5760	2.5760	2.5760
util living area	0.9464	0.9228	0.8881	0.8306	0.7405	0.6121	0.4810	0.5112	0.6828	0.8433	0.9232	0.9525 (86)
Tweekday	18.7275	18.8360	18.9892	19.1669	19.3214	19.4265	19.4672	19.4629	19.3978	19.2068	18.9447	18.7201
Tweekend	20.4346	20.4823	20.5503	20.6307	20.7042	20.7581	20.7827	20.7795	20.7416	20.6477	20.5277	20.4273
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	20.1274	20.1991	20.3060	20.4233	20.5435	20.6284	20.6646	20.6596	20.5964	20.4563	20.2626	20.1161 (87)
Th 2	19.9303	19.9336	19.9369	19.9400	19.9400	19.9400	19.9400	19.9400	19.9400	19.9400	19.9400	19.9400 (88)
util rest of house	0.9387	0.9119	0.8718	0.8043	0.6969	0.5409	0.3829	0.4145	0.6184	0.8136	0.9104	0.9456 (89)
Tweekday	18.7275	18.8360	18.9892	19.1669	19.3214	19.4265	19.4672	19.4629	19.3978	19.2068	18.9447	18.7201
Tweekend	18.7275	18.8360	18.9892	19.1669	19.3214	19.4265	19.4672	19.4629	19.3978	19.2068	18.9447	18.7201
MIT 2	18.7275	18.8360	18.9892	19.1669	19.3214	19.4265	19.4672	19.4629	19.3978	19.2068	18.9447	18.7201 (90)
Living area fraction	f _{LA} = Living area / (4) =											0.2826 (91)
MIT	19.1232	19.2213	19.3613	19.5220	19.6668	19.7662	19.8056	19.8011	19.7365	19.5599	19.3171	19.1146 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1232	19.2213	19.3613	19.5220	19.6668	19.7662	19.8056	19.8011	19.7365	19.5599	19.3171	19.1146 (93)

8. Space heating requirement

Utilisation	0.9318	0.9034	0.8617	0.7926	0.6843	0.5279	0.3694	0.4006	0.6045	0.8013	0.9016	0.9392 (94)
Useful gains	451.1355	504.9541	527.2137	514.1023	454.9296	339.8764	228.9162	239.8323	349.4483	426.1379	433.0284	430.8083 (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	1133.3048	1091.1311	976.4861	803.7826	602.8604	390.9325	242.5728	257.3668	426.5255	678.0105	924.4891	1128.6141 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	507.5340	393.9109	334.2587	208.5698	110.0605	0.0000	0.0000	0.0000	0.0000	187.3933	353.8517	519.1675 (98)
Space heating												2614.7464 (98)
Space heating per m2												(98) / (4) = 40.6017 (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 %)												237.5658 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1100.6409 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	507.5340	393.9109	334.2587	208.5698	110.0605	0.0000	0.0000	0.0000	0.0000	187.3933	353.8517	519.1675 (98)
Space heating efficiency (main heating system 1)	237.5658	237.5658	237.5658	237.5658	237.5658	0.0000	0.0000	0.0000	0.0000	237.5658	237.5658	237.5658 (210)
Space heating fuel (main heating system)	213.6393	165.8113	140.7015	87.7945	46.3284	0.0000	0.0000	0.0000	0.0000	78.8806	148.9489	218.5363 (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 requirement	187.4759	165.4047	174.0950	156.5966	153.8449	138.0197	133.0799	145.3039	144.8197	162.3556	171.0056	183.1448 (64)
Efficiency of water heater (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 (216)
Fuel for water heating, kWh/month	59.3692	52.3797	55.1317	49.5904	48.7190	43.7076	42.1432	46.0143	45.8610	51.4142	54.1534	57.9976 (219)
Water heating fuel used												606.4812 (219)
Annual totals kWh/year												
Space heating fuel - main system												1100.6409 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 3.6690, total flow = 21.0000, SFP = 0.1747) mechanical ventilation fans (SFP = 0.1747)												32.9447 (230a)
Total electricity for the above, kWh/year												32.9447 (231)
Electricity for lighting (calculated in Appendix L)												306.0561 (232)
Total delivered energy for all uses												2046.1229 (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	1100.6409	0.5190	571.2326 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	606.4812	0.5190	314.7637 (264)
Space and water heating			885.9964 (265)
Pumps and fans	32.9447	0.5190	17.0983 (267)
Energy for lighting	306.0561	0.5190	158.8431 (268)
Total CO2, kg/year			1061.9378 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.4900 (273)

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

DER		16.4900 ZC1
Total Floor Area		TFA 64.4000
Assumed number of occupants		N 2.1029
CO2 emission factor in Table 12 for electricity displaced from grid		EF 0.5190
CO2 emissions from appliances, equation (L14)		16.9209 ZC2
CO2 emissions from cooking, equation (L16)		2.6315 ZC3
Total CO2 emissions		36.0424 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		36.0424 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.4000 (1b)	x 2.4000 (2b)	= 154.5600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.5600 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1294 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3794 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3509 (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 infiltr rate	0.4475	0.4387	0.4299	0.3860	0.3773	0.3334	0.3334	0.3246	0.3509	0.3773	0.3948	0.4124 (22b)
Effective ac	0.6001	0.5962	0.5924	0.5745	0.5712	0.5556	0.5556	0.5527	0.5616	0.5712	0.5779	0.5850 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1400	1.0000	2.1400		(26)
TER Opening Type (Uw = 1.40)			9.6600	1.3258	12.8068		(27)
Heat Loss Floor 1			36.1300	0.1300	4.6969		(28a)
BRICK TF	56.7400	11.8000	44.9400	0.1800	8.0892		(29a)
CEILING	64.4000		64.4000	0.1300	8.3720		(30)
Total net area of external elements Aum(A, m ²)			157.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	36.1049	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3121 (36)
Total fabric heat loss							(33) + (36) = 45.4170 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	30.6084	30.4101	30.2158	29.3029	29.1321	28.3371	28.3371	28.1899	28.6433	29.1321	29.4776	29.8388 (38)
Average = Sum(39)m / 12 =	76.0254	75.8271	75.6328	74.7199	74.5492	73.7541	73.7541	73.6069	74.0603	74.5492	74.8947	75.2559 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1805	1.1774	1.1744	1.1602	1.1576	1.1453	1.1453	1.1430	1.1500	1.1576	1.1630	1.1686 (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	2.1029 (42)											
Average daily hot water use (litres/day)	84.1444 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	92.5589	89.1931	85.8273	82.4615	79.0958	75.7300	75.7300	79.0958	82.4615	85.8273	89.1931	92.5589 (44)
Energy content (annual)	137.2621	120.0503	123.8812	108.0026	103.6311	89.4257	82.8661	95.0901	96.2257	112.1418	122.4116	132.9310 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1323.9193 (45)											
Water storage loss:	20.5893	18.0075	18.5822	16.2004	15.5447	13.4139	12.4299	14.2635	14.4339	16.8213	18.3617	19.9397 (46)
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)											
Enter (49) or (54) in (55)	0.8381 (55)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	186.5048	164.5276	173.1238	155.6568	152.8737	137.0799	132.1088	144.3327	143.8799	161.3845	170.0658	182.1737 (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)
Output from w/h	186.5048	164.5276	173.1238	155.6568	152.8737	137.0799	132.1088	144.3327	143.8799	161.3845	170.0658	182.1737 (64)
Heat gains from water heating, kWh/month	85.0338	75.4985	80.5846	74.0342	73.8515	67.8574	66.9471	71.0116	70.1184	76.6813	78.8252	83.5937 (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	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3302	15.3925	12.5180	9.4769	7.0841	5.9807	6.4624	8.4000	11.2745	14.3156	16.7084	17.8118 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	183.8921	185.8004	180.9917	170.7546	157.8322	145.6868	137.5730	135.6648	140.4735	150.7106	163.6330	175.7783 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146 (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)	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169 (71)
Water heating gains (Table 5)	114.2927	112.3490	108.3127	102.8253	99.2627	94.2464	89.9827	95.4457	97.3867	103.0662	109.4794	112.3571 (72)
Total internal gains	373.0589	371.0857	359.3662	340.6007	321.7229	303.4578	291.5619	297.0544	306.6785	325.6362	347.3647	363.4911 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
North	3.0000	10.6334	0.6300	0.7000	0.7700	9.7491 (74)						
East	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217 (76)						
South	5.9400	46.7521	0.6300	0.7000	0.7700	84.8710 (78)						
Solar gains	98.9417	166.0819	222.6386	271.2705	301.9176	299.4900	288.7975	265.5713	239.2138	182.1304	118.0164	85.0176 (83)
Total gains	472.0006	537.1676	582.0048	611.8712	623.6404	602.9478	580.3594	562.6257	545.8924	507.7666	465.3812	448.5087 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.8254	58.9792	59.1307	59.8531	59.9902	60.6369	60.6369	60.7582	60.3862	59.9902	59.7135	59.4269	
alpha	4.9217	4.9319	4.9420	4.9902	4.9993	5.0425	5.0425	5.0505	5.0257	4.9993	4.9809	4.9618	
util living area	0.9952	0.9902	0.9790	0.9490	0.8741	0.7188	0.5456	0.5825	0.8053	0.9548	0.9899	0.9962 (86)	
MIT	19.8399	20.0003	20.2350	20.5292	20.7842	20.9436	20.9885	20.9841	20.8959	20.5770	20.1556	19.8119 (87)	
Th 2	19.9356	19.9381	19.9405	19.9519	19.9541	19.9640	19.9640	19.9659	19.9602	19.9541	19.9497	19.9452 (88)	
util rest of house	0.9936	0.9869	0.9718	0.9304	0.8277	0.6269	0.4241	0.4612	0.7263	0.9346	0.9860	0.9950 (89)	
MIT 2	18.4068	18.6413	18.9816	19.4051	19.7426	19.9264	19.9598	19.9595	19.8801	19.4789	18.8768	18.3728 (90)	
Living area fraction	18.8118	19.0254	19.3358	19.7228	20.0370	20.2138	20.2506	20.2490	20.1672	19.7892	19.2382	18.7795 (92)	
Temperature adjustment	18.8118	19.0254	19.3358	19.7228	20.0370	20.2138	20.2506	20.2490	20.1672	19.7892	19.2382	18.7795 (93)	
adjusted MIT	18.8118	19.0254	19.3358	19.7228	20.0370	20.2138	20.2506	20.2490	20.1672	19.7892	19.2382	18.7795 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	467.8366	528.1127	562.4774	566.2618	518.7991	392.3062	266.2120	278.8469	406.0648	472.5159	457.1424	445.3616 (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	1103.2670	1071.0883	970.8097	808.6777	621.5129	414.0439	269.2435	283.3161	449.3367	685.0481	909.0865	1097.1926 (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	472.7602	364.8796	303.7992	174.5394	76.4191	0.0000	0.0000	0.0000	0.0000	158.1240	325.3997	484.9622 (98)
Space heating												2360.8835 (98)
Space heating per m2												(98) / (4) = 36.6597 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													2525.0090 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	472.7602	364.8796	303.7992	174.5394	76.4191	0.0000	0.0000	0.0000	0.0000	158.1240	325.3997	484.9622	(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)	505.6259	390.2456	324.9190	186.6732	81.7316	0.0000	0.0000	0.0000	0.0000	169.1165	348.0211	518.6762	(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 requirement	186.5048	164.5276	173.1238	155.6568	152.8737	137.0799	132.1088	144.3327	143.8799	161.3845	170.0658	182.1737	(64)
Efficiency of water heater (217)m	87.1926	86.8797	86.2995	85.1197	83.0735	79.8000	79.8000	79.8000	79.8000	84.7595	86.5181	87.3034	(216)
Fuel for water heating, kWh/month	213.8999	189.3741	200.6081	182.8681	184.0223	171.7794	165.5498	180.8681	180.3007	190.4028	196.5667	208.6673	(219)
Water heating fuel used													2264.9072 (219)
Annual totals kWh/year													
Space heating fuel - main system													2525.0090 (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)													306.0561 (232)
Total delivered energy for all uses													5170.9724 (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	2525.0090	0.2160	545.4020 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2264.9072	0.2160	489.2200 (264)
Space and water heating			1034.6219 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	306.0561	0.5190	158.8431 (268)
Total CO2, kg/m2/year			1232.3900 (272)
Emissions per m2 for space and water heating			16.0656 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.4665 (272b)
Emissions per m2 for pumps and fans			0.6044 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0656 * 1.55) + 2.4665 + 0.6044, rounded to 2 d.p.			27.9700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	64.4000 (1b)	x 2.4000 (2b)	= 154.5600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.5600 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1294 (8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.3544	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3278 (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	0.4180	0.4098	0.4016	0.3606	0.3524	0.3114	0.3114	0.3032	0.3278	0.3524	0.3688	0.3852 (22b)
Effective ac	0.5873	0.5840	0.5806	0.5650	0.5621	0.5485	0.5485	0.5460	0.5537	0.5621	0.5680	0.5742 (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)			5.8600	1.3258	7.7689		(27)					
FRENCH DOOR (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
external door			2.1400	1.2000	2.5680		(26)					
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)					
BRICK TF	56.7400	11.8000	44.9400	0.2300	10.3362		(29a)					
CEILING	64.4000		64.4000	0.1400	9.0160		(30)					
Total net area of external elements Aum(A, m2)			157.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5078		(33)					
Party Wall 1			16.1300	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)							9.6614 (36)					
Total fabric heat loss						(33) + (36) =	50.1692 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	29.9576	29.7846	29.6151	28.8186	28.6695	27.9758	27.9758	27.8474	28.2430	28.6695	28.9710	29.2862 (38)
Average = Sum(39)m / 12 =	80.1268	79.9538	79.7843	78.9878	78.8387	78.1450	78.1450	78.0166	78.4122	78.8387	79.1402	79.4554 (39)
	80.1268	79.9538	79.7843	78.9878	78.8387	78.1450	78.1450	78.0166	78.4122	78.8387	79.1402	79.4554 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2442	1.2415	1.2389	1.2265	1.2242	1.2134	1.2134	1.2114	1.2176	1.2242	1.2289	1.2338 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.1029 (42)
Average daily hot water use (litres/day)												84.1444 (43)
Daily hot water use	92.5589	89.1931	85.8273	82.4615	79.0958	75.7300	75.7300	79.0958	82.4615	85.8273	89.1931	92.5589 (44)
Energy conte	137.2621	120.0503	123.8812	108.0026	103.6311	89.4257	82.8661	95.0901	96.2257	112.1418	122.4116	132.9310 (45)
Energy content (annual)												Total = Sum(45)m = 1323.9193 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000	(59)
Heat gains from water heating, kWh/month	29.1682	25.5107	26.3248	22.9506	22.0216	19.0030	17.6090	20.2066	20.4480	23.8301	26.0125	28.2478		(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	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3302	15.3925	12.5180	9.4769	7.0841	5.9807	6.4624	8.4000	11.2745	14.3156	16.7084	17.8118	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	183.8921	185.8004	180.9917	170.7546	157.8322	145.6868	137.5730	135.6648	140.4735	150.7106	163.6330	175.7783	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	(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)	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	(71)
Water heating gains (Table 5)	39.2046	37.9623	35.3827	31.8758	29.5989	26.3930	23.6681	27.1595	28.4000	32.0298	36.1284	37.9675	(72)
Total internal gains	294.9707	293.6991	283.4363	266.6512	249.0591	232.6044	222.2473	225.7682	234.6918	251.5998	271.0137	286.1015	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	3.0000	10.6334	0.7200	0.7000	0.7700	11.1418 (74)							
East	0.7200	19.6403	0.7200	0.7000	0.7700	4.9391 (76)							
South	2.1400	46.7521	0.7200	0.7000	0.7700	34.9445 (78)							
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509 (78)							
Solar gains	113.0763	189.8079	254.4441	310.0234	345.0486	342.2743	330.0542	303.5101	273.3873	208.1490	134.8759	97.1630	(83)
Total gains	408.0470	483.5069	537.8804	576.6746	594.1077	574.8787	552.3016	529.2782	508.0791	459.7487	405.8896	383.2645	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)	22.3257	22.3740	22.4216	22.6477	22.6905	22.8919	22.8919	22.9296	22.8139	22.6905	22.6040	22.5144	21.0000 (85)
tau	2.4884	2.4916	2.4948	2.5098	2.5127	2.5261	2.5261	2.5286	2.5209	2.5127	2.5069	2.5010	
alpha	0.9632	0.9437	0.9150	0.8656	0.7859	0.6650	0.5351	0.5685	0.7381	0.8819	0.9466	0.9681	(86)
util living area	18.4611	18.7656	19.2110	19.7660	20.2798	20.6801	20.8690	20.8425	20.5500	19.8789	19.0669	18.4017	(87)
MIT	19.8848	19.8869	19.8890	19.8988	19.9007	19.9093	19.9093	19.9109	19.9060	19.9007	19.8970	19.8931	(88)
Th 2	0.9575	0.9351	0.9014	0.8424	0.7449	0.5928	0.4289	0.4652	0.6757	0.8568	0.9369	0.9632	(89)
util rest of house	17.5797	17.8806	18.3189	18.8638	19.3489	19.7080	19.8503	19.8356	19.6025	18.9829	18.1890	17.5267	(90)
MIT 2	17.8287	18.1307	18.5710	19.1188	19.6120	19.9827	20.1382	20.1202	19.8703	19.2361	18.4371	17.7740	(92)
Living area fraction	17.8287	18.1307	18.5710	19.1188	19.6120	19.9827	20.1382	20.1202	19.8703	19.2361	18.4371	17.7740	(91)
MIT	17.8287	18.1307	18.5710	19.1188	19.6120	19.9827	20.1382	20.1202	19.8703	19.2361	18.4371	17.7740	(92)
Temperature adjustment	17.8287	18.1307	18.5710	19.1188	19.6120	19.9827	20.1382	20.1202	19.8703	19.2361	18.4371	17.7740	(93)
adjusted MIT	17.8287	18.1307	18.5710	19.1188	19.6120	19.9827	20.1382	20.1202	19.8703	19.2361	18.4371	17.7740	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	384.9085	443.5923	474.0141	474.4592	435.1981	343.8507	250.1499	257.6326	342.1304	385.3590	373.4537	364.1739	(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	1084.0157	1057.8487	963.0797	807.1584	623.7741	420.6348	276.4915	290.2362	452.4585	680.8601	897.2235	1078.5269	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	520.1358	412.7803	363.8648	239.5434	140.3005	0.0000	0.0000	0.0000	0.0000	219.8528	377.1143	531.4786	(98)
Space heating												2805.0705	(98)
Space heating per m2												43.5570	(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	734.5632	578.2731	592.9258	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7241	0.7910	0.7719	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	531.9035	457.4084	457.7066	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	750.6276	722.7135	697.1753	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													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	157.4814	197.3870	178.1647	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												533.0331 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	39.3703	49.3467	44.5412	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												133.2583 (107)
Energy for space heating												2.0692 (108)
Energy for space cooling												43.5570 (99)
Total												2.0692 (108)
Dwelling Fabric Energy Efficiency (DFEE)												45.6262 (109)
												45.6 (109)

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Calculation Type: New Build (As Designed)

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.4000 (1b)	x 2.4000 (2b)	= 154.5600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.5600 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1294 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3794	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3509 (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	0.4475	0.4387	0.4299	0.3860	0.3773	0.3334	0.3334	0.3246	0.3509	0.3773	0.3948	0.4124 (22b)
Effective ac	0.6001	0.5962	0.5924	0.5745	0.5712	0.5556	0.5556	0.5527	0.5616	0.5712	0.5779	0.5850 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1400	1.0000	2.1400		(26)
TER Opening Type (Uw = 1.40)			9.6600	1.3258	12.8068		(27)
Heat Loss Floor 1			36.1300	0.1300	4.6969		(28a)
BRICK TF	56.7400	11.8000	44.9400	0.1800	8.0892		(29a)
CEILING	64.4000		64.4000	0.1300	8.3720		(30)
Total net area of external elements Aum(A, m ²)			157.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	36.1049	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3121 (36)
Total fabric heat loss	(33) + (36) = 45.4170 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	30.6084	30.4101	30.2158	29.3029	29.1321	28.3371	28.3371	28.1899	28.6433	29.1321	29.4776	29.8388 (38)
Heat transfer coeff	76.0254	75.8271	75.6328	74.7199	74.5492	73.7541	73.7541	73.6069	74.0603	74.5492	74.8947	75.2559 (39)
Average = Sum(39)m / 12 =												74.7191 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1805	1.1774	1.1744	1.1602	1.1576	1.1453	1.1453	1.1430	1.1500	1.1576	1.1630	1.1686 (40)
HLP (average)												1.1602 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.1029 (42)
Average daily hot water use (litres/day)												84.1444 (43)
Daily hot water use	92.5589	89.1931	85.8273	82.4615	79.0958	75.7300	75.7300	79.0958	82.4615	85.8273	89.1931	92.5589 (44)
Energy conte	137.2621	120.0503	123.8812	108.0026	103.6311	89.4257	82.8661	95.0901	96.2257	112.1418	122.4116	132.9310 (45)
Energy content (annual)												Total = Sum(45)m = 1323.9193 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

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Calculation Type: New Build (As Designed)

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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	0.0000 (59)
Heat gains from water heating, kWh/month	29.1682	25.5107	26.3248	22.9506	22.0216	19.0030	17.6090	20.2066	20.4480	23.8301	26.0125	28.2478	(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	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	105.1461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3302	15.3925	12.5180	9.4769	7.0841	5.9807	6.4624	8.4000	11.2745	14.3156	16.7084	17.8118	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	183.8921	185.8004	180.9917	170.7546	157.8322	145.6868	137.5730	135.6648	140.4735	150.7106	163.6330	175.7783	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	33.5146	(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)	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	(71)
Water heating gains (Table 5)	39.2046	37.9623	35.3827	31.8758	29.5989	26.3930	23.6681	27.1595	28.4000	32.0298	36.1284	37.9675	(72)
Total internal gains	294.9707	293.6991	283.4363	266.6512	249.0591	232.6044	222.2473	225.7682	234.6918	251.5998	271.0137	286.1015	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.0000	10.6334	0.6300	0.7000	0.7700	9.7491 (74)
East	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217 (76)
South	5.9400	46.7521	0.6300	0.7000	0.7700	84.8710 (78)

Solar gains	98.9417	166.0819	222.6386	271.2705	301.9176	299.4900	288.7975	265.5713	239.2138	182.1304	118.0164	85.0176	(83)
Total gains	393.9125	459.7810	506.0749	537.9217	550.9766	532.0944	511.0448	491.3395	473.9056	433.7301	389.0301	371.1191	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	58.8254	58.9792	59.1307	59.8531	59.9902	60.6369	60.6369	60.7582	60.3862	59.9902	59.7135	59.4269	21.0000 (85)
alpha	4.9217	4.9319	4.9420	4.9902	4.9993	5.0425	5.0425	5.0505	5.0257	4.9993	4.9809	4.9618	
util living area	0.9978	0.9949	0.9881	0.9682	0.9130	0.7808	0.6099	0.6526	0.8638	0.9751	0.9953	0.9984	(86)
MIT	19.7287	19.8923	20.1338	20.4421	20.7229	20.9175	20.9813	20.9738	20.8518	20.4868	20.0488	19.7010	(87)
Th 2	19.9356	19.9381	19.9405	19.9519	19.9541	19.9640	19.9640	19.9659	19.9602	19.9541	19.9497	19.9452	(88)
util rest of house	0.9971	0.9932	0.9838	0.9555	0.8758	0.6922	0.4789	0.5235	0.7953	0.9626	0.9934	0.9978	(89)
MIT 2	18.7813	18.9461	19.1874	19.4981	19.7607	19.9242	19.9591	19.9582	19.8769	19.5466	19.1119	18.7613	(90)
Living area fraction										fLA = Living area / (4) =		0.2826	(91)
MIT	19.0491	19.2135	19.4549	19.7649	20.0326	20.2049	20.2480	20.2452	20.1524	19.8123	19.3766	19.0268	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0491	19.2135	19.4549	19.7649	20.0326	20.2049	20.2480	20.2452	20.1524	19.8123	19.3766	19.0268	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9962	0.9916	0.9812	0.9527	0.8790	0.7149	0.5165	0.5604	0.8100	0.9605	0.9920	0.9972	(94)
Ext temp.	392.4255	455.9243	496.5415	512.4851	484.3341	380.3797	263.9332	275.3602	383.8619	416.5807	385.9183	370.0662	(95)
Heat loss rate W	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)
Month fracti	1121.3025	1085.3509	979.8142	811.8222	621.1882	413.3828	269.0541	283.0347	448.2457	686.7690	919.4551	1115.8068	(97)
Space heating kWh	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	542.2845	422.9747	359.5549	215.5227	101.8195	0.0000	0.0000	0.0000	0.0000	201.0201	384.1465	554.8310	(98)
Space heating per m2												2782.1539	(98)
												(98) / (4) =	43.2011 (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	693.2886	545.7804	559.4123	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8389	0.9091	0.8920	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	581.5738	496.1739	498.9735	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	700.6200	674.4913	652.8313	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	85.7133	132.6681	114.4702	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												332.8516	(104)
Cooled fraction												1.0000	(105)
												fC = cooled area / (4) =	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	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	21.4283	33.1670	28.6175	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												83.2129 (107)
Space cooling per m2												1.2921 (108)
Energy for space heating												43.2011 (99)
Energy for space cooling												1.2921 (108)
Total												44.4933 (109)
Target Fabric Energy Efficiency (TFEE)												51.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	64.4000 (1b)	2.4000 (2b)	154.5600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	154.5600 (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	0.2250 (18)
Number of sides sheltered				1	1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2081 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.5000	4.4000	3.9000	3.8000	3.4000	3.3000	3.3000	3.5000	3.8000	3.9000	4.1000 (22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250 (22a)
Adj infilt rate	0.2341	0.2341	0.2289	0.2029	0.1977	0.1769	0.1717	0.1717	0.1821	0.1977	0.2029	0.2133 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
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)			5.8600	1.3258	7.7689		(27)
FRENCH DOOR (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
external door			2.1400	1.2000	2.5680		(26)
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)
BRICK TF	56.7400	11.8000	44.9400	0.2300	10.3362		(29a)
CEILING	64.4000		64.4000	0.1400	9.0160		(30)
Total net area of external elements Aum(A, m2)			157.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.5078	(33)
Party Wall 1			16.1300	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)							9.6614 (36)
Total fabric heat loss						(33) + (36) =	50.1692 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024 (38)
Heat transfer coeff	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716 (39)
Average = Sum(39)m / 12 =												75.6716 (39)
HLP	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750 (40)
HLP (average)												1.1750 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.1029 (42)
Average daily hot water use (litres/day)												84.1444 (43)
Daily hot water use	92.5589	89.1931	85.8273	82.4615	79.0958	75.7300	75.7300	79.0958	82.4615	85.8273	89.1931	92.5589 (44)
Energy conte	137.2621	120.0503	123.8812	108.0026	103.6311	89.4257	82.8661	95.0901	96.2257	112.1418	122.4116	132.9310 (45)
Energy content (annual)										Total = Sum(45)m =		1323.9193 (45)
Distribution loss (46)m = 0.15 x (45)m	20.5893	18.0075	18.5822	16.2004	15.5447	13.4139	12.4299	14.2635	14.4339	16.8213	18.3617	19.9397 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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												
Primary 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 (57)
	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												
Solar input	187.4759	165.4047	174.0950	156.5966	153.8449	138.0197	133.0799	145.3039	144.8197	162.3556	171.0056	183.1448 (62)
	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	187.4759	165.4047	174.0950	156.5966	153.8449	138.0197	133.0799	145.3039	144.8197	162.3556	171.0056	183.1448 (64)
								Total per year (kWh/year) = Sum(64)m =				1915.1463 (64)
												1915 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	85.8107	76.2003	81.3615	74.7861	74.6284	68.6093	67.7240	71.7885	70.8703	77.4582	79.5770	84.3706 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	126.1754	126.1754	126.1754	126.1754	126.1754	126.1754	126.1754	126.1754	126.1754	126.1754	126.1754	126.1754 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	43.3254	38.4812	31.2951	23.6924	17.7103	14.9518	16.1559	21.0001	28.1863	35.7890	41.7710	44.5296 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	274.4659	277.3140	270.1369	254.8577	235.5704	217.4431	205.3329	202.4848	209.6619	224.9411	244.2284	262.3557 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	49.7205	49.7205	49.7205	49.7205	49.7205	49.7205	49.7205	49.7205	49.7205	49.7205	49.7205	49.7205 (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)												
	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169	-84.1169 (71)
Water heating gains (Table 5)												
	115.3370	113.3932	109.3569	103.8695	100.3070	95.2906	91.0269	96.4899	98.4309	104.1105	110.5237	113.4014 (72)
Total internal gains	524.9072	520.9674	502.5677	474.1985	445.3666	419.4644	404.2947	411.7537	428.0580	456.6195	488.3020	512.0656 (73)

6. Solar gains

[Jan]			Area	Solar flux						Access		Gains
			m ²	Table 6a	g					factor		W
				W/m ²	Specific data					Table 6d		
					or Table 6b							
						Specific data						
						or Table 6c						
North			3.0000	11.3201	0.7200	0.7000		0.7700				11.8614 (74)
East			0.7200	21.0039	0.7200	0.7000		0.7700				5.2820 (76)
South			2.1400	49.0238	0.7200	0.7000		0.7700				36.6425 (78)
South			3.8000	49.0238	0.7200	0.7000		0.7700				65.0660 (78)
Solar gains	118.8519	202.4620	272.3671	339.5942	357.2092	383.3694	356.2174	333.5783	303.0213	227.9817	159.5576	112.9064 (83)
Total gains	643.7591	723.4294	774.9349	813.7926	802.5758	802.8338	760.5121	745.3321	731.0794	684.6012	647.8597	624.9719 (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	23.6402	23.6402	23.6402	23.6402	23.6402	23.6402	23.6402	23.6402	23.6402	23.6402	23.6402	23.6402
alpha	2.5760	2.5760	2.5760	2.5760	2.5760	2.5760	2.5760	2.5760	2.5760	2.5760	2.5760	2.5760
util living area	0.9052	0.8758	0.8296	0.7586	0.6675	0.5131	0.4069	0.4218	0.5973	0.7717	0.8661	0.9114 (86)
Tweekday	18.8698	18.9557	19.0966	19.2445	19.3636	19.4490	19.4726	19.4712	19.4224	19.2705	19.0567	18.8496
Tweekend	20.4955	20.5349	20.5996	20.6690	20.7268	20.7727	20.7877	20.7865	20.7568	20.6798	20.5801	20.4863
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	20.2214	20.2806	20.3820	20.4831	20.5784	20.6509	20.6724	20.6706	20.6203	20.5059	20.3443	20.2072 (87)
Th 2	19.9400	19.9400	19.9400	19.9400	19.9400	19.9400	19.9400	19.9400	19.9400	19.9400	19.9400	19.9400 (88)
util rest of house	0.8928	0.8602	0.8077	0.7265	0.6200	0.4427	0.3191	0.3338	0.5328	0.7355	0.8467	0.8998 (89)
Tweekday	18.8698	18.9557	19.0966	19.2445	19.3636	19.4490	19.4726	19.4712	19.4224	19.2705	19.0567	18.8496
Tweekend	18.8698	18.9557	19.0966	19.2445	19.3636	19.4490	19.4726	19.4712	19.4224	19.2705	19.0567	18.8496
MIT 2	18.8698	18.9557	19.0966	19.2445	19.3636	19.4490	19.4726	19.4712	19.4224	19.2705	19.0567	18.8496 (90)
Living area fraction									fLA = Living area / (4) =			0.2826 (91)
MIT	19.2517	19.3302	19.4598	19.5945	19.7069	19.7887	19.8117	19.8101	19.7609	19.6196	19.4206	19.2333 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2517	19.3302	19.4598	19.5945	19.7069	19.7887	19.8117	19.8101	19.7609	19.6196	19.4206	19.2333 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8837	0.8501	0.7967	0.7149	0.6086	0.4320	0.3079	0.3223	0.5209	0.7232	0.8359	0.8909 (94)
Useful gains	568.8750	614.9933	617.3622	581.8194	488.4169	346.8051	234.1303	240.2533	380.7994	495.1255	541.5372	556.7640 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1131.4214	1099.5198	973.1249	801.7052	598.3275	377.5035	243.0348	250.4830	435.9386	690.0958	932.3200	1137.5906 (97)
Space heating kWh	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	418.5345	325.6019	264.6874	158.3178	81.7735	0.0000	0.0000	0.0000	0.0000	145.0579	281.3637	432.1350 (98)
RHI space heating demand												2107.4717 (98)
												2107 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	64.4000 (1b)	x 2.4000 (2b)	= 154.5600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.5600 (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	0.2250 (18)
Number of sides sheltered				1	1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2081 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2654	0.2602	0.2550	0.2289	0.2237	0.1977	0.1977	0.1925	0.2081	0.2237	0.2341	0.2445 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5154	0.5102	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
upvc window (Uw = 1.40)			5.8600	1.3258	7.7689		(27)
FRENCH DOOR (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
external door			2.1400	1.2000	2.5680		(26)
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)
BRICK TF	56.7400	11.8000	44.9400	0.2300	10.3362		(29a)
CEILING	64.4000		64.4000	0.1400	9.0160		(30)
Total net area of external elements Aum(A, m2)			157.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.5078	(33)
Party Wall 1			16.1300	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)							9.6614 (36)
Total fabric heat loss						(33) + (36) =	50.1692 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	26.2858	26.0204	25.7550	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024 (38)
Heat transfer coeff	76.4550	76.1896	75.9242	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716 (39)
Average = Sum(39)m / 12 =												75.8011 (39)
HLP	1.1872	1.1831	1.1789	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750 (40)
HLP (average)												1.1770 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.1029 (42)
Average daily hot water use (litres/day)												84.1444 (43)
Daily hot water use	92.5589	89.1931	85.8273	82.4615	79.0958	75.7300	75.7300	79.0958	82.4615	85.8273	89.1931	92.5589 (44)
Energy conte	137.2621	120.0503	123.8812	108.0026	103.6311	89.4257	82.8661	95.0901	96.2257	112.1418	122.4116	132.9310 (45)
Energy content (annual)										Total = Sum(45)m =		1323.9193 (45)
Distribution loss (46)m = 0.15 x (45)m	20.5893	18.0075	18.5822	16.2004	15.5447	13.4139	12.4299	14.2635	14.4339	16.8213	18.3617	19.9397 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	428.6511	330.5361	276.9109	169.0428	86.3051	0.0000	0.0000	0.0000	0.0000	146.7616	291.0163	439.7706 (98)
Space heating												2168.9946 (98)
Space heating per m2												(98) / (4) = 33.6800 (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 %)												237.5658 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												913.0079 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	428.6511	330.5361	276.9109	169.0428	86.3051	0.0000	0.0000	0.0000	0.0000	146.7616	291.0163	439.7706 (98)
Space heating efficiency (main heating system 1)	237.5658	237.5658	237.5658	237.5658	237.5658	0.0000	0.0000	0.0000	0.0000	237.5658	237.5658	237.5658 (210)
Space heating fuel (main heating system)	180.4347	139.1345	116.5618	71.1562	36.3289	0.0000	0.0000	0.0000	0.0000	61.7773	122.4993	185.1153 (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 requirement	187.4759	165.4047	174.0950	156.5966	153.8449	138.0197	133.0799	145.3039	144.8197	162.3556	171.0056	183.1448 (64)
Efficiency of water heater (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 (216)
Fuel for water heating, kWh/month	59.3692	52.3797	55.1317	49.5904	48.7190	43.7076	42.1432	46.0143	45.8610	51.4142	54.1534	57.9976 (219)
Water heating fuel used												606.4812 (219)
Annual totals kWh/year												
Space heating fuel - main system												913.0079 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans: (MEV/Decentralised, Database: total watage = 3.6690, total flow = 21.0000, SFP = 0.1747)												
mechanical ventilation fans (SFP = 0.1747)												32.9447 (230a)
Total electricity for the above, kWh/year												32.9447 (231)
Electricity for lighting (calculated in Appendix L)												306.0561 (232)
Total delivered energy for all uses												1858.4899 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	913.0079	13.1900	120.4257 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	606.4812	13.1900	79.9949 (247)
Mechanical ventilation fans	32.9447	13.1900	4.3454 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	306.0561	13.1900	40.3688 (250)
Additional standing charges			0.0000 (251)
Total energy cost			245.1348 (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] =	0.9411 (257)
SAP value		86.8716
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	913.0079	0.5190	473.8511 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	606.4812	0.5190	314.7637 (264)
Space and water heating			788.6149 (265)
Pumps and fans	32.9447	0.5190	17.0983 (267)
Energy for lighting	306.0561	0.5190	158.8431 (268)
Total kg/year			964.5563 (272)
CO2 emissions per m2			14.9800 (273)
EI value			88.1855
EI rating			88 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency $13.19 \times (1 + 0.29 \times 0.75) / 2.3757 = 6.760$, stars = 3
Main heating environmental impact $0.519 \times (1 + 0.29 \times 0.75) / 2.3757 = 0.2660$, 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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	64.4000 (1b)	x 2.4000 (2b)	= 154.5600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.5600 (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	0.2250 (18)
Number of sides sheltered				1	1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2081 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.5000	4.4000	3.9000	3.8000	3.4000	3.3000	3.3000	3.5000	3.8000	3.9000	4.1000 (22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250 (22a)
Adj infiltr rate	0.2341	0.2341	0.2289	0.2029	0.1977	0.1769	0.1717	0.1717	0.1821	0.1977	0.2029	0.2133 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
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)			5.8600	1.3258	7.7689		(27)
FRENCH DOOR (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
external door			2.1400	1.2000	2.5680		(26)
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)
BRICK TF	56.7400	11.8000	44.9400	0.2300	10.3362		(29a)
CEILING	64.4000		64.4000	0.1400	9.0160		(30)
Total net area of external elements Aum(A, m2)			157.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.5078	(33)
Party Wall 1			16.1300	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)							9.6614 (36)
Total fabric heat loss						(33) + (36) =	50.1692 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024 (38)
Heat transfer coeff	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716 (39)
Average = Sum(39)m / 12 =												75.6716 (39)
HLP	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750 (40)
HLP (average)												1.1750 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.1029 (42)
Average daily hot water use (litres/day)												84.1444 (43)
Daily hot water use	92.5589	89.1931	85.8273	82.4615	79.0958	75.7300	75.7300	79.0958	82.4615	85.8273	89.1931	92.5589 (44)
Energy conte	137.2621	120.0503	123.8812	108.0026	103.6311	89.4257	82.8661	95.0901	96.2257	112.1418	122.4116	132.9310 (45)
Energy content (annual)										Total = Sum(45)m =		1323.9193 (45)
Distribution loss (46)m = 0.15 x (45)m	20.5893	18.0075	18.5822	16.2004	15.5447	13.4139	12.4299	14.2635	14.4339	16.8213	18.3617	19.9397 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	1.0000 (97a)
Space heating kWh	418.5345	325.6019	264.6874	158.3178	81.7735	0.0000	0.0000	0.0000	0.0000	145.0579	281.3637	432.1350	(98)
Space heating													2107.4717 (98)
Space heating per m2													(98) / (4) = 32.7247 (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 %)													237.1996 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													888.4804 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	418.5345	325.6019	264.6874	158.3178	81.7735	0.0000	0.0000	0.0000	0.0000	145.0579	281.3637	432.1350	(98)
Space heating efficiency (main heating system 1)	237.1996	237.1996	237.1996	237.1996	237.1996	0.0000	0.0000	0.0000	0.0000	237.1996	237.1996	237.1996	(210)
Space heating fuel (main heating system)	176.4483	137.2692	111.5885	66.7446	34.4746	0.0000	0.0000	0.0000	0.0000	61.1544	118.6190	182.1820	(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 requirement	187.4759	165.4047	174.0950	156.5966	153.8449	138.0197	133.0799	145.3039	144.8197	162.3556	171.0056	183.1448	(64)
Efficiency of water heater (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	(216)
Fuel for water heating, kWh/month	59.3692	52.3797	55.1317	49.5904	48.7190	43.7076	42.1432	46.0143	45.8610	51.4142	54.1534	57.9976	(219)
Water heating fuel used													606.4812 (219)
Annual totals kWh/year													
Space heating fuel - main system													888.4804 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 3.6690, total flow = 21.0000, SFP = 0.1747)													32.9447 (230a)
mechanical ventilation fans (SFP = 0.1747)													32.9447 (231)
Total electricity for the above, kWh/year													306.0561 (232)
Electricity for lighting (calculated in Appendix L)													1833.9624 (238)
Total delivered energy for all uses													

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	888.4804	20.4300	181.5166 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	606.4812	20.4300	123.9041 (247)
Mechanical ventilation fans	32.9447	20.4300	6.7306 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	306.0561	20.4300	62.5273 (250)
Additional standing charges			0.0000 (251)
Total energy cost			374.6785 (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	888.4804	0.5190	461.1214 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	606.4812	0.5190	314.7637 (264)
Space and water heating			775.8851 (265)
Pumps and fans	32.9447	0.5190	17.0983 (267)
Energy for lighting	306.0561	0.5190	158.8431 (268)
Total kg/year			951.8265 (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	888.4804	3.0700	2727.6350 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	606.4812	3.0700	1861.8973 (264)
Space and water heating			4589.5322 (265)
Pumps and fans	32.9447	3.0700	101.1402 (267)
Energy for lighting	306.0561	3.0700	939.5923 (268)
Primary energy kWh/year			5630.2647 (272)
Primary energy kWh/m2/year			87.4265 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 88

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.6	-£ 47	-120 kg (12.6%)
U Solar photovoltaic panels	+ 12.2	-£ 388	-985 kg (118.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£47	1.87 kg/m ²	B 88 B 90
Solar photovoltaic panels	£388	15.29 kg/m ²	A 101 A 101
Total Savings	£435	17.16 kg/m²	

Potential energy efficiency rating: A 101
 Potential environmental impact rating: A 101

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	£375	£327	£47
Space heating	£188	£189	-£0
Water heating	£124	£76	£48
Lighting	£63	£63	£0
Generated (PV)	-£0	-£388	£388
Total cost of fuels	£375	-£61	£435
Total cost of uses	£375	-£60	£436
Delivered energy	28 kWh/m ²	-5 kWh/m ²	33 kWh/m ²
Carbon dioxide emissions	1.0 tonnes	-0.2 tonnes	1.1 tonnes
CO2 emissions per m ²	15 kg/m ²	-2 kg/m ²	17 kg/m ²
Primary energy	87 kWh/m ²	-14 kWh/m ²	101 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	64.4000 (1b)	x 2.4000 (2b)	= 154.5600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.5600 (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	0.2250 (18)
Number of sides sheltered				1	1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2081 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2654	0.2602	0.2550	0.2289	0.2237	0.1977	0.1977	0.1925	0.2081	0.2237	0.2341	0.2445 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5154	0.5102	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
upvc window (Uw = 1.40)			5.8600	1.3258	7.7689		(27)
FRENCH DOOR (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
external door			2.1400	1.2000	2.5680		(26)
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)
BRICK TF	56.7400	11.8000	44.9400	0.2300	10.3362		(29a)
CEILING	64.4000		64.4000	0.1400	9.0160		(30)
Total net area of external elements Aum(A, m2)			157.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.5078	(33)
Party Wall 1			16.1300	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)							9.6614 (36)
Total fabric heat loss						(33) + (36) =	50.1692 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	26.2858	26.0204	25.7550	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024 (38)
Heat transfer coeff	76.4550	76.1896	75.9242	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716 (39)
Average = Sum(39)m / 12 =												75.8011 (39)
HLP	1.1872	1.1831	1.1789	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750 (40)
HLP (average)												1.1770 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.1029 (42)
Average daily hot water use (litres/day)												84.1444 (43)
Daily hot water use	92.5589	89.1931	85.8273	82.4615	79.0958	75.7300	75.7300	79.0958	82.4615	85.8273	89.1931	92.5589 (44)
Energy conte	137.2621	120.0503	123.8812	108.0026	103.6311	89.4257	82.8661	95.0901	96.2257	112.1418	122.4116	132.9310 (45)
Energy content (annual)										Total = Sum(45)m =		1323.9193 (45)
Distribution loss (46)m = 0.15 x (45)m	20.5893	18.0075	18.5822	16.2004	15.5447	13.4139	12.4299	14.2635	14.4339	16.8213	18.3617	19.9397 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Tweekend	18.8446	18.9406	19.0741	19.2251	19.3535	19.4397	19.4714	19.4684	19.4199	19.2672	19.0418	18.8382
MIT 2	18.8446	18.9406	19.0741	19.2251	19.3535	19.4397	19.4714	19.4684	19.4199	19.2672	19.0418	18.8382 (90)
Living area fraction										fLA = Living area / (4) =		0.2826 (91)
MIT	19.2304	19.3174	19.4397	19.5763	19.6974	19.7794	19.8103	19.8071	19.7584	19.6165	19.4068	19.2228 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2304	19.3174	19.4397	19.5763	19.6974	19.7794	19.8103	19.8071	19.7584	19.6165	19.4068	19.2228 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8862	0.8534	0.8068	0.7344	0.6259	0.4717	0.3234	0.3490	0.5333	0.7305	0.8458	0.8957 (94)
Useful gains	565.3620	606.5833	609.5256	570.4085	486.1201	352.7224	232.9327	245.1222	370.8932	484.4944	527.0841	545.7103 (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												
Month fracti	1141.5059	1098.4525	982.4381	807.8965	605.1739	391.9347	242.9280	257.8239	428.1785	682.2900	931.2734	1136.7998 (97)
Space heating kWh	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	428.6511	330.5361	277.4469	170.9913	88.5761	0.0000	0.0000	0.0000	0.0000	147.1599	291.0163	439.7706 (98)
Space heating per m2												2174.1484 (98)
												(98) / (4) = 33.7601 (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 %)												237.5658 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												915.1773 (211)
Space heating requirement	428.6511	330.5361	277.4469	170.9913	88.5761	0.0000	0.0000	0.0000	0.0000	147.1599	291.0163	439.7706 (98)
Space heating efficiency (main heating system 1)	237.5658	237.5658	237.5658	237.5658	237.5658	0.0000	0.0000	0.0000	0.0000	237.5658	237.5658	237.5658 (210)
Space heating fuel (main heating system)	180.4347	139.1345	116.7874	71.9764	37.2849	0.0000	0.0000	0.0000	0.0000	61.9449	122.4993	185.1153 (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 requirement	164.0693	126.3459	106.1775	60.6908	30.9105	17.1278	13.1988	39.8484	66.2980	111.0283	143.2420	163.5575 (64)
Efficiency of water heater (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 (216)
Fuel for water heating, kWh/month	51.9568	40.0107	33.6239	19.2193	9.7886	5.4240	4.1797	12.6190	20.9950	35.1600	45.3613	51.7948 (219)
Water heating fuel used												330.1332 (219)
Annual totals kWh/year												
Space heating fuel - main system												915.1773 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 3.6690, total flow = 21.0000, SFP = 0.1747)												
mechanical ventilation fans (SFP = 0.1747)												32.9447 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												82.9447 (231)
Electricity for lighting (calculated in Appendix L)												306.0561 (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												-92.9280 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	915.1773	13.1900	120.7119 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	330.1332	13.1900	43.5446 (247)
Mechanical ventilation fans	32.9447	13.1900	4.3454 (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	306.0561	13.1900	40.3688 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit			-227.8229 (252)
Total energy cost			-12.2572 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = -0.0471 (257)
 SAP value 100.6564
 SAP rating (Section 12) 101 (258)
 SAP band A

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	915.1773	0.5190	474.9770 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	330.1332	0.5190	171.3391 (264)
Space and water heating			646.3162 (265)
Pumps and fans	82.9447	0.5190	43.0483 (267)
Energy for lighting	306.0561	0.5190	158.8431 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			-48.2297 (272)
CO2 emissions per m2			-0.7500 (273)
EI value			100.5907
EI rating			101 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	64.4000 (1b)	x 2.4000 (2b)	= 154.5600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.5600 (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	0.2250 (18)
Number of sides sheltered				1	1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2081 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.5000	4.4000	3.9000	3.8000	3.4000	3.3000	3.3000	3.5000	3.8000	3.9000	4.1000 (22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250 (22a)
Adj infilt rate	0.2341	0.2341	0.2289	0.2029	0.1977	0.1769	0.1717	0.1717	0.1821	0.1977	0.2029	0.2133 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
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)			5.8600	1.3258	7.7689		(27)
FRENCH DOOR (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
external door			2.1400	1.2000	2.5680		(26)
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)
BRICK TF	56.7400	11.8000	44.9400	0.2300	10.3362		(29a)
CEILING	64.4000		64.4000	0.1400	9.0160		(30)
Total net area of external elements Aum(A, m2)			157.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.5078	(33)
Party Wall 1			16.1300	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)							9.6614 (36)
Total fabric heat loss						(33) + (36) =	50.1692 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024	25.5024 (38)
Heat transfer coeff	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716	75.6716 (39)
Average = Sum(39)m / 12 =												75.6716 (39)
HLP	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750	1.1750 (40)
HLP (average)												1.1750 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.1029 (42)
Average daily hot water use (litres/day)												84.1444 (43)
Daily hot water use	92.5589	89.1931	85.8273	82.4615	79.0958	75.7300	75.7300	79.0958	82.4615	85.8273	89.1931	92.5589 (44)
Energy conte	137.2621	120.0503	123.8812	108.0026	103.6311	89.4257	82.8661	95.0901	96.2257	112.1418	122.4116	132.9310 (45)
Energy content (annual)												Total = Sum(45)m = 1323.9193 (45)
Distribution loss (46)m = 0.15 x (45)m	20.5893	18.0075	18.5822	16.2004	15.5447	13.4139	12.4299	14.2635	14.4339	16.8213	18.3617	19.9397 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Tweekend	18.8698	18.9557	19.0958	19.2417	19.3604	19.4479	19.4722	19.4707	19.4215	19.2699	19.0567	18.8496
MIT 2	18.8698	18.9557	19.0958	19.2417	19.3604	19.4479	19.4722	19.4707	19.4215	19.2699	19.0567	18.8496 (90)
Living area fraction									fLA = Living area / (4) =			0.2826 (91)
MIT	19.2517	19.3302	19.4591	19.5919	19.7038	19.7875	19.8112	19.8096	19.7601	19.6191	19.4206	19.2333 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2517	19.3302	19.4591	19.5919	19.7038	19.7875	19.8112	19.8096	19.7601	19.6191	19.4206	19.2333 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8837	0.8501	0.7972	0.7182	0.6152	0.4382	0.3131	0.3275	0.5240	0.7240	0.8359	0.8909 (94)
Useful gains	568.8750	614.9933	616.6131	579.0864	485.2858	345.6710	233.7337	239.8282	379.9493	494.5627	541.5372	556.7640 (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												
Month fracti	1131.4214	1099.5198	973.0707	801.5053	598.0949	377.4140	242.9994	250.4455	435.8730	690.0544	932.3200	1137.5906 (97)
Space heating kWh	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	418.5345	325.6019	265.2045	160.1416	83.9299	0.0000	0.0000	0.0000	0.0000	145.4458	281.3637	432.1350 (98)
Space heating per m2												2112.3568 (98)
												(98) / (4) = 32.8006 (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 %)												237.1996 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												890.5400 (211)
Space heating requirement	418.5345	325.6019	265.2045	160.1416	83.9299	0.0000	0.0000	0.0000	0.0000	145.4458	281.3637	432.1350 (98)
Space heating efficiency (main heating system 1)	237.1996	237.1996	237.1996	237.1996	237.1996	0.0000	0.0000	0.0000	0.0000	237.1996	237.1996	237.1996 (210)
Space heating fuel (main heating system)	176.4483	137.2692	111.8065	67.5134	35.3837	0.0000	0.0000	0.0000	0.0000	61.3179	118.6190	182.1820 (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 requirement	164.1741	125.9161	105.2319	57.5460	33.5957	11.2683	11.4548	36.3469	62.6872	109.1205	139.8891	161.5933 (64)
Efficiency of water heater (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 (216)
Fuel for water heating, kWh/month	51.9900	39.8746	33.3244	18.2235	10.6390	3.5684	3.6275	11.5102	19.8515	34.5559	44.2995	51.1727 (219)
Water heating fuel used												322.6373 (219)
Annual totals kWh/year												
Space heating fuel - main system												890.5400 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 3.6690, total flow = 21.0000, SFP = 0.1747)												
mechanical ventilation fans (SFP = 0.1747)												32.9447 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												82.9447 (231)
Electricity for lighting (calculated in Appendix L)												306.0561 (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												-294.8594 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	890.5400	20.4300	181.9373 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	322.6373	20.4300	65.9148 (247)
Mechanical ventilation fans	32.9447	20.4300	6.7306 (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	306.0561	20.4300	62.5273 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1897.0374	20.4300	-387.5647 (252)
Total energy cost			-60.2398 (255)

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

Energy Emission factor Emissions

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	890.5400	0.5190	462.1902 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	322.6373	0.5190	167.4488 (264)
Space and water heating			629.6390 (265)
Pumps and fans	82.9447	0.5190	43.0483 (267)
Energy for lighting	306.0561	0.5190	158.8431 (268)
Energy saving/generation technologies			
PV Unit	-1897.0374	0.5190	-984.5624 (269)
Total kg/year			-153.0320 (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	890.5400	3.0700	2733.9577 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	322.6373	3.0700	990.4965 (264)
Space and water heating			3724.4541 (265)
Pumps and fans	82.9447	3.0700	254.6402 (267)
Energy for lighting	306.0561	3.0700	939.5923 (268)
Energy saving/generation technologies			
PV Unit	-1897.0374	3.0700	-5823.9049 (269)
Primary energy kWh/year			-905.2183 (272)
Primary energy kWh/m2/year			-14.0562 (273)

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	HOUSE TYPE D2	Issued on Date	09/11/2022
Assessment Reference	GRANT ASHP	Prop Type Ref	
Property			

SAP Rating	87 B	DER	16.49	TER	27.97
Environmental	88 B	% DER<TER	41.05		
CO₂ Emissions (t/year)	0.95	DFEE	45.63	TFEE	51.17
General Requirements Compliance	Pass	% DFEE<TFEE	10.83		

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)

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)	27.97	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.49	kgCO ₂ /m ²	Pass
	-11.48 (-41.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.17	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.63	kWh/m ² /yr	
	-5.6 (-10.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (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	1.36 (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	

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

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	
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	3.00 m ² , No overhang	
Windows facing East	0.72 m ² , No overhang	
Windows facing South	5.94 m ² , 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	W/m ² K	
Filled Cavity with Edge Sealing	0.00		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/m ² K
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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)

Property Reference	HOUSE TYPE D2	Issued on Date	09/11/2022
Assessment Reference	GRANT ASHP	Prop Type Ref	
Property			

SAP Rating	87 B	DER	16.49	TER	27.97
Environmental	88 B	% DER<TER	41.05		
CO ₂ Emissions (t/year)	0.95	DFEE	45.63	TFEE	51.17
General Requirements Compliance	Pass	% DFEE<TFEE	10.83		

Assessor Details	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com	Assessor ID	K559-0001
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Client	
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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	Bungalow, Semi-Detached
2.0 Number of Storeys	1
3.0 Date Built	2022
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	23.64 m	64.40 m ²	2.40 m

7.0 Living Area	18.20	m ²
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8.0 Thermal Mass Parameter	Simple calculation - Low	
Thermal Mass	100.00	kJ/m ² K

9.0 External Walls

Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
BRICK TF	Timber Frame	0.23	56.74	44.94

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Area (m ²)
Party Wall 1	Filled Cavity with Edge Sealing		0.00	16.13

10.0 External Roofs

Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
CEILING	External Plane Roof	0.14	64.40	64.40

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Area (m ²)
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)

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
upvc window	Manufacture	Window	Double Low-E Hard	0.15		0.72		0.70	1.40
FRENCH DOOR	Manufacture	Window	Double Low-E Hard	0.15		0.72		0.70	1.40
external door	Manufacture	Solid Door							1.20
REAR DOOR	Manufacture	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 (m ²)	Curtain Closed
FRONT WINDOW	Window	[1] BRICK TF	North	None	0.00					3.00	
REAR WINDOW	Window	[1] BRICK TF	South	None	0.00					2.14	
GABLE WINDOW	Window	[1] BRICK TF	East	None	0.00					0.72	
FRONT DOOR	Solid Door	[1] BRICK TF	North							2.14	
FRENCH DOOR	Window	[1] BRICK TF	South	None	0.00					3.80	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	7.59	0.141	Yes	TRADA
Independently assessed	E3 Sill	6.58	0.027	Yes	TRADA
Independently assessed	E4 Jamb	18.02	0.038	Yes	TRADA
Independently assessed	E5 Ground floor (normal)	23.64	0.131	Yes	TRADA
Independently assessed	E10 Eaves (insulation at ceiling level)	9.76	0.060	No	TRADA
Independently assessed	E12 Gable (insulation at ceiling level)	13.21	0.062	No	TRADA
Independently assessed	E16 Corner (normal)	4.80	0.058	Yes	TRADA
Independently assessed	E18 Party wall between dwellings	4.80	0.119	Yes	TRADA
Independently assessed	P1 Party wall - Ground floor	9.11	0.119	No	TRADA
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.11	0.142	No	TRADA

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Cross ventilation possible

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

MV Reference Number
 Duct Type

19.1 Mechanical extract ventilation - Decentralised

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

22.0 Lighting

Internal

Total number of light fittings	<input type="text" value="17"/>	
Total number of L.E.L. fittings	<input type="text" value="17"/>	
Percentage of L.E.L. fittings	<input type="text" value="100.00"/>	%

External

External lights fitted	<input type="text" value="Yes"/>
Light and motion sensor	<input type="text" value="Yes"/>

23.0 Electricity Tariff

24.0 Main Heating 1

Database	<input type="text" value="Database"/>	
Description	<input type="text" value="ASHP"/>	
Percentage of Heat	<input type="text" value="100"/>	%
Database Ref. No.	<input type="text" value="103763"/>	
Fuel Type	<input type="text" value="Electricity"/>	
Main Heating	<input type="text" value="PET"/>	
SAP Code	<input type="text" value="224"/>	
In Winter	<input type="text" value="250.1"/>	
In Summer	<input type="text" value="332.4"/>	
Controls	<input type="text" value="CHD Time and temperature zone control"/>	
PCDF Controls	<input type="text" value="0"/>	
Sap Code	<input type="text" value="2207"/>	
Is MHS Pumped	<input type="text" value="Pump in heated space"/>	
Heat Emitter	<input type="text" value="Radiators and Underfloor"/>	
Underfloor Heating	<input type="text" value="Yes - Pipes in Concrete"/>	
Flow Temperature	<input type="text" value="36° - 45°C"/>	

25.0 Main Heating 2

Community Heating

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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
Loss	1.61
Pipes insulation	Fully insulated primary pipework

L kWh/day

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	£47	B 88	
	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 101	