

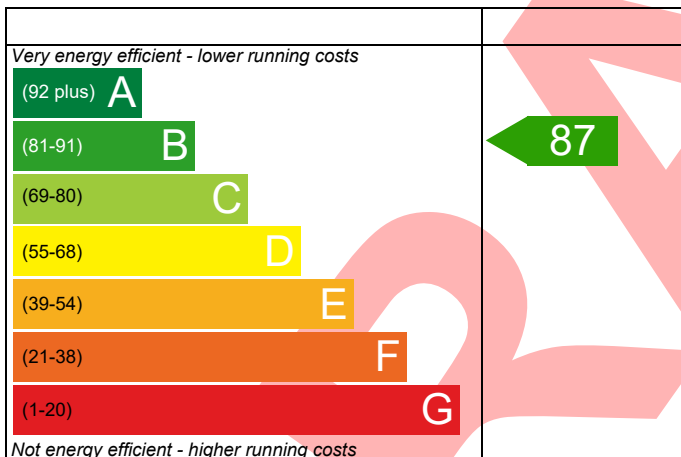
PREDICTED ENERGY ASSESSMENT

Dwelling type: Bungalow, Detached
 Date of assessment: 09/11/2022
 Produced by: S J Roberts Construction Limited
 Total floor area: 61.85 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.

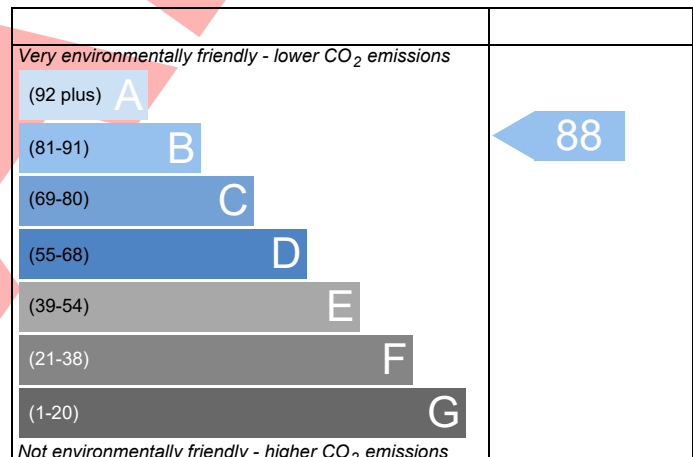
Energy Efficiency Rating



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 D4	Issued on Date	09/11/2022
Assessment Reference	GRANT ASHP	Prop Type Ref	
Property			

SAP Rating	87 B	DER	16.89	TER	29.78
Environmental	88 B	% DER<TER	43.28		
CO ₂ Emissions (t/year)	0.95	DFEE	50.66	TFEE	57.24
General Requirements Compliance	Pass	% DFEE<TFEE	11.48		

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)	29.78	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.89	kgCO ₂ /m ²	Pass
	-12.89 (-43.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.24	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	50.66	kWh/m ² /yr	
	-6.5 (-11.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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)

Main heating system

Secondary heating system

5 Cylinder insulation

Hot water storage

Primary pipework insulated

6 Controls

Space heating controls

Hot water controls

7 Low energy lights

Percentage of fixed lights with low-energy fittings %

Minimum %

8 Mechanical ventilation

Continuous extract system (decentralised)

Maximum

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Midlands)

Based on:

Overshading

Windows facing North

Windows facing East

Windows facing South

Air change rate

Blinds/curtains

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type U-value W/m²K

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals m³/(h.m²) @ 50 Pa

Maximum m³/(h.m²) @ 50 Pa

10 Key features

Party wall U-value W/m²K

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	HOUSE TYPE D4			Issued on Date	09/11/2022
Assessment Reference	GRANT ASHP	Prop Type Ref			
Property					
SAP Rating	87 B	DER	16.89	TER	29.78
Environmental	88 B	% DER<TER	43.28		
CO ₂ Emissions (t/year)	0.95	DFEE	50.66	TFEE	57.24
General Requirements Compliance	Pass	% DFEE<TFEE	11.48		
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

Detached Bungalow, total floor area 62 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) 29.78 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.89 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.7 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	1.37 (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: 2.81 m², No overhang
Windows facing East: 2.61 m², No overhang
Windows facing South: 7.11 m², No overhang
Air change rate: 6.00 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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.8500 (1b)	x 2.4000 (2b)	= 148.4400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4400 (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				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.2250	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2081 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2654	0.2602	0.2550	0.2289	0.2237	0.1977	0.1977	0.1925	0.2081	0.2237	0.2341	0.2445 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (25)
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 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
upvc window (Uw = 1.40)			7.5500	1.3258	10.0095		(27)
FRENCH DOOR (Uw = 1.40)			4.9800	1.3258	6.6023		(27)
external door			2.1400	1.2000	2.5680		(26)
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)
BRICK TF	80.5700	14.6700	65.9000	0.2300	15.1570		(29a)
CEILING	61.8500		61.8500	0.1400	8.6590		(30)
Total net area of external elements Aum, m ²			178.5500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.7765	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3903 (36)
Total fabric heat loss	(33) + (36) = 58.1668 (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	25.2450	24.9901	24.7352	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926 (38)
Average = Sum(39)m / 12 =	83.4118	83.1569	82.9021	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594 (39)
												82.7838 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3486	1.3445	1.3404	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364 (40)
HLP (average)												1.3385 (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	2.0334 (42)
Average daily hot water use (litres/day)	82.4939 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.7433	87.4436	84.1438	80.8441	77.5443	74.2445	74.2445	77.5443	80.8441	84.1438	87.4436	90.7433 (44)
Energy conte	134.5697	117.6955	121.4513	105.8842	101.5984	87.6717	81.2407	93.2249	94.3383	109.9422	120.0105	130.3236 (45)
Energy content (annual)												Total = Sum(45)m = 1297.9508 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1855	17.6543	18.2177	15.8826	15.2398	13.1507	12.1861	13.9837	14.1507	16.4913	18.0016	19.5485 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	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	26.9514	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	(59)
Total heat required for water heating calculated for each month													
184.7835	163.0499	171.6651	154.4782	151.8122	136.2657	131.4545	143.4387	142.9323	160.1560	168.6045	180.5374	180.5374	(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													
184.7835	163.0499	171.6651	154.4782	151.8122	136.2657	131.4545	143.4387	142.9323	160.1560	168.6045	180.5374	180.5374	(64)
Total per year (kWh/year) = Sum(64)m =													1889.1778 (64)
Heat gains from water heating, kWh/month													
84.9155	75.4173	80.5536	74.0817	73.9525	68.0260	67.1836	71.1683	70.2427	76.7268	78.7787	83.5036	83.5036	(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	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.9231	14.1427	11.5016	8.7075	6.5089	5.4951	5.9377	7.7180	10.3591	13.1533	15.3518	16.3656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.5874	179.4302	174.7864	164.9003	152.4209	140.6920	132.8563		131.0135	135.6573	145.5434	158.0229	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	(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)	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	(71)
Water heating gains (Table 5)	114.1337	112.2281	108.2709	102.8912	99.3985	94.4806	90.3005	95.6563	97.5593	103.1274	109.4148	112.2361	(72)
Total internal gains	361.1456	359.3025	348.0604	330.0004	311.8298	294.1691	282.5959	287.8893	297.0771	315.3256	336.2909	351.8549	(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	2.8100	10.6334	0.7200	0.7000	0.7700	10.4362 (74)							
East	2.6100	19.6403	0.7200	0.7000	0.7700	17.9041 (76)							
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812 (78)							
South	4.9800	46.7521	0.7200	0.7000	0.7700	81.3194 (78)							
Solar gains	144.4408	245.1110	333.7778	412.3061	461.6875	458.5643	441.9952	404.9412	360.8456	270.3867	172.8174	123.7451	(83)
Total gains	505.5864	604.4134	681.8382	742.3065	773.5172	752.7335	724.5911	692.8305	657.9227	585.7123	509.1083	475.6000	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.5973	20.6604	20.7239	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	
alpha	2.3732	2.3774	2.3816	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	
util living area	0.9406	0.9111	0.8685	0.8008	0.7024	0.5736	0.4485	0.4807	0.6529	0.8246	0.9147	0.9476	(86)
Tweekday	18.4941	18.6213	18.7953	18.9912	19.1552	19.2627	19.3039	19.2992	19.2307	19.0230	18.7309	18.4815	
Tweekend	20.3807	20.4371	20.5151	20.6046	20.6837	20.7399	20.7655	20.7618	20.7208	20.6173	20.4829	20.3712	
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	20.0442	20.1292	20.2516	20.3826	20.5118	20.6005	20.6381	20.6324	20.5640	20.4094	20.1926	20.0295	(87)
Th 2	19.8029	19.8061	19.8093	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	(88)
util rest of house	0.9315	0.8981	0.8489	0.7697	0.6529	0.4962	0.3446	0.3774	0.5816	0.7904	0.8999	0.9396	(89)
Tweekday	18.4941	18.6213	18.7953	18.9912	19.1552	19.2627	19.3039	19.2992	19.2307	19.0230	18.7309	18.4815	
Tweekend	18.4941	18.6213	18.7953	18.9912	19.1552	19.2627	19.3039	19.2992	19.2307	19.0230	18.7309	18.4815	
MIT 2	18.4941	18.6213	18.7953	18.9912	19.1552	19.2627	19.3039	19.2992	19.2307	19.0230	18.7309	18.4815	(90)
Living area fraction													fLA = Living area / (4) = 0.2441 (91)
MIT	18.8725	18.9895	19.1509	19.3309	19.4864	19.5893	19.6296	19.6247	19.5562	19.3615	19.0877	18.8594	(92)
Temperature adjustment													0.0000
adjusted MIT	18.8725	18.9895	19.1509	19.3309	19.4864	19.5893	19.6296	19.6247	19.5562	19.3615	19.0877	18.8594	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9232	0.8876	0.8364	0.7553	0.6376	0.4801	0.3272	0.3595	0.5641	0.7751	0.8891	0.9319	(94)
Useful gains	466.7453	536.4897	570.2763	560.6977	493.1750	361.3768	237.0673	249.0683	371.1484	454.0115	452.6411	443.2016	(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	1215.5219	1171.6380	1048.7815	862.2101	643.6182	412.4118	250.4277	266.5518	451.0072	724.2212	990.8974	1211.7405	(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)



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating kWh	557.0898	426.8196	356.0079	217.0889	111.9297	0.0000	0.0000	0.0000	0.0000	201.0360	387.5446	571.7930 (98)
Space heating												2829.3095 (98)
Space heating per m2												(98) / (4) = 45.7447 (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 %)												257.1337 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1100.3264 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	557.0898	426.8196	356.0079	217.0889	111.9297	0.0000	0.0000	0.0000	0.0000	201.0360	387.5446	571.7930	(98)
Space heating efficiency (main heating system 1)	257.1337	257.1337	257.1337	257.1337	257.1337	0.0000	0.0000	0.0000	0.0000	257.1337	257.1337	257.1337	(210)
Space heating fuel (main heating system)	216.6538	165.9914	138.4525	84.4265	43.5298	0.0000	0.0000	0.0000	0.0000	78.1835	150.7172	222.3719	(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	184.7835	163.0499	171.6651	154.4782	151.8122	136.2657	131.4545	143.4387	142.9323	160.1560	168.6045	180.5374	(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	58.5165	51.6340	54.3622	48.9195	48.0753	43.1521	41.6285	45.4236	45.2632	50.7176	53.3930	57.1719	(219)
Water heating fuel used												598.2576 (219)	
Annual totals kWh/year													
Space heating fuel - main system												1100.3264 (211)	
Space heating fuel - secondary												0.0000 (215)	

Electricity for pumps and fans: (MEV)Decentralised, Database: total watage = 3.8610, total flow = 21.0000, SFP = 0.1839)												
mechanical ventilation fans (SFP = 0.1839)												33.2959 (230a)
Total electricity for the above, kWh/year												33.2959 (231)
Electricity for lighting (calculated in Appendix L)												281.2063 (232)
Total delivered energy for all uses												2013.0862 (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	1100.3264	0.5190	571.0694	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	598.2576	0.5190	310.4957	(264)
Space and water heating			881.5651	(265)
Pumps and fans	33.2959	0.5190	17.2806	(267)
Energy for lighting	281.2063	0.5190	145.9461	(268)
Total CO2, kg/year			1044.7917	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.8900	(273)

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

DER		16.8900	ZC1
Total Floor Area		61.8500	TFA
Assumed number of occupants		2.0334	N
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	EF
CO2 emissions from appliances, equation (L14)		17.0145	ZC2
CO2 emissions from cooking, equation (L16)		2.7131	ZC3
Total CO2 emissions		36.6175	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		36.6175	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	61.8500 (1b)	x 2.4000 (2b)	= 148.4400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4400 (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) =	0.1347 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3847 (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) =		0.3559 (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	0.4537	0.4448	0.4360	0.3915	0.3826	0.3381	0.3381	0.3292	0.3559	0.3826	0.4004	0.4182 (22b)
Effective ac	0.6029	0.5989	0.5950	0.5766	0.5732	0.5572	0.5572	0.5542	0.5633	0.5732	0.5801	0.5874 (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)			12.5300	1.3258	16.6117		(27)					
Heat Loss Floor 1			36.1300	0.1300	4.6969		(28a)					
BRICK TF	80.5700	14.6700	65.9000	0.1800	11.8620		(29a)					
CEILING	61.8500		61.8500	0.1300	8.0405		(30)					
Total net area of external elements Aum(A, m ²)			178.5500				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	43.3511	(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)							10.1739 (36)					
Total fabric heat loss						(33) + (36) =	53.5250 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.5353	Feb 29.3395	Mar 29.1475	Apr 28.2460	May 28.0773	Jun 27.2921	Jul 27.2921	Aug 27.1467	Sep 27.5946	Oct 28.0773	Nov 28.4186	Dec 28.7753 (38)
Heat transfer coeff	83.0603	82.8645	82.6726	81.7711	81.6024	80.8172	80.8172	80.6718	81.1196	81.6024	81.9436	82.3003 (39)
Average = Sum(39)m / 12 =												81.7702 (39)
HLP	Jan 1.3429	Feb 1.3398	Mar 1.3367	Apr 1.3221	May 1.3194	Jun 1.3067	Jul 1.3067	Aug 1.3043	Sep 1.3116	Oct 1.3194	Nov 1.3249	Dec 1.3306 (40)
HLP (average)												1.3221 (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												2.0334 (42)
Average daily hot water use (litres/day)												82.4939 (43)
Daily hot water use	90.7433	87.4436	84.1438	80.8441	77.5443	74.2445	74.2445	77.5443	80.8441	84.1438	87.4436	90.7433 (44)
Energy conte	134.5697	117.6955	121.4513	105.8842	101.5984	87.6717	81.2407	93.2249	94.3383	109.9422	120.0105	130.3236 (45)
Energy content (annual)												Total = Sum(45)m = 1297.9508 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1855	17.6543	18.2177	15.8826	15.2398	13.1507	12.1861	13.9837	14.1507	16.4913	18.0016	19.5485 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (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	183.8124	162.1728	170.6939	153.5384	150.8410	135.3259	130.4834	142.4675	141.9925	159.1848	167.6647	179.5663 (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	183.8124	162.1728	170.6939	153.5384	150.8410	135.3259	130.4834	142.4675	141.9925	159.1848	167.6647	179.5663 (64)
Heat gains from water heating, kWh/month	84.1386	74.7156	79.7767	73.3298	73.1756	67.2742	66.4067	70.3914	69.4908	75.9499	78.0268	82.7267 (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	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.9231	14.1427	11.5016	8.7075	6.5089	5.4951	5.9377	7.7180	10.3591	13.1533	15.3518	16.3656 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.5874	179.4302	174.7864	164.9003	152.4209	140.6920	132.8563	131.0135	135.6573	145.5434	158.0229	169.7518 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671 (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)	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372 (71)
Water heating gains (Table 5)	113.0895	111.1839	107.2267	101.8470	98.3543	93.4364	89.2563	94.6121	96.5150	102.0832	108.3706	111.1918 (72)
Total internal gains	363.1014	361.2582	350.0162	331.9562	313.7855	296.1249	284.5517	289.8451	299.0329	317.2813	338.2467	353.8107 (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	2.8100	10.6334	0.6300	0.7000	0.7700	9.1317 (74)						
East	2.6100	19.6403	0.6300	0.7000	0.7700	15.6661 (76)						
South	7.1100	46.7521	0.6300	0.7000	0.7700	101.5880 (78)						
Solar gains	126.3857	214.4721	292.0556	360.7679	403.9765	401.2438	386.7458	354.3235	315.7399	236.5884	151.2152	108.2770 (83)
Total gains	489.4870	575.7303	642.0717	692.7241	717.7621	697.3687	671.2975	644.1686	614.7728	553.8697	489.4619	462.0876 (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	51.7111	51.8333	51.9536	52.5264	52.6350	53.1464	53.1464	53.2421	52.9482	52.6350	52.4158	52.1886
alpha	4.4474	4.4556	4.4636	4.5018	4.5090	4.5431	4.5431	4.5495	4.5299	4.5090	4.4944	4.4792
util living area	0.9937	0.9864	0.9704	0.9299	0.8405	0.6808	0.5154	0.5552	0.7788	0.9439	0.9871	0.9951 (86)
MIT	19.6787	19.8754	20.1546	20.4917	20.7708	20.9373	20.9858	20.9802	20.8806	20.5200	20.0348	19.6434 (87)
Th 2	19.8074	19.8098	19.8122	19.8236	19.8257	19.8356	19.8356	19.8375	19.8318	19.8257	19.8214	19.8169 (88)
util rest of house	0.9916	0.9819	0.9603	0.9051	0.7846	0.5804	0.3862	0.4251	0.6902	0.9188	0.9820	0.9934 (89)
MIT 2	18.0828	18.3692	18.7713	19.2494	19.6102	19.7960	19.8308	19.8300	19.7440	19.2994	18.6105	18.0379 (90)
Living area fraction	fLA = Living area / (4) =											0.2441 (91)
MIT	18.4724	18.7369	19.1090	19.5527	19.8935	20.0746	20.1128	20.1108	20.0215	19.5974	18.9583	18.4299 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4724	18.7369	19.1090	19.5527	19.8935	20.0746	20.1128	20.1108	20.0215	19.5974	18.9583	18.4299 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9881	0.9763	0.9525	0.8981	0.7883	0.6025	0.4180	0.4570	0.7063	0.9126	0.9767	0.9905 (94)
Ext temp.	483.6652	562.0990	611.5592	622.1461	565.8146	420.1874	280.5831	294.3812	434.2101	505.4519	478.0568	457.7185 (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	1177.1664	1146.5885	1042.4192	871.0822	668.6109	442.4417	283.8951	299.3572	480.3471	734.2098	971.7083	1171.1229 (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 per m2	515.9649	392.7769	320.5598	179.2340	76.4805	0.0000	0.0000	0.0000	0.0000	170.1959	355.4291	530.7728 (98)
												2541.4139 (98)
												(98) / (4) = 41.0900 (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													2718.0898 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	515.9649	392.7769	320.5598	179.2340	76.4805	0.0000	0.0000	0.0000	0.0000	170.1959	355.4291	530.7728	(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)	551.8341	420.0823	342.8447	191.6941	81.7973	0.0000	0.0000	0.0000	0.0000	182.0277	380.1380	567.6715	(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	183.8124	162.1728	170.6939	153.5384	150.8410	135.3259	130.4834	142.4675	141.9925	159.1848	167.6647	179.5663	(64)
Efficiency of water heater (217)m	87.4210	87.0876	86.4713	85.2273	83.1058	79.8000	79.8000	79.8000	79.8000	84.9924	86.7708	87.5330	(216)
Fuel for water heating, kWh/month	210.2612	186.2180	197.3995	180.1515	181.5048	169.5813	163.5130	178.5308	177.9354	187.2931	193.2271	205.1411	(219)
Water heating fuel used													2230.7568 (219)
Annual totals kWh/year													
Space heating fuel - main system													2718.0898 (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)													281.2063 (232)
Total delivered energy for all uses													5305.0529 (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	2718.0898	0.2160	587.1074 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2230.7568	0.2160	481.8435 (264)
Space and water heating			1068.9509 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	281.2063	0.5190	145.9461 (268)
Total CO2, kg/m2/year			1253.8219 (272)
Emissions per m2 for space and water heating			17.2830 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3597 (272b)
Emissions per m2 for pumps and fans			0.6293 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.2830 * 1.55) + 2.3597 + 0.6293, rounded to 2 d.p.			29.7800 (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	61.8500 (1b)	x 2.4000 (2b)	= 148.4400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4400 (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) =	0.1347 (8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.3597	(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) =		0.3328 (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												
Effective ac	0.4243	0.4159	0.4076	0.3660	0.3577	0.3161	0.3161	0.3078	0.3328	0.3577	0.3743	0.3910 (22b)
Effective ac	0.5900	0.5865	0.5831	0.5670	0.5640	0.5500	0.5500	0.5474	0.5554	0.5640	0.5701	0.5764 (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)			7.5500	1.3258	10.0095		(27)
FRENCH DOOR (Uw = 1.40)			4.9800	1.3258	6.6023		(27)
external door			2.1400	1.2000	2.5680		(26)
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)
BRICK TF	80.5700	14.6700	65.9000	0.2300	15.1570		(29a)
CEILING	61.8500		61.8500	0.1400	8.6590		(30)
Total net area of external elements Aum(A, m2)			178.5500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.7765	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3903 (36)
 Total fabric heat loss (33) + (36) = 58.1668 (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	28.9012	28.7300	28.5622	27.7741	27.6266	26.9401	26.9401	26.8130	27.2046	27.6266	27.9249	28.2368 (38)
Heat transfer coeff	87.0680	86.8969	86.7291	85.9409	85.7934	85.1070	85.1070	84.9798	85.3714	85.7934	86.0917	86.4036 (39)
Average = Sum(39)m / 12 =												85.9402 (39)
HLP	1.4077	1.4050	1.4022	1.3895	1.3871	1.3760	1.3760	1.3740	1.3803	1.3871	1.3919	1.3970 (40)
HLP (average)												1.3895 (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												2.0334 (42)
Average daily hot water use (litres/day)												82.4939 (43)
Daily hot water use	90.7433	87.4436	84.1438	80.8441	77.5443	74.2445	74.2445	77.5443	80.8441	84.1438	87.4436	90.7433 (44)
Energy conte	134.5697	117.6955	121.4513	105.8842	101.5984	87.6717	81.2407	93.2249	94.3383	109.9422	120.0105	130.3236 (45)
Energy content (annual)												Total = Sum(45)m = 1297.9508 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	28.5961	25.0103	25.8084	22.5004	21.5897	18.6302	17.2636	19.8103	20.0469	23.3627	25.5022	27.6938	(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	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.9231	14.1427	11.5016	8.7075	6.5089	5.4951	5.9377	7.7180	10.3591	13.1533	15.3518	16.3656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.5874	179.4302	174.7864	164.9003	152.4209	140.6920	132.8563	131.0135	135.6573	145.5434	158.0229	169.7518	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	(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)	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	(71)
Water heating gains (Table 5)	38.4356	37.2177	34.6887	31.2505	29.0184	25.8753	23.2038	26.6267	27.8429	31.4015	35.4198	37.2228	(72)
Total internal gains	285.4475	284.2921	274.4782	258.3597	241.4496	225.5638	215.4993	218.8597	227.3608	243.5996	262.2959	276.8416	(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		2.8100	10.6334	0.7200	0.7000	0.7700	10.4362 (74)						
East		2.6100	19.6403	0.7200	0.7000	0.7700	17.9041 (76)						
South		2.1300	46.7521	0.7200	0.7000	0.7700	34.7812 (78)						
South		4.9800	46.7521	0.7200	0.7000	0.7700	81.3194 (78)						
Solar gains	144.4408	245.1110	333.7778	412.3061	461.6875	458.5643	441.9952	404.9412	360.8456	270.3867	172.8174	123.7451	(83)
Total gains	429.8882	529.4030	608.2559	670.6659	703.1371	684.1282	657.4944	623.8009	588.2063	513.9863	435.1132	400.5867	(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	19.7323	19.7712	19.8095	19.9911	20.0255	20.1870	20.1870	20.2172	20.1245	20.0255	19.9561	19.8841	
alpha	2.3155	2.3181	2.3206	2.3327	2.3350	2.3458	2.3458	2.3478	2.3416	2.3350	2.3304	2.3256	
util living area	0.9573	0.9320	0.8949	0.8338	0.7430	0.6180	0.4923	0.5279	0.7013	0.8610	0.9376	0.9632	(86)
MIT	18.2356	18.5963	19.1053	19.7180	20.2648	20.6735	20.8640	20.8349	20.5276	19.7996	18.8980	18.1643	(87)
Th 2	19.7574	19.7595	19.7616	19.7714	19.7732	19.7818	19.7818	19.7833	19.7785	19.7732	19.7695	19.7656	(88)
util rest of house	0.9504	0.9212	0.8778	0.8053	0.6949	0.5384	0.3800	0.4173	0.6306	0.8309	0.9259	0.9572	(89)
MIT 2	17.2720	17.6268	18.1247	18.7199	19.2286	19.5871	19.7256	19.7105	19.4739	18.8124	17.9363	17.2073	(90)
Living area fraction									fLA = Living area / (4) =			0.2441	(91)
MIT	17.5072	17.8635	18.3641	18.9636	19.4816	19.8523	20.0036	19.9850	19.7311	19.0534	18.1711	17.4410	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5072	17.8635	18.3641	18.9636	19.4816	19.8523	20.0036	19.9850	19.7311	19.0534	18.1711	17.4410	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	401.2096	476.3284	519.3091	525.0764	479.3994	371.8072	264.3460	272.7846	369.0762	415.8555	394.0650	377.1950	(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	1149.9293	1126.4893	1028.9635	864.8746	667.6068	447.0083	289.6665	304.6520	480.7374	725.2484	953.1278	1144.0662	(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	557.0475	436.9082	379.1829	244.6547	140.0263	0.0000	0.0000	0.0000	0.0000	230.1883	402.5252	570.5522	(98)
Space heating												2961.0854	(98)
Space heating per m2										(98) / (4) =		47.8753	(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	800.0055	629.7915	645.8468	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7320	0.7951	0.7739	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	585.6340	500.7521	499.8363	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	875.4880	842.8614	804.6748	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	208.6949	254.5293	226.7998	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											690.0240 (104)	
Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
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	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	52.1737	63.6323	56.7000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												172.5060 (107)
Space cooling per m2												2.7891 (108)
Energy for space heating												47.8753 (99)
Energy for space cooling												2.7891 (108)
Total												50.6644 (109)
Dwelling Fabric Energy Efficiency (DFEE)												50.7 (109)

FULL SAP CALCULATION PRINTOUT

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 (m2)	Storey height (m)	Volume (m3)
Ground floor	61.8500 (1b)	x 2.4000 (2b)	= 148.4400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4400 (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) =	0.1347 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3847	(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) =		0.3559 (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	0.4537	0.4448	0.4360	0.3915	0.3826	0.3381	0.3381	0.3292	0.3559	0.3826	0.4004	0.4182 (22b)
Effective ac	0.6029	0.5989	0.5950	0.5766	0.5732	0.5572	0.5572	0.5542	0.5633	0.5732	0.5801	0.5874 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1400	1.0000	2.1400		(26)					
TER Opening Type (Uw = 1.40)			12.5300	1.3258	16.6117		(27)					
Heat Loss Floor 1			36.1300	0.1300	4.6969		(28a)					
BRICK TF	80.5700	14.6700	65.9000	0.1800	11.8620		(29a)					
CEILING	61.8500		61.8500	0.1300	8.0405		(30)					
Total net area of external elements Aum(A, m2)			178.5500				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	43.3511	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1739 (36)					
Total fabric heat loss							(33) + (36) = 53.5250 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.5353	Feb 29.3395	Mar 29.1475	Apr 28.2460	May 28.0773	Jun 27.2921	Jul 27.2921	Aug 27.1467	Sep 27.5946	Oct 28.0773	Nov 28.4186	Dec 28.7753 (38)
Heat transfer coeff	83.0603	82.8645	82.6726	81.7711	81.6024	80.8172	80.8172	80.6718	81.1196	81.6024	81.9436	82.3003 (39)
Average = Sum(39)m / 12 =												81.7702 (39)
HLP	Jan 1.3429	Feb 1.3398	Mar 1.3367	Apr 1.3221	May 1.3194	Jun 1.3067	Jul 1.3067	Aug 1.3043	Sep 1.3116	Oct 1.3194	Nov 1.3249	Dec 1.3306 (40)
HLP (average)												1.3221 (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												2.0334 (42)
Average daily hot water use (litres/day)												82.4939 (43)
Daily hot water use	90.7433	87.4436	84.1438	80.8441	77.5443	74.2445	74.2445	77.5443	80.8441	84.1438	87.4436	90.7433 (44)
Energy conte	134.5697	117.6955	121.4513	105.8842	101.5984	87.6717	81.2407	93.2249	94.3383	109.9422	120.0105	130.3236 (45)
Energy content (annual)												Total = Sum(45)m = 1297.9508 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	28.5961	25.0103	25.8084	22.5004	21.5897	18.6302	17.2636	19.8103	20.0469	23.3627	25.5022	27.6938	(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	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	101.6714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.9231	14.1427	11.5016	8.7075	6.5089	5.4951	5.9377	7.7180	10.3591	13.1533	15.3518	16.3656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.5874	179.4302	174.7864	164.9003	152.4209	140.6920	132.8563	131.0135	135.6573	145.5434	158.0229	169.7518	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	33.1671	(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)	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	(71)
Water heating gains (Table 5)	38.4356	37.2177	34.6887	31.2505	29.0184	25.8753	23.2038	26.6267	27.8429	31.4015	35.4198	37.2228	(72)
Total internal gains	285.4475	284.2921	274.4782	258.3597	241.4496	225.5638	215.4993	218.8597	227.3608	243.5996	262.2959	276.8416	(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	2.8100	10.6334	0.6300	0.7000	0.7700	9.1317 (74)							
East	2.6100	19.6403	0.6300	0.7000	0.7700	15.6661 (76)							
South	7.1100	46.7521	0.6300	0.7000	0.7700	101.5880 (78)							
Solar gains	126.3857	214.4721	292.0556	360.7679	403.9765	401.2438	386.7458	354.3235	315.7399	236.5884	151.2152	108.2770	(83)
Total gains	411.8331	498.7642	566.5337	619.1276	645.4261	626.8076	602.2450	573.1832	543.1006	480.1880	413.5110	385.1186	(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)	51.7111	51.8333	51.9536	52.5264	52.6350	53.1464	53.1464	53.2421	52.9482	52.6350	52.4158	52.1886	21.0000 (85)
tau	4.4474	4.4556	4.4636	4.5018	4.5090	4.5431	4.5431	4.5495	4.5299	4.5090	4.4944	4.4792	
util living area	0.9968	0.9922	0.9811	0.9509	0.8780	0.7332	0.5671	0.6127	0.8313	0.9652	0.9933	0.9976	(86)
MIT	19.5675	19.7682	20.0558	20.4101	20.7168	20.9149	20.9793	20.9706	20.8403	20.4326	19.9283	19.5322	(87)
Th 2	19.8074	19.8098	19.8122	19.8236	19.8257	19.8356	19.8356	19.8375	19.8318	19.8257	19.8214	19.8169	(88)
util rest of house	0.9957	0.9894	0.9743	0.9320	0.8293	0.6336	0.4286	0.4745	0.7504	0.9479	0.9905	0.9968	(89)
MIT 2	18.5195	18.7208	19.0066	19.3580	19.6375	19.7972	19.8306	19.8295	19.7471	19.3873	18.8901	18.4918	(90)
Living area fraction	18.7753	18.9765	19.2628	19.6149	19.9010	20.0701	20.1111	20.1081	20.0140	19.6425	19.1436	18.7458	(91)
MIT	18.7753	18.9765	19.2628	19.6149	19.9010	20.0701	20.1111	20.1081	20.0140	19.6425	19.1436	18.7458	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7753	18.9765	19.2628	19.6149	19.9010	20.0701	20.1111	20.1081	20.0140	19.6425	19.1436	18.7458	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9869	0.9702	0.9279	0.8330	0.6556	0.4629	0.5086	0.7650	0.9445	0.9883	0.9958	(94)
Useful gains	409.5185	492.2196	549.6246	574.4733	537.6223	410.9086	278.7626	291.5122	415.4624	453.5182	408.6534	383.4906	(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	1202.3241	1166.4416	1055.1303	876.1674	669.2186	442.0773	283.7536	299.1413	479.7412	737.8874	986.8922	1197.1253	(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	589.8474	453.0772	376.0963	217.2197	97.9077	0.0000	0.0000	0.0000	0.0000	211.5707	416.3319	605.3442	(98)
Space heating												2967.3951	(98)
Space heating per m2										(98) / (4) =		47.9773	(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	759.6816	598.0472	613.1056	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8441	0.9089	0.8898	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	641.2775	543.5406	545.5432	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	808.4900	778.2841	745.5113	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	120.3930	174.6492	148.7763	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												443.8184	(104)
Cooled fraction												1.0000	(105)

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	30.0982	43.6623	37.1941	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												110.9546 (107)
Space cooling per m2												1.7939 (108)
Energy for space heating												47.9773 (99)
Energy for space cooling												1.7939 (108)
Total												49.7712 (109)
Target Fabric Energy Efficiency (TFEE)												57.2 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.8500 (1b)	x 2.4000 (2b)	= 148.4400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4400 (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				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 (25)
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 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
upvc window (Uw = 1.40)			7.5500	1.3258	10.0095		(27)
FRENCH DOOR (Uw = 1.40)			4.9800	1.3258	6.6023		(27)
external door			2.1400	1.2000	2.5680		(26)
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)
BRICK TF	80.5700	14.6700	65.9000	0.2300	15.1570		(29a)
CEILING	61.8500		61.8500	0.1400	8.6590		(30)
Total net area of external elements Aum, m ²			178.5500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.7765	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3903 (36)
 Total fabric heat loss (33) + (36) = 58.1668 (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	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926 (38)
Average = Sum(39)m / 12 =	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364 (40)
HLP (average)												1.3364 (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 2.0334 (42)
 Average daily hot water use (litres/day) 82.4939 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	90.7433	87.4436	84.1438	80.8441	77.5443	74.2445	74.2445	77.5443	80.8441	84.1438	87.4436	90.7433 (44)
Energy content (annual)	134.5697	117.6955	121.4513	105.8842	101.5984	87.6717	81.2407	93.2249	94.3383	109.9422	120.0105	130.3236 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1297.9508 (45)
Water storage loss:	20.1855	17.6543	18.2177	15.8826	15.2398	13.1507	12.1861	13.9837	14.1507	16.4913	18.0016	19.5485 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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)
Total heat required for water heating calculated for each month	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)
Solar input	184.7835	163.0499	171.6651	154.4782	151.8122	136.2657	131.4545	143.4387	142.9323	160.1560	168.6045	180.5374	(62)
Solar input (sum of months) = Sum(63)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	(63)
Output from w/h	184.7835	163.0499	171.6651	154.4782	151.8122	136.2657	131.4545	143.4387	142.9323	160.1560	168.6045	180.5374	(64)
Total per year (kWh/year) = Sum(64)m =												1889.1778	(64)
RHI water heating demand												1889	(64)
Heat gains from water heating, kWh/month	84.9155	75.4173	80.5536	74.0817	73.9525	68.0260	67.1836	71.1683	70.2427	76.7268	78.7787	83.5036	(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	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.8077	35.3568	28.7541	21.7687	16.2724	13.7378	14.8442	19.2950	25.8978	32.8831	38.3795	40.9140	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.0558	267.8063	260.8752	246.1198	227.4938	209.9880	198.2930	195.5426	202.4736	217.2290	235.8550	253.3609	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	(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)	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	(71)
Water heating gains (Table 5)	114.1337	112.2281	108.2709	102.8912	99.3985	94.4806	90.3005	95.6563	97.5593	103.1274	109.4148	112.2361	(72)
Total internal gains	508.8998	505.2938	487.8028	460.6823	433.0673	408.1090	393.3403	400.3965	415.8333	443.1422	473.5519	496.4135	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North		2.8100	11.3201	0.7200	0.7000	0.7700	11.1102	(74)					
East		2.6100	21.0039	0.7200	0.7000	0.7700	19.1472	(76)					
South		2.1300	49.0238	0.7200	0.7000	0.7700	36.4712	(78)					
South		4.9800	49.0238	0.7200	0.7000	0.7700	85.2708	(78)					
Solar gains	151.9994	261.7892	357.7274	452.0012	478.1270	513.6981	477.1437	445.3330	400.4005	296.5344	204.6933	143.9612	(83)
Total gains	660.8991	767.0829	845.5303	912.6835	911.1943	921.8071	870.4840	845.7295	816.2338	739.6766	678.2452	640.3748	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th _l (C)													21.0000	(85)
Utilisation factor for gains for living area, nil, m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848		
alpha	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857		
util living area	0.9020	0.8667	0.8132	0.7334	0.6387	0.4855	0.3858	0.4028	0.5769	0.7586	0.8600	0.9083	(86)	
Tweekday	18.6291	18.7340	18.8969	19.0639	19.1925	19.2836	19.3087	19.3069	19.2531	19.0829	18.8408	18.6073		
Tweekend	20.4386	20.4869	20.5621	20.6411	20.7043	20.7540	20.7703	20.7688	20.7353	20.6480	20.5345	20.4286		
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	20.1336	20.2062	20.3241	20.4395	20.5436	20.6222	20.6455	20.6432	20.5866	20.4567	20.2731	20.1182	(87)	
Th 2	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	(88)	
util rest of house	0.8885	0.8492	0.7884	0.6972	0.5864	0.4101	0.2923	0.3086	0.5066	0.7185	0.8386	0.8956	(89)	
Tweekday	18.6291	18.7340	18.8969	19.0639	19.1925	19.2836	19.3087	19.3069	19.2531	19.0829	18.8408	18.6073		
Tweekend	18.6291	18.7340	18.8969	19.0639	19.1925	19.2836	19.3087	19.3069	19.2531	19.0829	18.8408	18.6073		
MIT 2	18.6291	18.7340	18.8969	19.0639	19.1925	19.2836	19.3087	19.3069	19.2531	19.0829	18.8408	18.6073	(90)	
Living area fraction									fLA = Living area / (4) =				0.2441	(91)
MIT	18.9964	19.0934	19.2454	19.3998	19.5224	19.6104	19.6350	19.6331	19.5787	19.4183	19.1904	18.9762	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9964	19.0934	19.2454	19.3998	19.5224	19.6104	19.6350	19.6331	19.5787	19.4183	19.1904	18.9762	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8777	0.8371	0.7751	0.6833	0.5724	0.3963	0.2775	0.2934	0.4914	0.7034	0.8256	0.8852	(94)
Ext temp.	580.0786	642.1197	655.3525	623.6034	521.5504	365.3323	241.5570	248.1104	401.0679	520.3224	559.9632	566.8314	(95)
Heat loss rate W	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)
Total	1214.7974	1181.4861	1045.2593	859.6384	638.3268	397.6266	250.8749	258.9831	461.1324	737.1846	999.3890	1221.3910	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 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													
Space heating	472.2308	362.4542	290.0906	169.9452	86.8816	0.0000	0.0000	0.0000	0.0000	161.3455	316.3866	486.9923	(98)
RHI space heating demand												2346.3269	(98)
												2346	(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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.8500 (1b)	2.4000 (2b)	148.4400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	148.4400 (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				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
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 (25)
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 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
upvc window (Uw = 1.40)			7.5500	1.3258	10.0095		(27)
FRENCH DOOR (Uw = 1.40)			4.9800	1.3258	6.6023		(27)
external door			2.1400	1.2000	2.5680		(26)
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)
BRICK TF	80.5700	14.6700	65.9000	0.2300	15.1570		(29a)
CEILING	61.8500		61.8500	0.1400	8.6590		(30)
Total net area of external elements Aum, m ²			178.5500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.7765	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3903 (36)
Total fabric heat loss	(33) + (36) = 58.1668 (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	25.2450	24.9901	24.7352	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926 (38)
Average = Sum(39)m / 12 =	83.4118	83.1569	82.9021	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3486	1.3445	1.3404	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364 (40)
HLP (average)												1.3385 (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	2.0334 (42)
Average daily hot water use (litres/day)	82.4939 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.7433	87.4436	84.1438	80.8441	77.5443	74.2445	74.2445	77.5443	80.8441	84.1438	87.4436	90.7433 (44)
Energy conte	134.5697	117.6955	121.4513	105.8842	101.5984	87.6717	81.2407	93.2249	94.3383	109.9422	120.0105	130.3236 (45)
Energy content (annual)												Total = Sum(45)m = 1297.9508 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1855	17.6543	18.2177	15.8826	15.2398	13.1507	12.1861	13.9837	14.1507	16.4913	18.0016	19.5485 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	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	26.9514	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	(59)
Total heat required for water heating calculated for each month													
184.7835	163.0499	171.6651	154.4782	151.8122	136.2657	131.4545	143.4387	142.9323	160.1560	168.6045	180.5374	168.6045	(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													
184.7835	163.0499	171.6651	154.4782	151.8122	136.2657	131.4545	143.4387	142.9323	160.1560	168.6045	180.5374	168.6045	(64)
Heat gains from water heating, kWh/month													
84.9155	75.4173	80.5536	74.0817	73.9525	68.0260	67.1836	71.1683	70.2427	76.7268	78.7787	83.5036	78.7787	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.8077	35.3568	28.7541	21.7687	16.2724	13.7378	14.8442	19.2950	25.8978	32.8831	38.3795	40.9140	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.0558	267.8063	260.8752	246.1198	227.4938	209.9880	198.2930	195.5426	202.4736	217.2290	235.8550	253.3609	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	(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)	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	(71)
Water heating gains (Table 5)	114.1337	112.2281	108.2709	102.8912	99.3985	94.4806	90.3005	95.6563	97.5593	103.1274	109.4148	112.2361	(72)
Total internal gains	508.8998	505.2938	487.8028	460.6823	433.0673	408.1090	393.3403	400.3965	415.8333	443.1422	473.5519	496.4135	(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		2.8100	10.6334	0.7200	0.7000	0.7700	10.4362 (74)						
East		2.6100	19.6403	0.7200	0.7000	0.7700	17.9041 (76)						
South		2.1300	46.7521	0.7200	0.7000	0.7700	34.7812 (78)						
South		4.9800	46.7521	0.7200	0.7000	0.7700	81.3194 (78)						
Solar gains	144.4408	245.1110	333.7778	412.3061	461.6875	458.5643	441.9952	404.9412	360.8456	270.3867	172.8174	123.7451	(83)
Total gains	653.3405	750.4047	821.5806	872.9885	894.7548	866.6733	835.3355	805.3377	776.6788	713.5289	646.3693	620.1586	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
Jan	20.5973	20.6604	20.7239	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	
Feb	2.3732	2.3774	2.3816	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	
util living area	0.9045	0.8707	0.8234	0.7509	0.6495	0.5202	0.3994	0.4270	0.5903	0.7670	0.8707	0.9135	(86)
Tweekday	18.6043	18.7181	18.8728	19.0446	19.1851	19.2748	19.3077	19.3043	19.2508	19.0786	18.8218	18.5929	
Tweekend	20.4311	20.4820	20.5520	20.6314	20.7003	20.7482	20.7693	20.7666	20.7335	20.6455	20.5255	20.4220	
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	20.1220	20.1987	20.3085	20.4244	20.5374	20.6133	20.6440	20.6397	20.5838	20.4530	20.2590	20.1079	(87)
Th 2	19.8029	19.8061	19.8093	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	(88)
util rest of house	0.8912	0.8534	0.7995	0.7161	0.5981	0.4451	0.3035	0.3311	0.5187	0.7272	0.8504	0.9013	(89)
Tweekday	18.6043	18.7181	18.8728	19.0446	19.1851	19.2748	19.3077	19.3043	19.2508	19.0786	18.8218	18.5929	
Tweekend	18.6043	18.7181	18.8728	19.0446	19.1851	19.2748	19.3077	19.3043	19.2508	19.0786	18.8218	18.5929	
MIT 2	18.6043	18.7181	18.8728	19.0446	19.1851	19.2748	19.3077	19.3043	19.2508	19.0786	18.8218	18.5929	(90)
Living area fraction													fLA = Living area / (4) =
MIT	18.9748	19.0795	19.2233	19.3814	19.5152	19.6016	19.6340	19.6303	19.5762	19.4141	19.1727	18.9628	(91)
Temperature adjustment													0.0000
adjusted MIT	18.9748	19.0795	19.2233	19.3814	19.5152	19.6016	19.6340	19.6303	19.5762	19.4141	19.1727	18.9628	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8805	0.8413	0.7862	0.7020	0.5839	0.4306	0.2881	0.3153	0.5029	0.7120	0.8377	0.8912 (94)
Ext temp.	575.2929	631.3502	645.9515	612.8012	522.4168	373.1607	240.6684	253.8874	390.5955	507.9973	541.4587	552.6601 (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	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
1224.0507	1179.1272	1054.7861	866.3900	646.0040	413.4293	250.7859	267.0185	452.6618	728.5725	997.9202	1220.2805	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh	482.6758	368.1061	304.1729	182.5839	91.9489	0.0000	0.0000	0.0000	0.0000	164.1080	328.6523	496.7096 (98)
Space heating												2418.9575 (98)
Space heating per m2												(98) / (4) = 39.1101 (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 %)												257.1337 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												940.7394 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	482.6758	368.1061	304.1729	182.5839	91.9489	0.0000	0.0000	0.0000	0.0000	164.1080	328.6523	496.7096 (98)
Space heating efficiency (main heating system 1)	257.1337	257.1337	257.1337	257.1337	257.1337	0.0000	0.0000	0.0000	0.0000	257.1337	257.1337	257.1337 (210)
Space heating fuel (main heating system)	187.7140	143.1575	118.2937	71.0074	35.7592	0.0000	0.0000	0.0000	0.0000	63.8220	127.8138	193.1718 (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	184.7835	163.0499	171.6651	154.4782	151.8122	136.2657	131.4545	143.4387	142.9323	160.1560	168.6045	180.5374 (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	58.5165	51.6340	54.3622	48.9195	48.0753	43.1521	41.6285	45.4236	45.2632	50.7176	53.3930	57.1719 (219)
Water heating fuel used												598.2576 (219)
Annual totals kWh/year												
Space heating fuel - main system												940.7394 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans: (MEV)Decentralised, Database: total watage = 3.8610, total flow = 21.0000, SFP = 0.1839)												
mechanical ventilation fans (SFP = 0.1839)												33.2959 (230a)
Total electricity for the above, kWh/year												33.2959 (231)
Electricity for lighting (calculated in Appendix L)												281.2063 (232)
Total delivered energy for all uses												1853.4992 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	940.7394	13.1900	124.0835 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	598.2576	13.1900	78.9102 (247)
Mechanical ventilation fans	33.2959	13.1900	4.3917 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	281.2063	13.1900	37.0911 (250)
Additional standing charges			0.0000 (251)
Total energy cost			244.4765 (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] =	0.9610 (257)
SAP value		86.5944
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	940.7394	0.5190	488.2437 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	598.2576	0.5190	310.4957 (264)
Space and water heating			798.7394 (265)
Pumps and fans	33.2959	0.5190	17.2806 (267)
Energy for lighting	281.2063	0.5190	145.9461 (268)
Total kg/year			961.9661 (272)
CO2 emissions per m2			15.5500 (273)
EI value			87.9360
EI rating			88 (274)
EI band			B

 Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency $13.19 \times (1 + 0.29 \times 0.75) / 2.5713 = 6.245$, stars = 3
Main heating environmental impact $0.519 \times (1 + 0.29 \times 0.75) / 2.5713 = 0.2457$, 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	61.8500 (1b)	x 2.4000 (2b)	= 148.4400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4400 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.2250	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2081 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.5000	4.4000	3.9000	3.8000	3.4000	3.3000	3.3000	3.5000	3.8000	3.9000	4.1000 (22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250 (22a)
Adj infilt rate	0.2341	0.2341	0.2289	0.2029	0.1977	0.1769	0.1717	0.1717	0.1821	0.1977	0.2029	0.2133 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (25)
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)			7.5500	1.3258	10.0095		(27)
FRENCH DOOR (Uw = 1.40)			4.9800	1.3258	6.6023		(27)
external door			2.1400	1.2000	2.5680		(26)
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)
BRICK TF	80.5700	14.6700	65.9000	0.2300	15.1570		(29a)
CEILING	61.8500		61.8500	0.1400	8.6590		(30)
Total net area of external elements Aum, m2)			178.5500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.7765	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3903 (36)
Total fabric heat loss	(33) + (36) = 58.1668 (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	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926 (38)
Average = Sum(39)m / 12 =	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364 (40)
HLP (average)												1.3364 (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	2.0334 (42)
Average daily hot water use (litres/day)	82.4939 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.7433	87.4436	84.1438	80.8441	77.5443	74.2445	74.2445	77.5443	80.8441	84.1438	87.4436	90.7433 (44)
Energy conte	134.5697	117.6955	121.4513	105.8842	101.5984	87.6717	81.2407	93.2249	94.3383	109.9422	120.0105	130.3236 (45)
Energy content (annual)												Total = Sum(45)m = 1297.9508 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1855	17.6543	18.2177	15.8826	15.2398	13.1507	12.1861	13.9837	14.1507	16.4913	18.0016	19.5485 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating kWh	472.2308	362.4542	290.0906	169.9452	86.8816	0.0000	0.0000	0.0000	0.0000	161.3455	316.3866	486.9923 (98)
Space heating												2346.3269 (98)
Space heating per m2												(98) / (4) = 37.9358 (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 %)												256.7882 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												913.7208 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	472.2308	362.4542	290.0906	169.9452	86.8816	0.0000	0.0000	0.0000	0.0000	161.3455	316.3866	486.9923 (98)
Space heating efficiency (main heating system 1)	256.7882	256.7882	256.7882	256.7882	256.7882	0.0000	0.0000	0.0000	0.0000	256.7882	256.7882	256.7882 (210)
Space heating fuel (main heating system)	183.8990	141.1491	112.9689	66.1811	33.8340	0.0000	0.0000	0.0000	0.0000	62.8321	123.2092	189.6475 (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	184.7835	163.0499	171.6651	154.4782	151.8122	136.2657	131.4545	143.4387	142.9323	160.1560	168.6045	180.5374 (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	58.5165	51.6340	54.3622	48.9195	48.0753	43.1521	41.6285	45.4236	45.2632	50.7176	53.3930	57.1719 (219)
Water heating fuel used												598.2576 (219)
Annual totals kWh/year												
Space heating fuel - main system												913.7208 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans: (MEV)Decentralised, Database: total watage = 3.8610, total flow = 21.0000, SFP = 0.1839)												
mechanical ventilation fans (SFP = 0.1839)												33.2959 (230a)
Total electricity for the above, kWh/year												33.2959 (231)
Electricity for lighting (calculated in Appendix L)												281.2063 (232)
Total delivered energy for all uses												1826.4806 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	913.7208	20.4300	186.6732 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	598.2576	20.4300	122.2240 (247)
Mechanical ventilation fans	33.2959	20.4300	6.8024 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	281.2063	20.4300	57.4504 (250)
Additional standing charges			0.0000 (251)
Total energy cost			373.1500 (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	913.7208	0.5190	474.2211 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	598.2576	0.5190	310.4957 (264)
Space and water heating			784.7168 (265)
Pumps and fans	33.2959	0.5190	17.2806 (267)
Energy for lighting	281.2063	0.5190	145.9461 (268)
Total kg/year			947.9434 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	913.7208	3.0700	2805.1228 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	598.2576	3.0700	1836.6508 (264)
Space and water heating			4641.7736 (265)
Pumps and fans	33.2959	3.0700	102.2185 (267)
Energy for lighting	281.2063	3.0700	863.3032 (268)
Primary energy kWh/year			5607.2954 (272)
Primary energy kWh/m2/year			90.6596 (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
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	Recommended
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
A2	Recommended
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
L2	Not applicable
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.6	-£ 47	-119 kg (12.6%)
U Solar photovoltaic panels	+ 12.5	-£ 388	-985 kg (118.8%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£47	1.93 kg/m ²	B 88 B 89
Solar photovoltaic panels	£388	15.92 kg/m ²	A 101 A 101
Total Savings	£434	17.84 kg/m ²	

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	£373	£326	£47
Space heating	£193	£194	-£0
Water heating	£122	£75	£47
Lighting	£57	£57	£0
Generated (PV)	-£0	-£388	£388
Total cost of fuels	£373	-£62	£435
Total cost of uses	£372	-£62	£435
Delivered energy	30 kWh/m ²	-5 kWh/m ²	34 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	-0.2 tonnes	1.1 tonnes
CO2 emissions per m ²	15 kg/m ²	-3 kg/m ²	18 kg/m ²
Primary energy	91 kWh/m ²	-15 kWh/m ²	106 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	61.8500 (1b)	x 2.4000 (2b)	= 148.4400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4400 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.2250	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2081 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2654	0.2602	0.2550	0.2289	0.2237	0.1977	0.1977	0.1925	0.2081	0.2237	0.2341	0.2445 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (25)
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)			7.5500	1.3258	10.0095		(27)
FRENCH DOOR (Uw = 1.40)			4.9800	1.3258	6.6023		(27)
external door			2.1400	1.2000	2.5680		(26)
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)
BRICK TF	80.5700	14.6700	65.9000	0.2300	15.1570		(29a)
CEILING	61.8500		61.8500	0.1400	8.6590		(30)
Total net area of external elements Aum, m2)			178.5500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.7765	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3903 (36)
 Total fabric heat loss (33) + (36) = 58.1668 (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	25.2450	24.9901	24.7352	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926	24.4926 (38)
Average = Sum(39)m / 12 =	83.4118	83.1569	82.9021	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3486	1.3445	1.3404	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364	1.3364 (40)
HLP (average)												1.3385 (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 2.0334 (42)
 Average daily hot water use (litres/day) 82.4939 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	90.7433	87.4436	84.1438	80.8441	77.5443	74.2445	74.2445	77.5443	80.8441	84.1438	87.4436	90.7433 (44)
Energy content (annual)	134.5697	117.6955	121.4513	105.8842	101.5984	87.6717	81.2407	93.2249	94.3383	109.9422	120.0105	130.3236 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1297.9508 (45)
Water storage loss:	20.1855	17.6543	18.2177	15.8826	15.2398	13.1507	12.1861	13.9837	14.1507	16.4913	18.0016	19.5485 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	18.6043	18.7181	18.8720	19.0418	19.1821	19.2735	19.3073	19.3038	19.2499	19.0780	18.8218	18.5929 (90)
Living area fraction									fLA = Living area / (4) =			0.2441 (91)
MIT	18.9748	19.0795	19.2226	19.3788	19.5123	19.6003	19.6335	19.6298	19.5754	19.4136	19.1727	18.9628 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9748	19.0795	19.2226	19.3788	19.5123	19.6003	19.6335	19.6298	19.5754	19.4136	19.1727	18.9628 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8805	0.8413	0.7868	0.7049	0.5896	0.4362	0.2926	0.3198	0.5057	0.7127	0.8377	0.8912 (94)
Useful gains	575.2929	631.3502	645.2078	610.0936	519.4550	371.9044	240.2847	253.4212	389.7581	507.4360	541.4587	552.6601 (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	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	482.6758	368.1061	304.6822	184.3769	93.9726	0.0000	0.0000	0.0000	0.0000	164.4918	328.6523	496.7096 (98)
Space heating per m2												(98) / (4) = 39.1862 (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 %)												257.1337 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												942.5711 (211)
Space heating requirement	482.6758	368.1061	304.6822	184.3769	93.9726	0.0000	0.0000	0.0000	0.0000	164.4918	328.6523	496.7096 (98)
Space heating efficiency (main heating system 1)	257.1337	257.1337	257.1337	257.1337	257.1337	0.0000	0.0000	0.0000	0.0000	257.1337	257.1337	257.1337 (210)
Space heating fuel (main heating system)	187.7140	143.1575	118.4918	71.7047	36.5462	0.0000	0.0000	0.0000	0.0000	63.9713	127.8138	193.1718 (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	161.5973	124.3588	104.3738	59.4116	29.9146	16.3931	12.5793	38.8621	65.0989	109.2987	141.1022	161.1345 (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	51.1740	39.3815	33.0527	18.8142	9.4732	5.1913	3.9836	12.3067	20.6153	34.6123	44.6837	51.0274 (219)
Water heating fuel used												324.3159 (219)
Annual totals kWh/year												
Space heating fuel - main system												942.5711 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 3.8610, total flow = 21.0000, SFP = 0.1839)												
mechanical ventilation fans (SFP = 0.1839)												33.2959 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												83.2959 (231)
Electricity for lighting (calculated in Appendix L)												281.2063 (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												-95.8502 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	942.5711	13.1900	124.3251 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	324.3159	13.1900	42.7773 (247)
Mechanical ventilation fans	33.2959	13.1900	4.3917 (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	281.2063	13.1900	37.0911 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			-12.6426 (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] =	-0.0497 (257)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP value 100.6932
 SAP rating (Section 12) 101 (258)
 SAP band A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	942.5711	0.5190	489.1944 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	324.3159	0.5190	168.3200 (264)
Space and water heating			657.5143 (265)
Pumps and fans	83.2959	0.5190	43.2306 (267)
Energy for lighting	281.2063	0.5190	145.9461 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			-49.7463 (272)
CO2 emissions per m2			-0.8000 (273)
EI value			100.6239
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.8500 (1b)	x 2.4000 (2b)	= 148.4400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4400 (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				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)							
Pressure test				Yes								
Measured/design AP50				4.5000								
Infiltration rate				0.2250	(18)							
Number of sides sheltered				1	(19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2081 (21)							
Wind speed	Jan 4.5000	Feb 4.5000	Mar 4.4000	Apr 3.9000	May 3.8000	Jun 3.4000	Jul 3.3000	Aug 3.3000	Sep 3.5000	Oct 3.8000	Nov 3.9000	Dec 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 (25)
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 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					
upvc window (Uw = 1.40)			7.5500	1.3258	10.0095		(27)					
FRENCH DOOR (Uw = 1.40)			4.9800	1.3258	6.6023		(27)					
external door			2.1400	1.2000	2.5680		(26)					
Heat Loss Floor 1			36.1300	0.1600	5.7808		(28a)					
BRICK TF	80.5700	14.6700	65.9000	0.2300	15.1570		(29a)					
CEILING	61.8500		61.8500	0.1400	8.6590		(30)					
Total net area of external elements Aum, m ²			178.5500				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.7765	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3903 (36)					
Total fabric heat loss						(33) + (36) =	58.1668 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.4926	Feb 24.4926	Mar 24.4926	Apr 24.4926	May 24.4926	Jun 24.4926	Jul 24.4926	Aug 24.4926	Sep 24.4926	Oct 24.4926	Nov 24.4926	Dec 24.4926 (38)
Heat transfer coeff	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594	82.6594 (39)
Average = Sum(39)m / 12 =												82.6594 (39)
HLP	Jan 1.3364	Feb 1.3364	Mar 1.3364	Apr 1.3364	May 1.3364	Jun 1.3364	Jul 1.3364	Aug 1.3364	Sep 1.3364	Oct 1.3364	Nov 1.3364	Dec 1.3364 (40)
HLP (average)												1.3364 (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												2.0334 (42)
Average daily hot water use (litres/day)												82.4939 (43)
Daily hot water use	90.7433	87.4436	84.1438	80.8441	77.5443	74.2445	74.2445	77.5443	80.8441	84.1438	87.4436	90.7433 (44)
Energy conte	134.5697	117.6955	121.4513	105.8842	101.5984	87.6717	81.2407	93.2249	94.3383	109.9422	120.0105	130.3236 (45)
Energy content (annual)												Total = Sum(45)m = 1297.9508 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.1855	17.6543	18.2177	15.8826	15.2398	13.1507	12.1861	13.9837	14.1507	16.4913	18.0016	19.5485 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Store volume											180.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):											1.6100 (48)	
Temperature factor from Table 2b											0.5400 (49)	
Enter (49) or (54) in (55)											0.8694 (55)	
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	184.7835	163.0499	170.2693	147.7246	139.0178	123.6589	118.4275	131.3422	137.5294	158.7602	168.6045	180.5374 (62)
Aperture area of solar collector											3.0000 (H1)	
Zero-loss collector efficiency											0.7000 (H2)	
Collector heat loss coefficient											1.8000 (H3)	
Collector 2nd order heat loss coefficient											0.0050 (H3a)	
Collector effective heat loss coefficient											1.8063 (H3b)	
Collector performance ratio											2.5804 (H4)	
Annual solar radiation per m2											1185.6484 (H5)	
Overshading factor											0.8000 (H6)	
Solar energy available											1991.8893 (H7)	
Adjustment factor for showers											1.0000 (H7a)	
Solar-to-load ratio											1.5346 (H8)	
Utilisation factor											0.4788 (H9)	
Collector performance factor											0.8793 (H10)	
Dedicated solar storage volume											75.0000 (H11)	
Effective solar volume											75.0000 (H13)	
Daily hot water demand											82.4939 (H14)	
Volume ratio Veff/V											0.9092 (H15)	
Solar storage volume factor											0.9810 (H16)	
Solar input	-23.0710	-39.0974	-66.7991	-91.3828	-106.3905	-113.0142	-107.5225	-95.9011	-75.9697	-51.3259	-30.8082	-822.6206 (H17)
Solar input (sum of months) = Sum(63)m =											-822.6206 (63)	
Output from w/h	161.7126	123.9525	103.4702	56.3418	32.6273	10.6448	10.9050	35.4411	61.5597	107.4343	137.7962	159.1993 (64)
Total per year (kWh/year) = Sum(64)m =											1001.0848 (64)	
Heat gains from water heating, kWh/month	84.9155	75.4173	79.4370	68.6788	63.7170	57.9407	56.7620	61.4912	65.9204	75.6102	78.7787	83.5036 (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	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057	122.0057 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.8077	35.3568	28.7541	21.7687	16.2724	13.7378	14.8442	19.2950	25.8978	32.8831	38.3795	40.9140 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.0558	267.8063	260.8752	246.1198	227.4938	209.9880	198.2930	195.5426	202.4736	217.2290	235.8550	253.3609 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340	49.2340 (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)	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372	-81.3372 (71)
Water heating gains (Table 5)	114.1337	112.2281	106.7701	95.3872	85.6412	80.4731	76.2930	82.6494	91.5561	101.6266	109.4148	112.2361 (72)
Total internal gains	508.8998	505.2938	486.3020	453.1783	419.3100	394.1015	379.3328	387.3896	409.8301	441.6414	473.5519	496.4135 (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		2.8100	11.3201	0.7200	0.7000	0.7700	11.1102 (74)					
East		2.6100	21.0039	0.7200	0.7000	0.7700	19.1472 (76)					
South		2.1300	49.0238	0.7200	0.7000	0.7700	36.4712 (78)					
South		4.9800	49.0238	0.7200	0.7000	0.7700	85.2708 (78)					
Solar gains	151.9994	261.7892	357.7274	452.0012	478.1270	513.6981	477.1437	445.3330	400.4005	296.5344	204.6933	143.9612 (83)
Total gains	660.8991	767.0829	844.0295	905.1795	897.4369	907.7996	856.4766	832.7226	810.2306	738.1758	678.2452	640.3748 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)											21.0000 (85)	
Utilisation factor for gains for living area, nil, m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848	20.7848
alpha	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857	2.3857
util living area	0.9020	0.8667	0.8137	0.7361	0.6444	0.4911	0.3911	0.4080	0.5797	0.7593	0.8600	0.9083 (86)
Tweekday	18.6291	18.7340	18.8962	19.0614	19.1897	19.2826	19.3083	19.3065	19.2523	19.0824	18.8408	18.6073
Tweekend	20.4386	20.4869	20.5617	20.6398	20.7026	20.7533	20.7699	20.7684	20.7348	20.6477	20.5345	20.4286
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	20.1336	20.2062	20.3236	20.4375	20.5411	20.6211	20.6449	20.6426	20.5858	20.4563	20.2731	20.1182 (87)
Th 2	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124	19.8124 (88)
util rest of house	0.8885	0.8492	0.7890	0.7001	0.5922	0.4153	0.2967	0.3129	0.5093	0.7192	0.8386	0.8956 (89)
Tweekday	18.6291	18.7340	18.8962	19.0614	19.1897	19.2826	19.3083	19.3065	19.2523	19.0824	18.8408	18.6073
Tweekend	18.6291	18.7340	18.8962	19.0614	19.1897	19.2826	19.3083	19.3065	19.2523	19.0824	18.8408	18.6073

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

MIT 2	18.6291	18.7340	18.8962	19.0614	19.1897	19.2826	19.3083	19.3065	19.2523	19.0824	18.8408	18.6073 (90)
Living area fraction									fLA = Living area / (4) =			0.2441 (91)
MIT	18.9964	19.0934	19.2447	19.3973	19.5196	19.6094	19.6346	19.6327	19.5779	19.4178	19.1904	18.9762 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9964	19.0934	19.2447	19.3973	19.5196	19.6094	19.6346	19.6327	19.5779	19.4178	19.1904	18.9762 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8777	0.8371	0.7756	0.6862	0.5780	0.4014	0.2816	0.2975	0.4940	0.7041	0.8256	0.8852 (94)	
Useful gains	580.0786	642.1197	654.6389	621.0955	518.7524	364.3483	241.2149	247.7352	400.2854	519.7801	559.9632	566.8314 (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													
	1214.7974	1181.4861	1045.2026	859.4371	638.0982	397.5406	250.8407	258.9460	461.0658	737.1409	999.3890	1221.3910 (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													
	472.2308	362.4542	290.5794	171.6060	88.7933	0.0000	0.0000	0.0000	0.0000	161.7164	316.3866	486.9923 (98)	
Space heating													
Space heating per m2													(98) / (4) =
													38.0074 (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 %)													256.7882 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													915.4468 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	472.2308	362.4542	290.5794	171.6060	88.7933	0.0000	0.0000	0.0000	0.0000	161.7164	316.3866	486.9923 (98)	
Space heating efficiency (main heating system 1)	256.7882	256.7882	256.7882	256.7882	256.7882	0.0000	0.0000	0.0000	0.0000	256.7882	256.7882	256.7882 (210)	
Space heating fuel (main heating system)	183.8990	141.1491	113.1592	66.8278	34.5784	0.0000	0.0000	0.0000	0.0000	62.9766	123.2092	189.6475 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	161.7126	123.9525	103.4702	56.3418	32.6273	10.6448	10.9050	35.4411	61.5597	107.4343	137.7962	159.1993 (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	51.2105	39.2528	32.7665	17.8421	10.3323	3.3710	3.4534	11.2234	19.4945	34.0219	43.6368	50.4146 (219)	
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													915.4468 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 3.8610, total flow = 21.0000, SFP = 0.1839)													
mechanical ventilation fans (SFP = 0.1839)													33.2959 (230a)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													83.2959 (231)
Electricity for lighting (calculated in Appendix L)													281.2063 (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													-300.0687 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	915.4468	20.4300	187.0258 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	317.0197	20.4300	64.7671 (247)	
Mechanical ventilation fans	33.2959	20.4300	6.8024 (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	281.2063	20.4300	57.4504 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1897.0374	20.4300	-387.5647 (252)	
Total energy cost			-61.3040 (255)	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
--	-----------------	----------------------------	-----------------------

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating - main system 1	915.4468	0.5190	475.1169 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	317.0197	0.5190	164.5332 (264)
Space and water heating			639.6501 (265)
Pumps and fans	83.2959	0.5190	43.2306 (267)
Energy for lighting	281.2063	0.5190	145.9461 (268)
Energy saving/generation technologies			
PV Unit	-1897.0374	0.5190	-984.5624 (269)
Total kg/year			-155.7357 (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	915.4468	3.0700	2810.4216 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	317.0197	3.0700	973.2505 (264)
Space and water heating			3783.6721 (265)
Pumps and fans	83.2959	3.0700	255.7185 (267)
Energy for lighting	281.2063	3.0700	863.3032 (268)
Energy saving/generation technologies			
PV Unit	-1897.0374	3.0700	-5823.9049 (269)
Primary energy kWh/year			-921.2109 (272)
Primary energy kWh/m2/year			-14.8943 (273)

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	HOUSE TYPE D4	Issued on Date	09/11/2022
Assessment Reference	GRANT ASHP	Prop Type Ref	
Property			

SAP Rating	87 B	DER	16.89	TER	29.78
Environmental	88 B	% DER<TER	43.28		
CO₂ Emissions (t/year)	0.95	DFEE	50.66	TFEE	57.24
General Requirements Compliance	Pass	% DFEE<TFEE	11.48		

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)	29.78	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.89	kgCO ₂ /m ²	Pass
	-12.89 (-43.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.24	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	50.66	kWh/m ² /yr	
	-6.5 (-11.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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

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	2.81 m ² , No overhang	
Windows facing East	2.61 m ² , No overhang	
Windows facing South	7.11 m ² , No overhang	
Air change rate	6.00 ach	
Blinds/curtains	None	

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value	
		W/m ² K 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
--------------------	------	--------------------

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 D4	Issued on Date	09/11/2022
Assessment Reference	GRANT ASHP	Prop Type Ref	
Property			

SAP Rating	87 B	DER	16.89	TER	29.78
Environmental	88 B	% DER<TER	43.28		
CO ₂ Emissions (t/year)	0.95	DFEE	50.66	TFEE	57.24
General Requirements Compliance	Pass	% DFEE<TFEE	11.48		

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

Client	
--------	--

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

Orientation	North
Property Tenure	Rented (social)
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	Bungalow, 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:	33.57 m	61.85 m ²	2.40 m

7.0 Living Area	15.10	m ²
-----------------	-------	----------------

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	80.57	65.90

9.1 Party Walls

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

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	61.85	61.85

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					2.81	
REAR WINDOW	Window	[1] BRICK TF	South	None	0.00					2.13	
GABLE WINDOW	Window	[1] BRICK TF	East	None	0.00					2.61	
FRONT DOOR	Solid Door	[1] BRICK TF	North							2.14	
FRENCH DOOR	Window	[1] BRICK TF	South	None	0.00					4.98	

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)	9.54	0.141	Yes	TRADA
Independently assessed	E3 Sill	8.53	0.027	Yes	TRADA
Independently assessed	E4 Jamb	20.42	0.038	Yes	TRADA
Independently assessed	E5 Ground floor (normal)	33.57	0.131	Yes	TRADA
Independently assessed	E10 Eaves (insulation at ceiling level)	14.07	0.060	No	TRADA
Independently assessed	E12 Gable (insulation at ceiling level)	19.50	0.062	No	TRADA
Independently assessed	E16 Corner (normal)	12.00	0.058	No	TRADA
Independently assessed	E17 Corner (inverted – internal area greater than external area)	2.40	-0.045	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

MV Reference Number

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Duct Type

Rigid

19.1 Mechanical extract ventilation - Decentralised

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

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Description	Database	
Description	ASHP	
Percentage of Heat	100	%
Database Ref. No.	103763	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	270.7	
In Summer	332.4	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in Concrete	
Flow Temperature	36° - 45°C	

25.0 Main Heating 2

None

Community Heating

None

28.0 Water Heating

HWP From main heating 1

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
Immersion Only Heating Hot Water	No	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	180.00	L
Loss	1.61	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£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	