

PREDICTED ENERGY ASSESSMENT

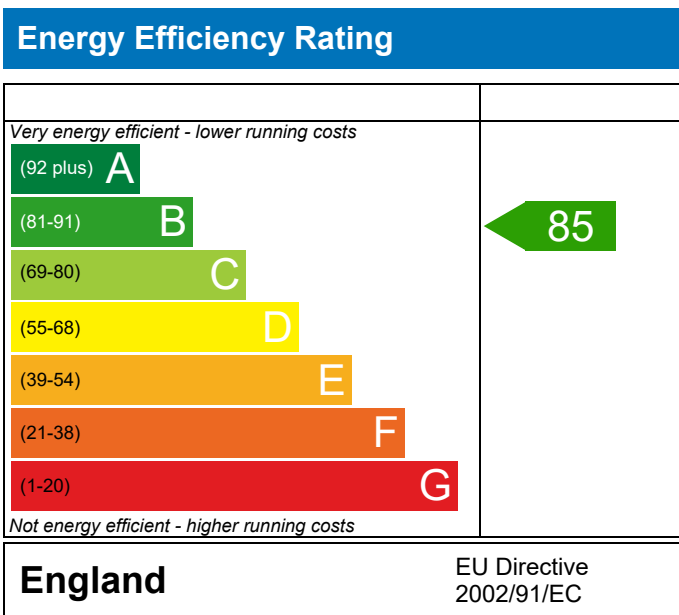


Plot 44

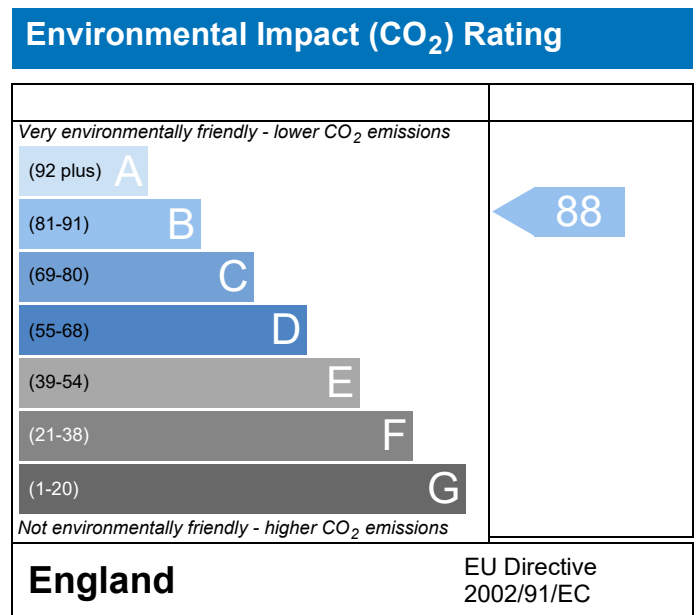
Dwelling type: House, Mid-Terrace
 Date of assessment: 18/08/2022
 Produced by: Michael Juckes
 Total floor area: 94.14 m²

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.



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.



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.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)



| | | | |
|----------------------|-----------------|----------------|------------|
| Property Reference | 044 - PRJ012620 | Issued on Date | 18/08/2022 |
| Assessment Reference | 044 M | Prop Type Ref | Clover |
| Property | Plot 44 | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 85 B | DER | 15.36 | TER | 16.33 |
| Environmental | 88 B | % DER<TER | 5.96 | | |
| CO ₂ Emissions (t/year) | 1.20 | DFEE | 38.35 | TFEE | 44.43 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 13.68 | | |

| | | | |
|------------------|--|-------------|-----------|
| Assessor Details | Mr. Michael Juckes, Michael Juckes, Tel: 02033971373, michael@briaryenergy.co.uk | Assessor ID | T850-0001 |
| 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 | Mains gas | | |
| Fuel factor | 1.00 (mains gas) | | |
| Target Carbon Dioxide Emission Rate (TER) | 16.33 | kgCO ₂ /m ² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.36 | kgCO ₂ /m ² | Pass |
| | -0.97 (-5.9%) | kgCO ₂ /m ² | |

1b TFEE and DFEE

| | | | |
|--|---------------|------------------------|------|
| Target Fabric Energy Efficiency (TFEE) | 44.43 | kWh/m ² /yr | |
| Dwelling Fabric Energy Efficiency (DFEE) | 38.35 | kWh/m ² /yr | |
| | -6.0 (-13.5%) | kWh/m ² /yr | Pass |

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

| Element | Average | Highest | |
|---------------|------------------|------------------|------|
| External wall | 0.25 (max. 0.30) | 0.25 (max. 0.70) | Pass |
| Party wall | 0.00 (max. 0.20) | - | Pass |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | Pass |
| Roof | 0.10 (max. 0.20) | 0.10 (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 | 5.01 (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

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)



Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (South East England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

5.99 m², No overhang

Windows facing West

5.94 m², No overhang

Air change rate

3.87 ach

Blinds/curtains

Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.01 (design value) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



| | | | |
|----------------------|-----------------|----------------|------------|
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| Assessment Reference | 044 M | Prop Type Ref | Clover |
| Property | Plot 44 | | |

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|------------------------------------|------|--------------|-------|-------|-------|
| SAP Rating | 85 B | DER | 15.36 | TER | 16.33 |
| Environmental | 88 B | % DER<TER | 5.96 | | |
| CO ₂ Emissions (t/year) | 1.20 | DFEE | 38.35 | TFFEE | 44.43 |
| General Requirements Compliance | Pass | % DFEE<TFFEE | 13.68 | | |

| | | | |
|------------------|--|-------------|-----------|
| Assessor Details | Mr. Michael Juckes, Michael Juckes, Tel: 02033971373, michael@briaryenergy.co.uk | Assessor ID | T850-0001 |
|------------------|--|-------------|-----------|

| | |
|--------|--|
| Client | |
|--------|--|

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 | 47.0700 (1b) | x 2.3900 (2b) | = 112.4973 (1b) - (3b) |
| First floor | 47.0700 (1c) | x 2.6900 (2c) | = 126.6183 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.1400 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.1156 (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 | | | | 3 * 10 = | 30.0000 (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) | | | | 30.0000 / (5) = | 0.1255 (8) | | | | | | | |
| Pressure test | | | | Yes | | | | | | | | |
| Measured/design AP50 | | | | | 5.0100 | | | | | | | |
| Infiltration rate | | | | | 0.3760 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.3196 (21) | | | | | | | |
| Wind speed | Jan 4.8000 | Feb 4.5000 | Mar 4.4000 | Apr 3.9000 | May 3.9000 | Jun 3.6000 | Jul 3.7000 | Aug 3.5000 | Sep 3.7000 | Oct 4.0000 | Nov 4.1000 | Dec 4.4000 (22) |
| Wind factor | 1.2000 | 1.1250 | 1.1000 | 0.9750 | 0.9750 | 0.9000 | 0.9250 | 0.8750 | 0.9250 | 1.0000 | 1.0250 | 1.1000 (22a) |
| Adj infiltr rate | 0.3835 | 0.3595 | 0.3515 | 0.3116 | 0.3116 | 0.2876 | 0.2956 | 0.2796 | 0.2956 | 0.3196 | 0.3276 | 0.3515 (22b) |
| Effective ac | 0.5735 | 0.5646 | 0.5618 | 0.5485 | 0.5485 | 0.5414 | 0.5437 | 0.5391 | 0.5437 | 0.5511 | 0.5536 | 0.5618 (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 |
|--|----------------------|-------------------------|------------------------|----------------------------|-----------|--------------------------------------|-----------------|
| Windows (Uw = 1.40) | | | 11.9300 | 1.3258 | 15.8163 | | (27) |
| Solid Door | | | 1.9500 | 1.2000 | 2.3400 | | (26) |
| Flr - Ground | | | 47.0720 | 0.1300 | 6.1194 | 75.6000 | 3558.6432 (28a) |
| Wl - Brick | 2.5550 | | 2.5550 | 0.2500 | 0.6388 | 51.1800 | 130.7649 (29a) |
| Wl - Render | 52.9540 | 13.8800 | 39.0740 | 0.2500 | 9.7685 | 51.1800 | 1999.8073 (29a) |
| Rf - Ins Joist | 47.0720 | | 47.0720 | 0.1000 | 4.7072 | 5.8200 | 273.9590 (30) |
| Total net area of external elements Aum(A, m ²) | | | 149.6530 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 39.3901 | | (33) |
| Party Wall | | | 87.1940 | 0.0000 | 0.0000 | 54.0300 | 4711.0918 (32) |
| Ground Floor Stud | | | 82.7595 | | | 5.8200 | 481.6603 (32c) |
| 1st Floor Stud | | | 100.8056 | | | 5.8200 | 586.6888 (32c) |
| Internal Floor | | | 47.0700 | | | 18.0000 | 847.2600 (32d) |
| Internal Ceiling | | | 47.0700 | | | 5.8200 | 273.9474 (32e) |
| Heat capacity Cm = Sum(A x k) | | | | | | (28)...(30) + (32) + (32a)...(32e) = | 12863.8228 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 136.6457 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 10.1451 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 49.5352 (37) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m | 45.2561 | 44.5535 | 44.3294 | 43.2843 | 43.2843 | 42.7177 | 42.9016 | 42.5389 | 42.9016 | 43.4833 | 43.6872 | 44.3294 (38) |
| Heat transfer coeff | 94.7913 | 94.0888 | 93.8646 | 92.8196 | 92.8196 | 92.2530 | 92.4368 | 92.0742 | 92.4368 | 93.0185 | 93.2225 | 93.8646 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 93.1408 (39) |
| HLP | 1.0069 | 0.9995 | 0.9971 | 0.9860 | 0.9860 | 0.9800 | 0.9819 | 0.9781 | 0.9819 | 0.9881 | 0.9903 | 0.9971 (40) |
| HLP (average) | | | | | | | | | | | | 0.9894 (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 2.6783 (42)
Average daily hot water use (litres/day) 97.8086 (43)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------------------|
| Daily hot water use | 107.5894 | 103.6771 | 99.7648 | 95.8524 | 91.9401 | 88.0277 | 88.0277 | 91.9401 | 95.8524 | 99.7648 | 103.6771 | 107.5894 (44) |
| Energy conte | 159.5520 | 139.5452 | 143.9982 | 125.5411 | 120.4597 | 103.9475 | 96.3227 | 110.5317 | 111.8518 | 130.3525 | 142.2899 | 154.5176 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1538.9098 (45) |
| Distribution loss (46)m = $0.15 \times (45)m$ | 23.9328 | 20.9318 | 21.5997 | 18.8312 | 18.0690 | 15.5921 | 14.4484 | 16.5798 | 16.7778 | 19.5529 | 21.3435 | 23.1776 (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) |
| Combi loss | 14.6956 | 13.2597 | 14.6479 | 14.1193 | 14.5492 | 14.0328 | 14.4713 | 14.5218 | 14.0799 | 14.6070 | 14.1852 | 14.6805 (61) |
| Total heat required for water heating calculated for each month | 174.2476 | 152.8049 | 158.6461 | 139.6604 | 135.0088 | 117.9803 | 110.7940 | 125.0535 | 125.9317 | 144.9595 | 156.4751 | 169.1981 (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 | 174.2476 | 152.8049 | 158.6461 | 139.6604 | 135.0088 | 117.9803 | 110.7940 | 125.0535 | 125.9317 | 144.9595 | 156.4751 | 169.1981 (64) |
| Total per year (kWh/year) = Sum(64)m = | | | | | | | | | | | | 1710.7600 (64) |
| RHI water heating demand | | | | | | | | | | | | 1711 (64) |
| Heat gains from water heating, kWh/month | 56.7249 | 49.7137 | 51.5414 | 45.2722 | 43.6901 | 38.0708 | 35.6451 | 40.3822 | 40.7107 | 46.9940 | 50.8577 | 55.0472 (65) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 60.2487 | 53.5124 | 43.5192 | 32.9468 | 24.6281 | 20.7921 | 22.4666 | 29.2030 | 39.1962 | 49.7685 | 58.0872 | 61.9232 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 367.8979 | 371.7155 | 362.0952 | 341.6147 | 315.7618 | 291.4637 | 275.2311 | 271.4134 | 281.0337 | 301.5142 | 327.3672 | 351.6653 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 (71) |
| Water heating gains (Table 5) | 76.2432 | 73.9787 | 69.2760 | 62.8781 | 58.7233 | 52.8761 | 47.9101 | 54.2772 | 56.5426 | 63.1639 | 70.6357 | 73.9882 (72) |
| Total internal gains | 614.7027 | 609.5196 | 585.2034 | 547.7526 | 509.4262 | 475.4448 | 455.9207 | 465.2065 | 487.0854 | 524.7596 | 566.4030 | 597.8896 (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 | | | | | | |
|-------------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|-----------|----------|----------|----------|----------|---------------|
| East | 5.9910 | 23.7288 | 0.5000 | 0.0000 | 0.7700 | 54.7313 (76) | | | | | | |
| West | 5.9360 | 23.7288 | 0.5000 | 0.0000 | 0.7700 | 54.2289 (80) | | | | | | |
| Solar gains | 108.9602 | 189.4214 | 309.9615 | 474.2749 | 556.9895 | 608.6565 | 573.0558 | 498.2369 | 385.2730 | 240.1730 | 137.1839 | 86.6500 (83) |
| Total gains | 723.6629 | 798.9410 | 895.1649 | 1022.0275 | 1066.4156 | 1084.1013 | 1028.9765 | 963.4434 | 872.3584 | 764.9326 | 703.5869 | 684.5396 (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 | 37.6963 | 37.9778 | 38.0685 | 38.4971 | 38.4971 | 38.7335 | 38.6565 | 38.8088 | 38.6565 | 38.4148 | 38.3307 | 38.0685 |
| alpha | 3.5131 | 3.5319 | 3.5379 | 3.5665 | 3.5665 | 3.5822 | 3.5771 | 3.5873 | 3.5771 | 3.5610 | 3.5554 | 3.5379 |
| util living area | 0.9597 | 0.9432 | 0.8989 | 0.7977 | 0.6465 | 0.4584 | 0.3195 | 0.3301 | 0.5834 | 0.8261 | 0.9324 | 0.9640 (86) |
| MIT | 19.6674 | 19.8398 | 20.1872 | 20.5887 | 20.8529 | 20.9679 | 20.9935 | 20.9931 | 20.9253 | 20.6199 | 20.1098 | 19.6619 (87) |
| Th 2 | 20.0776 | 20.0838 | 20.0858 | 20.0950 | 20.0950 | 20.1001 | 20.0984 | 20.1017 | 20.0984 | 20.0933 | 20.0915 | 20.0858 (88) |
| util rest of house | 0.9526 | 0.9335 | 0.8818 | 0.7657 | 0.5947 | 0.3908 | 0.2413 | 0.2474 | 0.5110 | 0.7887 | 0.9187 | 0.9575 (89) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

| | | | | | | | | | | | | |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| MIT 2 | 18.8784 | 19.0510 | 19.3874 | 19.7675 | 19.9948 | 20.0839 | 20.0965 | 20.0997 | 20.0569 | 19.8040 | 19.3234 | 18.8799 (90) |
| Living area fraction | | | | | | | | | fLA = Living area / (4) = | | | 0.2014 (91) |
| MIT | 19.0373 | 19.2099 | 19.5485 | 19.9329 | 20.1676 | 20.2619 | 20.2771 | 20.2796 | 20.2318 | 19.9683 | 19.4818 | 19.0374 (92) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 |
| adjusted MIT | 18.8873 | 19.0599 | 19.3985 | 19.7829 | 20.0176 | 20.1119 | 20.1271 | 20.1296 | 20.0818 | 19.8183 | 19.3318 | 18.8874 (93) |

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation | 0.9410 | 0.9202 | 0.8666 | 0.7536 | 0.5900 | 0.3917 | 0.2438 | 0.2500 | 0.5096 | 0.7757 | 0.9046 | 0.9466 (94) |
| Useful gains | 680.9718 | 735.1528 | 775.7676 | 770.1566 | 629.2157 | 424.6762 | 250.8440 | 240.8367 | 444.5809 | 593.3586 | 636.4562 | 647.9603 (95) |
| Ext temp. | 5.0000 | 5.4000 | 7.1000 | 9.5000 | 12.6000 | 15.4000 | 17.4000 | 17.5000 | 15.0000 | 11.7000 | 8.1000 | 5.2000 (96) |
| Heat loss rate W | | | | | | | | | | | | |
| | 1316.3955 | 1285.2418 | 1154.3954 | 954.4536 | 688.5016 | 434.6880 | 252.0889 | 242.1175 | 469.7421 | 755.1566 | 1047.0573 | 1284.7603 (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 | | | | | | | | | | | | |
| | 472.7552 | 369.6599 | 281.6991 | 132.6939 | 44.1088 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 120.3777 | 295.6328 | 473.7792 (98) |
| Space heating | | | | | | | | | | | | 2190.7064 (98) |
| RHI space heating demand | | | | | | | | | | | | 2191 (98) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m2) | Storey height (m) | Volume (m3) |
|--|--------------|-------------------|--|
| Ground floor | 47.0700 (1b) | x 2.3900 (2b) | = 112.4973 (1b) - (3b) |
| First floor | 47.0700 (1c) | x 2.6900 (2c) | = 126.6183 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.1400 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.1156 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 0 | + | 0 | = | 0 * 20 = 0.0000 (6b) | | | | | | | |
| Number of intermittent fans | | | | | 3 * 10 = 30.0000 (7a) | | | | | | | |
| Number of passive vents | | | | | 0 * 10 = 0.0000 (7b) | | | | | | | |
| Number of flueless gas fires | | | | | 0 * 40 = 0.0000 (7c) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | | 30.0000 / (5) = 0.1255 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0100 | | | | | | | |
| Infiltration rate | | | | | 0.3760 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3196 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4074 | 0.3995 | 0.3915 | 0.3515 | 0.3435 | 0.3036 | 0.3036 | 0.2956 | 0.3196 | 0.3435 | 0.3595 | 0.3755 (22b) |
| Effective ac | 0.5830 | 0.5798 | 0.5766 | 0.5618 | 0.5590 | 0.5461 | 0.5461 | 0.5437 | 0.5511 | 0.5590 | 0.5646 | 0.5705 (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 |
|--|----------|-------------|------------|----------------------|-----------|----------------|--|
| Windows (Uw = 1.40) | | | 11.9300 | 1.3258 | 15.8163 | | (27) |
| Solid Door | | | 1.9500 | 1.2000 | 2.3400 | | (26) |
| Flr - Ground | | | 47.0720 | 0.1300 | 6.1194 | 75.6000 | 3558.6432 (28a) |
| Wl - Brick | 2.5550 | | 2.5550 | 0.2500 | 0.6388 | 51.1800 | 130.7649 (29a) |
| Wl - Render | 52.9540 | 13.8800 | 39.0740 | 0.2500 | 9.7685 | 51.1800 | 1999.8073 (29a) |
| Rf - Ins Joist | 47.0720 | | 47.0720 | 0.1000 | 4.7072 | 5.8200 | 273.9590 (30) |
| Total net area of external elements Aum(A, m2) | | | 149.6530 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 39.3901 | | (33) |
| Party Wall | | | 87.1940 | 0.0000 | 0.0000 | 54.0300 | 4711.0918 (32) |
| Ground Floor Stud | | | 82.7595 | | | 5.8200 | 481.6603 (32c) |
| 1st Floor Stud | | | 100.8056 | | | 5.8200 | 586.6888 (32c) |
| Internal Floor | | | 47.0700 | | | 18.0000 | 847.2600 (32d) |
| Internal Ceiling | | | 47.0700 | | | 5.8200 | 273.9474 (32e) |
| Heat capacity Cm = Sum(A x k) | | | | | | | (28)...(30) + (32) + (32a)...(32e) = 12863.8228 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 136.6457 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 10.1451 (36) |
| Total fabric heat loss | | | | | | | (33) + (36) = 49.5352 (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 | 46.0040 | 45.7497 | 45.5004 | 44.3294 | 44.1103 | 43.0904 | 43.0904 | 42.9016 | 43.4833 | 44.1103 | 44.5535 | 45.0169 (38) |
| Average = Sum(39)m / 12 = | 95.5393 | 95.2849 | 95.0356 | 93.8646 | 93.6455 | 92.6257 | 92.6257 | 92.4368 | 93.0185 | 93.6455 | 94.0888 | 94.5521 (39) |
| HLP | 1.0149 | 1.0122 | 1.0095 | 0.9971 | 0.9947 | 0.9839 | 0.9839 | 0.9819 | 0.9881 | 0.9947 | 0.9995 | 1.0044 (40) |
| HLP (average) | | | | | | | | | | | | 0.9971 (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 | | | | | | | | | | | | 2.6783 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 97.8086 (43) |
| Daily hot water use | 107.5894 | 103.6771 | 99.7648 | 95.8524 | 91.9401 | 88.0277 | 88.0277 | 91.9401 | 95.8524 | 99.7648 | 103.6771 | 107.5894 (44) |
| Energy conte | 159.5520 | 139.5452 | 143.9982 | 125.5411 | 120.4597 | 103.9475 | 96.3227 | 110.5317 | 111.8518 | 130.3525 | 142.2899 | 154.5176 (45) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------------|
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = | 1538.9098 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | | |
| | 23.9328 | 20.9318 | 21.5997 | 18.8312 | 18.0690 | 15.5921 | 14.4484 | 16.5798 | 16.7778 | 19.5529 | 21.3435 | 23.1776 | (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) |
| Combi loss | 14.6956 | 13.2597 | 14.6479 | 14.1193 | 14.5492 | 14.0328 | 14.4713 | 14.5218 | 14.0799 | 14.6070 | 14.1852 | 14.6805 | (61) |
| Total heat required for water heating calculated for each month | 174.2476 | 152.8049 | 158.6461 | 139.6604 | 135.0088 | 117.9803 | 110.7940 | 125.0535 | 125.9317 | 144.9595 | 156.4751 | 169.1981 | (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 | 174.2476 | 152.8049 | 158.6461 | 139.6604 | 135.0088 | 117.9803 | 110.7940 | 125.0535 | 125.9317 | 144.9595 | 156.4751 | 169.1981 | (64) |
| Total per year (kWh/year) = Sum(64)m = | | | | | | | | | | | | 1710.7600 (64) | |
| Heat gains from water heating, kWh/month | 56.7249 | 49.7137 | 51.5414 | 45.2722 | 43.6901 | 38.0708 | 35.6451 | 40.3822 | 40.7107 | 46.9940 | 50.8577 | 55.0472 | (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 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 60.2487 | 53.5124 | 43.5192 | 32.9468 | 24.6281 | 20.7921 | 22.4666 | 29.2030 | 39.1962 | 49.7685 | 58.0872 | 61.9232 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 367.8979 | 371.7155 | 362.0952 | 341.6147 | 315.7618 | 291.4637 | 275.2311 | 271.4134 | 281.0337 | 301.5142 | 327.3672 | 351.6653 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | (71) |
| Water heating gains (Table 5) | 76.2432 | 73.9787 | 69.2760 | 62.8781 | 58.7233 | 52.8761 | 47.9101 | 54.2772 | 56.5426 | 63.1639 | 70.6357 | 73.9882 | (72) |
| Total internal gains | 614.7027 | 609.5196 | 585.2034 | 547.7526 | 509.4262 | 475.4448 | 455.9207 | 465.2065 | 487.0854 | 524.7596 | 566.4030 | 597.8896 | (73) |

6. Solar gains

| | | | | | | | | | | | | | |
|-------------|----------|------------------------|--|-----------------------------------|------------------------------------|------------------------------|------------|----------|----------|----------|----------|----------|------|
| [Jan] | | Area m ² | Solar flux Table 6a W/m ² | Specific data g or Table 6b | Specific data FF or Table 6c | Access factor Table 6d | Gains W | | | | | | |
| East | | 5.9910 | 19.6403 | 0.5000 | 0.0000 | 0.7700 | 45.3010 | (76) | | | | | |
| West | | 5.9360 | 19.6403 | 0.5000 | 0.0000 | 0.7700 | 44.8851 | (80) | | | | | |
| Solar gains | 90.1860 | 176.4230 | 290.5436 | 423.7405 | 519.3098 | 531.6060 | 506.1106 | 434.7415 | 337.9142 | 209.3408 | 112.4514 | 74.1646 | (83) |
| Total gains | 704.8888 | 785.9426 | 875.7469 | 971.4931 | 1028.7360 | 1007.0508 | 962.0313 | 899.9480 | 824.9996 | 734.1003 | 678.8543 | 672.0542 | (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 | 37.4012 | 37.5010 | 37.5994 | 38.0685 | 38.1575 | 38.5777 | 38.5777 | 38.6565 | 38.4148 | 38.1575 | 37.9778 | 37.7917 | |
| alpha | 3.4934 | 3.5001 | 3.5066 | 3.5379 | 3.5438 | 3.5718 | 3.5718 | 3.5771 | 3.5610 | 3.5438 | 3.5319 | 3.5194 | |
| util living area | 0.9670 | 0.9506 | 0.9146 | 0.8361 | 0.7110 | 0.5486 | 0.4120 | 0.4549 | 0.6744 | 0.8750 | 0.9500 | 0.9715 | (86) |
| MIT | 19.5222 | 19.7265 | 20.0654 | 20.4742 | 20.7731 | 20.9342 | 20.9818 | 20.9741 | 20.8607 | 20.4606 | 19.9231 | 19.4824 | (87) |
| Th 2 | 20.0710 | 20.0732 | 20.0754 | 20.0858 | 20.0877 | 20.0968 | 20.0968 | 20.0984 | 20.0933 | 20.0877 | 20.0838 | 20.0797 | (88) |
| util rest of house | 0.9613 | 0.9422 | 0.9000 | 0.8089 | 0.6653 | 0.4827 | 0.3321 | 0.3724 | 0.6106 | 0.8477 | 0.9400 | 0.9665 | (89) |
| MIT 2 | 18.7302 | 18.9319 | 19.2624 | 19.6564 | 19.9233 | 20.0592 | 20.0895 | 20.0875 | 20.0056 | 19.6547 | 19.1360 | 18.6978 | (90) |
| Living area fraction | | | | | | | | | | | | fLA = Living area / (4) = 0.2014 (91) | |
| MIT | 18.8897 | 19.0919 | 19.4241 | 19.8211 | 20.0945 | 20.2354 | 20.2692 | 20.2660 | 20.1778 | 19.8170 | 19.2945 | 18.8558 | (92) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 | |
| adjusted MIT | 18.7397 | 18.9419 | 19.2741 | 19.6711 | 19.9445 | 20.0854 | 20.1192 | 20.1160 | 20.0278 | 19.6670 | 19.1445 | 18.7058 | (93) |

8. Space heating requirement

| | | | | | | | | | | | | | |
|----------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|---------------------------|-------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| | 0.9508 | 0.9295 | 0.8850 | 0.7949 | 0.6576 | 0.4818 | 0.3341 | 0.3741 | 0.6056 | 0.8329 | 0.9272 | 0.9569 | (94) |
| Useful gains | 670.1740 | 730.5133 | 774.9957 | 772.2517 | 676.4520 | 485.2228 | 321.4240 | 336.6397 | 499.6029 | 611.3961 | 629.4586 | 643.0635 | (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 | 1379.5582 | 1337.9834 | 1213.9966 | 1011.0243 | 772.0582 | 508.0881 | 325.9716 | 343.4973 | 551.3989 | 849.0813 | 1133.2516 | 1371.5567 | (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 | 527.7819 | 408.2199 | 326.6167 | 171.9163 | 71.1310 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 176.8378 | 362.7310 | 541.9989 | (98) |
| Space heating | | | | | | | | | | | | 2587.2334 (98) | |
| Space heating per m ² | | | | | | | | | | | | (98) / (4) = 27.4828 (99) | |

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 90.5000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 2858.8215 (211) |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Space heating requirement | 527.7819 | 408.2199 | 326.6167 | 171.9163 | 71.1310 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 176.8378 | 362.7310 | 541.9989 | (98) |
| Space heating efficiency (main heating system 1) | 90.5000 | 90.5000 | 90.5000 | 90.5000 | 90.5000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 90.5000 | 90.5000 | 90.5000 | (210) |
| Space heating fuel (main heating system) | 583.1844 | 451.0717 | 360.9024 | 189.9627 | 78.5978 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 195.4009 | 400.8077 | 598.8938 | (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 | 174.2476 | 152.8049 | 158.6461 | 139.6604 | 135.0088 | 117.9803 | 110.7940 | 125.0535 | 125.9317 | 144.9595 | 156.4751 | 169.1981 | (64) |
| Efficiency of water heater (217)m | 89.6841 | 89.6054 | 89.4283 | 89.0371 | 88.3783 | 87.3000 | 87.3000 | 87.3000 | 87.3000 | 89.0299 | 89.5112 | 87.3000 | (216) |
| Fuel for water heating, kWh/month | 194.2905 | 170.5309 | 177.4002 | 156.8564 | 152.7624 | 135.1436 | 126.9117 | 143.2457 | 144.2517 | 162.8211 | 174.8107 | 188.5896 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 1927.6145 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2858.8215 (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) | | | | | | | | | | | | | 425.6046 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 5287.0406 (238) |

10a. Fuel costs - using Table 12 prices

| | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |
|-------------------------------|---------------|------------------|------------------|
| Space heating - main system 1 | 2858.8215 | 3.4800 | 99.4870 (240) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (242) |
| Water heating (other fuel) | 1927.6145 | 3.4800 | 67.0810 (247) |
| Pumps and fans for heating | 75.0000 | 13.1900 | 9.8925 (249) |
| Energy for lighting | 425.6046 | 13.1900 | 56.1372 (250) |
| Additional standing charges | | | 120.0000 (251) |
| Total energy cost | | | 352.5977 (255) |

11a. SAP rating - Individual heating systems

| | | |
|----------------------------------|---|--------------|
| Energy cost deflator (Table 12): | | 0.4200 (256) |
| Energy cost factor (ECF) | $[(255) \times (256)] / [(4) + 45.0] =$ | 1.0643 (257) |
| SAP value | | 85.1526 |
| SAP rating (Section 12) | | 85 (258) |
| SAP band | | B |

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

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |
|-------------------------------|-----------------|----------------------------|-----------------------|
| Space heating - main system 1 | 2858.8215 | 0.2160 | 617.5054 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 1927.6145 | 0.2160 | 416.3647 (264) |
| Space and water heating | | | 1033.8702 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 425.6046 | 0.5190 | 220.8888 (268) |
| Total kg/year | | | 1293.6840 (272) |
| CO2 emissions per m2 | | | 13.7400 (273) |
| EI value | | | 87.5411 |
| EI rating | | | 88 (274) |
| EI band | | | B |

Calculation of stars for heating and DHW

| | |
|------------------------------------|---|
| Main heating energy efficiency | $3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4 |
| Main heating environmental impact | $0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4 |
| Water heating energy efficiency | $3.48 / 0.8863 = 3.926$, stars = 4 |
| Water heating environmental impact | $0.216 / 0.8863 = 0.2437$, stars = 4 |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 | 47.0700 (1b) | 2.3900 (2b) | 112.4973 (1b) - (3b) |
| First floor | 47.0700 (1c) | 2.6900 (2c) | 126.6183 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.1400 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.1156 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour |
|---|--------------|-------------------|-------|-----------------------------|--------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 3 * 10 = | 30.0000 (7a) |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 30.0000 / (5) = | 0.1255 (8) |
| Pressure test | | | | | Yes |
| Measured/design AP50 | | | | | 5.0100 |
| Infiltration rate | | | | | 0.3760 (18) |
| Number of sides sheltered | | | | | 2 (19) |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3196 (21) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed | 4.8000 | 4.5000 | 4.4000 | 3.9000 | 3.9000 | 3.6000 | 3.7000 | 3.5000 | 3.7000 | 4.0000 | 4.1000 | 4.4000 (22) |
| Wind factor | 1.2000 | 1.1250 | 1.1000 | 0.9750 | 0.9750 | 0.9000 | 0.9250 | 0.8750 | 0.9250 | 1.0000 | 1.0250 | 1.1000 (22a) |
| Adj infilt rate | 0.3835 | 0.3595 | 0.3515 | 0.3116 | 0.3116 | 0.2876 | 0.2956 | 0.2796 | 0.2956 | 0.3196 | 0.3276 | 0.3515 (22b) |
| Effective ac | 0.5735 | 0.5646 | 0.5618 | 0.5485 | 0.5485 | 0.5414 | 0.5437 | 0.5391 | 0.5437 | 0.5511 | 0.5536 | 0.5618 (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 |
|--|----------|-------------|------------|---------------|------------------------------|----------------|--|
| Windows (Uw = 1.40) | | | 11.9300 | 1.3258 | 15.8163 | | (27) |
| Solid Door | | | 1.9500 | 1.2000 | 2.3400 | | (26) |
| Flr - Ground | | | 47.0720 | 0.1300 | 6.1194 | 75.6000 | 3558.6432 (28a) |
| Wl - Brick | 2.5550 | | 2.5550 | 0.2500 | 0.6388 | 51.1800 | 130.7649 (29a) |
| Wl - Render | 52.9540 | 13.8800 | 39.0740 | 0.2500 | 9.7685 | 51.1800 | 1999.8073 (29a) |
| Rf - Ins Joist | 47.0720 | | 47.0720 | 0.1000 | 4.7072 | 5.8200 | 273.9590 (30) |
| Total net area of external elements Aum(A, m2) | | | 149.6530 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = 39.3901 | | (33) |
| Party Wall | | | 87.1940 | 0.0000 | 0.0000 | 54.0300 | 4711.0918 (32) |
| Ground Floor Stud | | | 82.7595 | | | 5.8200 | 481.6603 (32c) |
| 1st Floor Stud | | | 100.8056 | | | 5.8200 | 586.6888 (32c) |
| Internal Floor | | | 47.0700 | | | 18.0000 | 847.2600 (32d) |
| Internal Ceiling | | | 47.0700 | | | 5.8200 | 273.9474 (32e) |
| Heat capacity Cm = Sum(A x k) | | | | | | | (28)...(30) + (32) + (32a)...(32e) = 12863.8228 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 136.6457 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 10.1451 (36) |
| Total fabric heat loss | | | | | | | (33) + (36) = 49.5352 (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 | 45.2561 | 44.5535 | 44.3294 | 43.2843 | 43.2843 | 42.7177 | 42.9016 | 42.5389 | 42.9016 | 43.4833 | 43.6872 | 44.3294 (38) |
| Average = Sum(39)m / 12 = | 94.7913 | 94.0888 | 93.8646 | 92.8196 | 92.8196 | 92.2530 | 92.4368 | 92.0742 | 92.4368 | 93.0185 | 93.2225 | 93.8646 (39) |
| HLP | 1.0069 | 0.9995 | 0.9971 | 0.9860 | 0.9860 | 0.9800 | 0.9819 | 0.9781 | 0.9819 | 0.9881 | 0.9903 | 0.9971 (40) |
| HLP (average) | | | | | | | | | | | | 0.9894 (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 | | | | | | | | | | | | 2.6783 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 97.8086 (43) |
| Daily hot water use | 107.5894 | 103.6771 | 99.7648 | 95.8524 | 91.9401 | 88.0277 | 88.0277 | 91.9401 | 95.8524 | 99.7648 | 103.6771 | 107.5894 (44) |
| Energy conte | 159.5520 | 139.5452 | 143.9982 | 125.5411 | 120.4597 | 103.9475 | 96.3227 | 110.5317 | 111.8518 | 130.3525 | 142.2899 | 154.5176 (45) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------------|
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = | 1538.9098 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | | |
| | 23.9328 | 20.9318 | 21.5997 | 18.8312 | 18.0690 | 15.5921 | 14.4484 | 16.5798 | 16.7778 | 19.5529 | 21.3435 | 23.1776 | (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) |
| Combi loss | 14.6956 | 13.2597 | 14.6479 | 14.1193 | 14.5492 | 14.0328 | 14.4713 | 14.5218 | 14.0799 | 14.6070 | 14.1852 | 14.6805 | (61) |
| Total heat required for water heating calculated for each month | 174.2476 | 152.8049 | 158.6461 | 139.6604 | 135.0088 | 117.9803 | 110.7940 | 125.0535 | 125.9317 | 144.9595 | 156.4751 | 169.1981 | (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 | 174.2476 | 152.8049 | 158.6461 | 139.6604 | 135.0088 | 117.9803 | 110.7940 | 125.0535 | 125.9317 | 144.9595 | 156.4751 | 169.1981 | (64) |
| Total per year (kWh/year) = Sum(64)m = | | | | | | | | | | | | 1710.7600 (64) | |
| Heat gains from water heating, kWh/month | 56.7249 | 49.7137 | 51.5414 | 45.2722 | 43.6901 | 38.0708 | 35.6451 | 40.3822 | 40.7107 | 46.9940 | 50.8577 | 55.0472 | (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 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 60.2487 | 53.5124 | 43.5192 | 32.9468 | 24.6281 | 20.7921 | 22.4666 | 29.2030 | 39.1962 | 49.7685 | 58.0872 | 61.9232 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 367.8979 | 371.7155 | 362.0952 | 341.6147 | 315.7618 | 291.4637 | 275.2311 | 271.4134 | 281.0337 | 301.5142 | 327.3672 | 351.6653 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | (71) |
| Water heating gains (Table 5) | 76.2432 | 73.9787 | 69.2760 | 62.8781 | 58.7233 | 52.8761 | 47.9101 | 54.2772 | 56.5426 | 63.1639 | 70.6357 | 73.9882 | (72) |
| Total internal gains | 614.7027 | 609.5196 | 585.2034 | 547.7526 | 509.4262 | 475.4448 | 455.9207 | 465.2065 | 487.0854 | 524.7596 | 566.4030 | 597.8896 | (73) |

6. Solar gains

| | | | | | | | | | | | | | |
|-------------|----------|----------|------------------------|--|------------------------------|-----------|------------------------------|----------|------------------------------|------------|----------|----------|------|
| [Jan] | | | Area m ² | Solar flux Table 6a W/m ² | Specific data or Table 6b | g | Specific data or Table 6c | FF | Access factor Table 6d | Gains W | | | |
| East | | | 5.9910 | 23.7288 | 0.5000 | 0.0000 | 0.0000 | 0.7700 | | 54.7313 | (76) | | |
| West | | | 5.9360 | 23.7288 | 0.5000 | 0.0000 | 0.0000 | 0.7700 | | 54.2289 | (80) | | |
| Solar gains | 108.9602 | 189.4214 | 309.9615 | 474.2749 | 556.9895 | 608.6565 | 573.0558 | 498.2369 | 385.2730 | 240.1730 | 137.1839 | 86.6500 | (83) |
| Total gains | 723.6629 | 798.9410 | 895.1649 | 1022.0275 | 1066.4156 | 1084.1013 | 1028.9765 | 963.4434 | 872.3584 | 764.9326 | 703.5869 | 684.5396 | (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 | 37.6963 | 37.9778 | 38.0685 | 38.4971 | 38.4971 | 38.7335 | 38.6565 | 38.8088 | 38.6565 | 38.4148 | 38.3307 | 38.0685 | |
| alpha | 3.5131 | 3.5319 | 3.5379 | 3.5665 | 3.5665 | 3.5822 | 3.5771 | 3.5873 | 3.5771 | 3.5610 | 3.5554 | 3.5379 | |
| util living area | 0.9597 | 0.9432 | 0.8989 | 0.7977 | 0.6465 | 0.4584 | 0.3195 | 0.3301 | 0.5834 | 0.8261 | 0.9324 | 0.9640 | (86) |
| MIT | 19.6674 | 19.8398 | 20.1872 | 20.5887 | 20.8529 | 20.9679 | 20.9935 | 20.9931 | 20.9253 | 20.6199 | 20.1098 | 19.6619 | (87) |
| Th 2 | 20.0776 | 20.0838 | 20.0858 | 20.0950 | 20.0950 | 20.1001 | 20.0984 | 20.1017 | 20.0984 | 20.0933 | 20.0915 | 20.0858 | (88) |
| util rest of house | 0.9526 | 0.9335 | 0.8818 | 0.7657 | 0.5947 | 0.3908 | 0.2413 | 0.2474 | 0.5110 | 0.7887 | 0.9187 | 0.9575 | (89) |
| MIT 2 | 18.8784 | 19.0510 | 19.3874 | 19.7675 | 19.9948 | 20.0839 | 20.0965 | 20.0997 | 20.0569 | 19.8040 | 19.3234 | 18.8799 | (90) |
| Living area fraction | | | | | | | | | | | | fLA = Living area / (4) = 0.2014 (91) | |
| MIT | 19.0373 | 19.2099 | 19.5485 | 19.9329 | 20.1676 | 20.2619 | 20.2771 | 20.2796 | 20.2318 | 19.9683 | 19.4818 | 19.0374 | (92) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 | |
| adjusted MIT | 18.8873 | 19.0599 | 19.3985 | 19.7829 | 20.0176 | 20.1119 | 20.1271 | 20.1296 | 20.0818 | 19.8183 | 19.3318 | 18.8874 | (93) |

8. Space heating requirement

| | | | | | | | | | | | | | |
|----------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------------------------|-------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| | 0.9410 | 0.9202 | 0.8666 | 0.7536 | 0.5900 | 0.3917 | 0.2438 | 0.2500 | 0.5096 | 0.7757 | 0.9046 | 0.9466 | (94) |
| Useful gains | 680.9718 | 735.1528 | 775.7676 | 770.1566 | 629.2157 | 424.6762 | 250.8440 | 240.8367 | 444.5809 | 593.3586 | 636.4562 | 647.9603 | (95) |
| Ext temp. | 5.0000 | 5.4000 | 7.1000 | 9.5000 | 12.6000 | 15.4000 | 17.4000 | 17.5000 | 15.0000 | 11.7000 | 8.1000 | 5.2000 | (96) |
| Heat loss rate W | 1316.3955 | 1285.2418 | 1154.3954 | 954.4536 | 688.5016 | 434.6880 | 252.0889 | 242.1175 | 469.7421 | 755.1566 | 1047.0573 | 1284.7603 | (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 | 472.7552 | 369.6599 | 281.6991 | 132.6939 | 44.1088 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 120.3777 | 295.6328 | 473.7792 | (98) |
| Space heating | | | | | | | | | | | | 2190.7064 (98) | |
| Space heating per m ² | | | | | | | | | | | | (98) / (4) = 23.2707 (99) | |

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Not applicable

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

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 90.5000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 2420.6701 (211) |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Space heating requirement | 472.7552 | 369.6599 | 281.6991 | 132.6939 | 44.1088 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 120.3777 | 295.6328 | 473.7792 | (98) |
| Space heating efficiency (main heating system 1) | 90.5000 | 90.5000 | 90.5000 | 90.5000 | 90.5000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 90.5000 | 90.5000 | 90.5000 | (210) |
| Space heating fuel (main heating system) | 522.3814 | 408.4639 | 311.2697 | 146.6231 | 48.7390 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 133.0140 | 326.6661 | 523.5129 | (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 | 174.2476 | 152.8049 | 158.6461 | 139.6604 | 135.0088 | 117.9803 | 110.7940 | 125.0535 | 125.9317 | 144.9595 | 156.4751 | 169.1981 | (64) |
| Efficiency of water heater (217)m | 89.6153 | 89.5401 | 89.3204 | 88.8303 | 88.0668 | 87.3000 | 87.3000 | 87.3000 | 87.3000 | 88.7233 | 89.3663 | 87.3000 | (216) |
| Fuel for water heating, kWh/month | 194.4395 | 170.6553 | 177.6145 | 157.2216 | 153.3027 | 135.1436 | 126.9117 | 143.2457 | 144.2517 | 163.3839 | 175.0941 | 188.7626 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 1930.0268 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2420.6701 (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) | | | | | | | | | | | | | 425.6046 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 4851.3015 (238) |

10a. Fuel costs - using BEDF prices (500)

| | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |
|-------------------------------|---------------|------------------|------------------|
| Space heating - main system 1 | 2420.6701 | 3.6300 | 87.8703 (240) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (242) |
| Water heating (other fuel) | 1930.0268 | 3.6300 | 70.0600 (247) |
| Pumps and fans for heating | 75.0000 | 19.4400 | 14.5800 (249) |
| Energy for lighting | 425.6046 | 19.4400 | 82.7375 (250) |
| Additional standing charges | | | 95.0000 (251) |
| Total energy cost | | | 350.2478 (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 | 2420.6701 | 0.2160 | 522.8647 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 1930.0268 | 0.2160 | 416.8858 (264) |
| Space and water heating | | | 939.7505 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 425.6046 | 0.5190 | 220.8888 (268) |
| Total kg/year | | | 1199.5643 (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 | 2420.6701 | 1.2200 | 2953.2175 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 1930.0268 | 1.2200 | 2354.6327 (264) |
| Space and water heating | | | 5307.8502 (265) |
| Pumps and fans | 75.0000 | 3.0700 | 230.2500 (267) |
| Energy for lighting | 425.6046 | 3.0700 | 1306.6062 (268) |
| Primary energy kWh/year | | | 6844.7064 (272) |
| Primary energy kWh/m2/year | | | 72.7077 (273) |

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
 Current environmental impact rating: B 88

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

(For testing purposes):

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

| | | | |
|-----------------------------|------------|-------------|------------------|
| Recommended measures: | SAP change | Cost change | CO2 change |
| N Solar water heating | + 1.2 | -£ 27 | -191 kg (15.9%) |
| U Solar photovoltaic panels | + 9.6 | -£ 375 | -1000 kg (99.2%) |

| Recommended measures | Typical annual savings | | Energy efficiency | Environmental impact |
|---------------------------|------------------------|-------------------------------|-------------------|----------------------|
| Solar water heating | £27 | 2.03 kg/m ² | B 86 | B 89 |
| Solar photovoltaic panels | £375 | 10.63 kg/m ² | A 96 | A 98 |
| Total Savings | £401 | 12.66 kg/m² | | |

Potential energy efficiency rating: A 96
 Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 500 TEST (30 Jun 2022)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, South East England):

| | Current | Potential | Saving |
|----------------------------------|-----------------------|-----------------------|-----------------------|
| Electricity | £97 | £107 | -£10 |
| Mains gas | £253 | £216 | £36 |
| Space heating | £197 | £197 | £0 |
| Water heating | £70 | £43 | £27 |
| Lighting | £83 | £83 | £0 |
| Generated (PV) | -£0 | -£375 | £375 |
| Total cost of fuels | £350 | -£52 | £401 |
| Total cost of uses | £350 | -£52 | £401 |
| Delivered energy | 52 kWh/m ² | 21 kWh/m ² | 31 kWh/m ² |
| Carbon dioxide emissions | 1.2 tonnes | 0.0 tonnes | 1.2 tonnes |
| CO2 emissions per m ² | 13 kg/m ² | 0 kg/m ² | 13 kg/m ² |
| Primary energy | 73 kWh/m ² | -2 kWh/m ² | 74 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 | 47.0700 (1b) | 2.3900 (2b) | 112.4973 (1b) - (3b) |
| First floor | 47.0700 (1c) | 2.6900 (2c) | 126.6183 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.1400 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.1156 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|--------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) | | | | | | | |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) | | | | | | | |
| Number of intermittent fans | | | | 3 * 10 = | 30.0000 (7a) | | | | | | | |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) | | | | | | | |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) | | | | 30.0000 / (5) = | 0.1255 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0100 | | | | | | | |
| Infiltration rate | | | | | 0.3760 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3196 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4074 | 0.3995 | 0.3915 | 0.3515 | 0.3435 | 0.3036 | 0.3036 | 0.2956 | 0.3196 | 0.3435 | 0.3595 | 0.3755 (22b) |
| Effective ac | 0.5830 | 0.5798 | 0.5766 | 0.5618 | 0.5590 | 0.5461 | 0.5461 | 0.5437 | 0.5511 | 0.5590 | 0.5646 | 0.5705 (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 |
|--|----------|-------------|------------|---------------|------------------------------|----------------|--|
| Windows (Uw = 1.40) | | | 11.9300 | 1.3258 | 15.8163 | | (27) |
| Solid Door | | | 1.9500 | 1.2000 | 2.3400 | | (26) |
| Flr - Ground | | | 47.0720 | 0.1300 | 6.1194 | 75.6000 | 3558.6432 (28a) |
| Wl - Brick | 2.5550 | | 2.5550 | 0.2500 | 0.6388 | 51.1800 | 130.7649 (29a) |
| Wl - Render | 52.9540 | 13.8800 | 39.0740 | 0.2500 | 9.7685 | 51.1800 | 1999.8073 (29a) |
| Rf - Ins Joist | 47.0720 | | 47.0720 | 0.1000 | 4.7072 | 5.8200 | 273.9590 (30) |
| Total net area of external elements Aum(A, m2) | | | 149.6530 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = 39.3901 | | (33) |
| Party Wall | | | 87.1940 | 0.0000 | 0.0000 | 54.0300 | 4711.0918 (32) |
| Ground Floor Stud | | | 82.7595 | | | 5.8200 | 481.6603 (32c) |
| 1st Floor Stud | | | 100.8056 | | | 5.8200 | 586.6888 (32c) |
| Internal Floor | | | 47.0700 | | | 18.0000 | 847.2600 (32d) |
| Internal Ceiling | | | 47.0700 | | | 5.8200 | 273.9474 (32e) |
| Heat capacity Cm = Sum(A x k) | | | | | | | (28)...(30) + (32) + (32a)...(32e) = 12863.8228 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 136.6457 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 10.1451 (36) |
| Total fabric heat loss | | | | | | | (33) + (36) = 49.5352 (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 | 46.0040 | 45.7497 | 45.5004 | 44.3294 | 44.1103 | 43.0904 | 43.0904 | 42.9016 | 43.4833 | 44.1103 | 44.5535 | 45.0169 (38) |
| Average = Sum(39)m / 12 = | 95.5393 | 95.2849 | 95.0356 | 93.8646 | 93.6455 | 92.6257 | 92.6257 | 92.4368 | 93.0185 | 93.6455 | 94.0888 | 94.5521 (39) |
| HLP | 1.0149 | 1.0122 | 1.0095 | 0.9971 | 0.9947 | 0.9839 | 0.9839 | 0.9819 | 0.9881 | 0.9947 | 0.9995 | 1.0044 (40) |
| HLP (average) | | | | | | | | | | | | 0.9971 (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 | | | | | | | | | | | | 2.6783 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 97.8086 (43) |
| Daily hot water use | 107.5894 | 103.6771 | 99.7648 | 95.8524 | 91.9401 | 88.0277 | 88.0277 | 91.9401 | 95.8524 | 99.7648 | 103.6771 | 107.5894 (44) |
| Energy conte | 159.5520 | 139.5452 | 143.9982 | 125.5411 | 120.4597 | 103.9475 | 96.3227 | 110.5317 | 111.8518 | 130.3525 | 142.2899 | 154.5176 (45) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|-----------|-----------|-----------|----------|----------|----------|----------|--------------------|----------------|
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = | 1538.9098 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | | |
| | 23.9328 | 20.9318 | 21.5997 | 18.8312 | 18.0690 | 15.5921 | 14.4484 | 16.5798 | 16.7778 | 19.5529 | 21.3435 | 23.1776 | (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) |
| Combi loss | 14.6956 | 13.2597 | 14.6479 | 14.1193 | 14.5492 | 14.0328 | 14.4713 | 14.5218 | 14.0799 | 14.6070 | 14.1852 | 14.6805 | (61) |
| Total heat required for water heating calculated for each month | 174.2476 | 152.8049 | 158.6461 | 139.6604 | 135.0088 | 117.9803 | 110.7940 | 125.0535 | 125.9317 | 144.9595 | 156.4751 | 169.1981 | (62) |
| Aperture area of solar collector | | | | | | | | | | | | | |
| Zero-loss collector efficiency | | | | | | | | | | | | | |
| Collector heat loss coefficient | | | | | | | | | | | | | |
| Collector 2nd order heat loss coefficient | | | | | | | | | | | | | |
| Collector effective heat loss coefficient | | | | | | | | | | | | | |
| Collector performance ratio | | | | | | | | | | | | | |
| Annual solar radiation per m2 | | | | | | | | | | | | | |
| Overshading factor | | | | | | | | | | | | | |
| Solar energy available | | | | | | | | | | | | | |
| Adjustment factor for showers | | | | | | | | | | | | | |
| Solar-to-load ratio | | | | | | | | | | | | | |
| Utilisation factor | | | | | | | | | | | | | |
| Collector performance factor | | | | | | | | | | | | | |
| Dedicated solar storage volume | | | | | | | | | | | | | |
| Effective solar volume | | | | | | | | | | | | | |
| Daily hot water demand | | | | | | | | | | | | | |
| Volume ratio Veff/V | | | | | | | | | | | | | |
| Solar storage volume factor | | | | | | | | | | | | | |
| Solar input | -25.0444 | -41.7920 | -71.1765 | -95.3905 | -117.8470 | -115.8623 | -114.3312 | -99.8917 | -78.2352 | -53.4255 | -29.7063 | -863.6605 | (63) |
| Solar input (sum of months) = Sum(63)m = | | | | | | | | | | | | | |
| Output from w/h | 149.2032 | 111.0130 | 87.4696 | 44.2699 | 17.1619 | 2.1180 | 0.0000 | 25.1617 | 47.6965 | 91.5340 | 126.7688 | 148.2402 | (64) |
| Total per year (kWh/year) = Sum(64)m = | | | | | | | | | | | | | |
| Heat gains from water heating, kWh/month | 56.7249 | 49.7137 | 51.5414 | 45.2722 | 43.6901 | 38.0708 | 35.6451 | 40.3822 | 40.7107 | 46.9940 | 50.8577 | 55.0472 | (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 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 60.2487 | 53.5124 | 43.5192 | 32.9468 | 24.6281 | 20.7921 | 22.4666 | 29.2030 | 39.1962 | 49.7685 | 58.0872 | 61.9232 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 367.8979 | 371.7155 | 362.0952 | 341.6147 | 315.7618 | 291.4637 | 275.2311 | 271.4134 | 281.0337 | 301.5142 | 327.3672 | 351.6653 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | (71) |
| Water heating gains (Table 5) | 76.2432 | 73.9787 | 69.2760 | 62.8781 | 58.7233 | 52.8761 | 47.9101 | 54.2772 | 56.5426 | 63.1639 | 70.6357 | 73.9882 | (72) |
| Total internal gains | 614.7027 | 609.5196 | 585.2034 | 547.7526 | 509.4262 | 475.4448 | 455.9207 | 465.2065 | 487.0854 | 524.7596 | 566.4030 | 597.8896 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b g | Specific data or Table 6c FF | Access factor Table 6d | Gains W | | | | | | | |
|-------------|----------|--------------------------|-----------------------------|------------------------------|------------------------|--------------|----------|----------|----------|----------|----------|----------|------|
| East | 5.9910 | 19.6403 | 0.5000 | 0.0000 | 0.7700 | 45.3010 (76) | | | | | | | |
| West | 5.9360 | 19.6403 | 0.5000 | 0.0000 | 0.7700 | 44.8851 (80) | | | | | | | |
| Solar gains | 90.1860 | 176.4230 | 290.5436 | 423.7405 | 519.3098 | 531.6060 | 506.1106 | 434.7415 | 337.9142 | 209.3408 | 112.4514 | 74.1646 | (83) |
| Total gains | 704.8888 | 785.9426 | 875.7469 | 971.4931 | 1028.7360 | 1007.0508 | 962.0313 | 899.9480 | 824.9996 | 734.1003 | 678.8543 | 672.0542 | (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 | 37.4012 | 37.5010 | 37.5994 | 38.0685 | 38.1575 | 38.5777 | 38.5777 | 38.6565 | 38.4148 | 38.1575 | 37.9778 | 37.7917 | |
| alpha | 3.4934 | 3.5001 | 3.5066 | 3.5379 | 3.5438 | 3.5718 | 3.5718 | 3.5771 | 3.5610 | 3.5438 | 3.5319 | 3.5194 | |
| util living area | 0.9670 | 0.9506 | 0.9146 | 0.8361 | 0.7110 | 0.5486 | 0.4120 | 0.4549 | 0.6744 | 0.8750 | 0.9500 | 0.9715 | (86) |
| MIT | 19.5222 | 19.7265 | 20.0654 | 20.4742 | 20.7731 | 20.9342 | 20.9818 | 20.9741 | 20.8607 | 20.4606 | 19.9231 | 19.4824 | (87) |
| Th 2 | 20.0710 | 20.0732 | 20.0754 | 20.0858 | 20.0877 | 20.0968 | 20.0968 | 20.0984 | 20.0933 | 20.0877 | 20.0838 | 20.0797 | (88) |
| util rest of house | 0.9613 | 0.9422 | 0.9000 | 0.8089 | 0.6653 | 0.4827 | 0.3321 | 0.3724 | 0.6106 | 0.8477 | 0.9400 | 0.9665 | (89) |
| MIT 2 | 18.7302 | 18.9319 | 19.2624 | 19.6564 | 19.9233 | 20.0592 | 20.0895 | 20.0875 | 20.0056 | 19.6547 | 19.1360 | 18.6978 | (90) |
| Living area fraction | | | | | | | | | | | | | |
| MIT | 18.8897 | 19.0919 | 19.4241 | 19.8211 | 20.0945 | 20.2354 | 20.2692 | 20.2660 | 20.1778 | 19.8170 | 19.2945 | 18.8558 | (91) |
| Temperature adjustment | | | | | | | | | | | | | |
| adjusted MIT | 18.7397 | 18.9419 | 19.2741 | 19.6711 | 19.9445 | 20.0854 | 20.1192 | 20.1160 | 20.0278 | 19.6670 | 19.1445 | 18.7058 | (92) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|----------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|--------------|--------------|
| Utilisation | 0.9508 | 0.9295 | 0.8850 | 0.7949 | 0.6576 | 0.4818 | 0.3341 | 0.3741 | 0.6056 | 0.8329 | 0.9272 | 0.9569 | (94) |
| Useful gains | 670.1740 | 730.5133 | 774.9957 | 772.2517 | 676.4520 | 485.2228 | 321.4240 | 336.6397 | 499.6029 | 611.3961 | 629.4586 | 643.0635 | (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 | | | | | | | | | | | | | |
| | 1379.5582 | 1337.9834 | 1213.9966 | 1011.0243 | 772.0582 | 508.0881 | 325.9716 | 343.4973 | 551.3989 | 849.0813 | 1133.2516 | 1371.5567 | (97) |
| 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) |
| Space heating kWh | | | | | | | | | | | | | |
| | 527.7819 | 408.2199 | 326.6167 | 171.9163 | 71.1310 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 176.8378 | 362.7310 | 541.9989 | (98) |
| Space heating | | | | | | | | | | | | 2587.2334 | (98) |
| Space heating per m2 | | | | | | | | | | | | (98) / (4) = | 27.4828 (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 %) | | | | | | | | | | | | | 90.5000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 2858.8215 (211) |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Space heating requirement | 527.7819 | 408.2199 | 326.6167 | 171.9163 | 71.1310 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 176.8378 | 362.7310 | 541.9989 | (98) |
| Space heating efficiency (main heating system 1) | 90.5000 | 90.5000 | 90.5000 | 90.5000 | 90.5000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 90.5000 | 90.5000 | 90.5000 | (210) |
| Space heating fuel (main heating system) | 583.1844 | 451.0717 | 360.9024 | 189.9627 | 78.5978 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 195.4009 | 400.8077 | 598.8938 | (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 | 149.2032 | 111.0130 | 87.4696 | 44.2699 | 17.1619 | 2.1180 | 0.0000 | 25.1617 | 47.6965 | 91.5340 | 126.7688 | 148.2402 | (64) |
| Efficiency of water heater | | | | | | | | | | | | | 87.3000 (216) |
| (217)m | 89.7747 | 89.7963 | 89.8047 | 89.8258 | 89.8598 | 87.3000 | 87.3000 | 87.3000 | 87.3000 | 89.3825 | 89.6490 | 89.7931 | (217) |
| Fuel for water heating, kWh/month | 166.1972 | 123.6276 | 97.3998 | 49.2842 | 19.0985 | 2.4261 | 0.0000 | 28.8222 | 54.6351 | 102.4071 | 141.4057 | 165.0908 | (219) |
| | | | | | | | | | | | | 950.3944 | (219) |
| Water heating fuel used | | | | | | | | | | | | | |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2858.8215 (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) |
| pump for solar water heating | | | | | | | | | | | | | 50.0000 (230g) |
| Total electricity for the above, kWh/year | | | | | | | | | | | | | 125.0000 (231) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | | | 425.6046 (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 | | | | | | | | | | | | | 2632.5811 (238) |

10a. Fuel costs - using Table 12 prices

| | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year | |
|---------------------------------------|---------------|------------------|------------------|-----------------|
| Space heating - main system 1 | 2858.8215 | 3.4800 | 99.4870 | (240) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (242) |
| Water heating (other fuel) | 950.3944 | 3.4800 | 33.0737 | (247) |
| Pumps and fans for heating | 75.0000 | 13.1900 | 9.8925 | (249) |
| Pump for solar water heating | 50.0000 | 13.1900 | 6.5950 | (249) |
| Energy for lighting | 425.6046 | 13.1900 | 56.1372 | (250) |
| Additional standing charges | | | 120.0000 | (251) |
| Energy saving/generation technologies | | | | |
| PV Unit | | -1727.2394 | 13.1900 | -227.8229 (252) |
| Total energy cost | | | 97.3626 | (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] = | 0.2939 (257) |
| SAP value | | | 95.9002 |
| SAP rating (Section 12) | | | 96 (258) |
| SAP band | | | A |

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

Energy Emission factor Emissions

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

| | kWh/year | kg CO2/kWh | kg CO2/year |
|---------------------------------------|------------|------------|-----------------|
| Space heating - main system 1 | 2858.8215 | 0.2160 | 617.5054 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 950.3944 | 0.2160 | 205.2852 (264) |
| Space and water heating | | | 822.7906 (265) |
| Pumps and fans | 125.0000 | 0.5190 | 64.8750 (267) |
| Energy for lighting | 425.6046 | 0.5190 | 220.8888 (268) |
| Energy saving/generation technologies | | | |
| PV Unit | -1727.2394 | 0.5190 | -896.4372 (269) |
| Total kg/year | | | 212.1172 (272) |
| CO2 emissions per m2 | | | 2.2500 (273) |
| EI value | | | 97.9572 |
| EI rating | | | 98 (274) |
| EI band | | | A |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

| | Area (m2) | Storey height (m) | Volume (m3) |
|--|--------------|-------------------|--|
| Ground floor | 47.0700 (1b) | x 2.3900 (2b) | = 112.4973 (1b) - (3b) |
| First floor | 47.0700 (1c) | x 2.6900 (2c) | = 126.6183 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.1400 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 239.1156 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 0 | + | 0 | = | 0 * 20 = 0.0000 (6b) | | | | | | | |
| Number of intermittent fans | | | | | 3 * 10 = 30.0000 (7a) | | | | | | | |
| Number of passive vents | | | | | 0 * 10 = 0.0000 (7b) | | | | | | | |
| Number of flueless gas fires | | | | | 0 * 40 = 0.0000 (7c) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | | 30.0000 / (5) = 0.1255 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0100 | | | | | | | |
| Infiltration rate | | | | | 0.3760 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3196 (21) | | | | | | | |
| Wind speed | Jan 4.8000 | Feb 4.5000 | Mar 4.4000 | Apr 3.9000 | May 3.9000 | Jun 3.6000 | Jul 3.7000 | Aug 3.5000 | Sep 3.7000 | Oct 4.0000 | Nov 4.1000 | Dec 4.4000 (22) |
| Wind factor | 1.2000 | 1.1250 | 1.1000 | 0.9750 | 0.9750 | 0.9000 | 0.9250 | 0.8750 | 0.9250 | 1.0000 | 1.0250 | 1.1000 (22a) |
| Adj infilt rate | 0.3835 | 0.3595 | 0.3515 | 0.3116 | 0.3116 | 0.2876 | 0.2956 | 0.2796 | 0.2956 | 0.3196 | 0.3276 | 0.3515 (22b) |
| Effective ac | 0.5735 | 0.5646 | 0.5618 | 0.5485 | 0.5485 | 0.5414 | 0.5437 | 0.5391 | 0.5437 | 0.5511 | 0.5536 | 0.5618 (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 |
|--|----------|-------------|------------|----------------------|-----------|--------------------------------------|-----------------|
| Windows (Uw = 1.40) | | | 11.9300 | 1.3258 | 15.8163 | | (27) |
| Solid Door | | | 1.9500 | 1.2000 | 2.3400 | | (26) |
| Flr - Ground | | | 47.0720 | 0.1300 | 6.1194 | 75.6000 | 3558.6432 (28a) |
| Wl - Brick | 2.5550 | | 2.5550 | 0.2500 | 0.6388 | 51.1800 | 130.7649 (29a) |
| Wl - Render | 52.9540 | 13.8800 | 39.0740 | 0.2500 | 9.7685 | 51.1800 | 1999.8073 (29a) |
| Rf - Ins Joist | 47.0720 | | 47.0720 | 0.1000 | 4.7072 | 5.8200 | 273.9590 (30) |
| Total net area of external elements Aum(A, m2) | | | 149.6530 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 39.3901 | | (33) |
| Party Wall | | | 87.1940 | 0.0000 | 0.0000 | 54.0300 | 4711.0918 (32) |
| Ground Floor Stud | | | 82.7595 | | | 5.8200 | 481.6603 (32c) |
| 1st Floor Stud | | | 100.8056 | | | 5.8200 | 586.6888 (32c) |
| Internal Floor | | | 47.0700 | | | 18.0000 | 847.2600 (32d) |
| Internal Ceiling | | | 47.0700 | | | 5.8200 | 273.9474 (32e) |
| Heat capacity Cm = Sum(A x k) | | | | | | (28)...(30) + (32) + (32a)...(32e) = | 12863.8228 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 136.6457 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 10.1451 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 49.5352 (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 | 45.2561 | 44.5535 | 44.3294 | 43.2843 | 43.2843 | 42.7177 | 42.9016 | 42.5389 | 42.9016 | 43.4833 | 43.6872 | 44.3294 (38) |
| Average = Sum(39)m / 12 = | 94.7913 | 94.0888 | 93.8646 | 92.8196 | 92.8196 | 92.2530 | 92.4368 | 92.0742 | 92.4368 | 93.0185 | 93.2225 | 93.8646 (39) |
| HLP | 1.0069 | 0.9995 | 0.9971 | 0.9860 | 0.9860 | 0.9800 | 0.9819 | 0.9781 | 0.9819 | 0.9881 | 0.9903 | 0.9971 (40) |
| HLP (average) | | | | | | | | | | | | 0.9894 (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 | | | | | | | | | | | | 2.6783 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 97.8086 (43) |
| Daily hot water use | 107.5894 | 103.6771 | 99.7648 | 95.8524 | 91.9401 | 88.0277 | 88.0277 | 91.9401 | 95.8524 | 99.7648 | 103.6771 | 107.5894 (44) |
| Energy conte | 159.5520 | 139.5452 | 143.9982 | 125.5411 | 120.4597 | 103.9475 | 96.3227 | 110.5317 | 111.8518 | 130.3525 | 142.2899 | 154.5176 (45) |



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|--------------------|----------------|
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = | 1538.9098 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | | |
| | 23.9328 | 20.9318 | 21.5997 | 18.8312 | 18.0690 | 15.5921 | 14.4484 | 16.5798 | 16.7778 | 19.5529 | 21.3435 | 23.1776 | (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) |
| Combi loss | 14.6956 | 13.2597 | 14.6479 | 14.1193 | 14.5492 | 14.0328 | 14.4713 | 14.5218 | 14.0799 | 14.6070 | 14.1852 | 14.6805 | (61) |
| Total heat required for water heating calculated for each month | 174.2476 | 152.8049 | 158.6461 | 139.6604 | 135.0088 | 117.9803 | 110.7940 | 125.0535 | 125.9317 | 144.9595 | 156.4751 | 169.1981 | (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 | | | | | | | | | | | | 1204.7564 (H5) | |
| Overshading factor | | | | | | | | | | | | 0.8000 (H6) | |
| Solar energy available | | | | | | | | | | | | 2023.9908 (H7) | |
| Adjustment factor for showers | | | | | | | | | | | | 1.0000 (H7a) | |
| Solar-to-load ratio | | | | | | | | | | | | 1.3152 (H8) | |
| Utilisation factor | | | | | | | | | | | | 0.5325 (H9) | |
| Collector performance factor | | | | | | | | | | | | 0.8793 (H10) | |
| Dedicated solar storage volume | | | | | | | | | | | | 75.0000 (H11) | |
| Effective solar volume | | | | | | | | | | | | 75.0000 (H13) | |
| Daily hot water demand | | | | | | | | | | | | 97.8086 (H14) | |
| Volume ratio Veff/V | | | | | | | | | | | | 0.7668 (H15) | |
| Solar storage volume factor | | | | | | | | | | | | 0.9469 (H16) | |
| Solar input | -27.6705 | -41.1031 | -69.8119 | -98.6192 | -117.1418 | -123.1027 | -120.0657 | -105.9061 | -82.1621 | -56.2149 | -33.1541 | -22.3851 | (63) |
| Solar input (sum of months) = Sum(63)m = | | | | | | | | | | | | -897.3372 (63) | |
| Output from w/h | 146.5771 | 111.7019 | 88.8341 | 41.0412 | 17.8670 | 0.0000 | 0.0000 | 19.1474 | 43.7697 | 88.7446 | 123.3210 | 146.8130 | (64) |
| Total per year (kWh/year) = Sum(64)m = | | | | | | | | | | | | 827.8169 (64) | |
| Heat gains from water heating, kWh/month | 56.7249 | 49.7137 | 51.5414 | 45.2722 | 43.6901 | 38.0708 | 35.6451 | 40.3822 | 40.7107 | 46.9940 | 50.8577 | 55.0472 | (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 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | 160.6954 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 60.2487 | 53.5124 | 43.5192 | 32.9468 | 24.6281 | 20.7921 | 22.4666 | 29.2030 | 39.1962 | 49.7685 | 58.0872 | 61.9232 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 367.8979 | 371.7155 | 362.0952 | 341.6147 | 315.7618 | 291.4637 | 275.2311 | 271.4134 | 281.0337 | 301.5142 | 327.3672 | 351.6653 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | 53.7478 | (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | -107.1302 | (71) |
| Water heating gains (Table 5) | 76.2432 | 73.9787 | 69.2760 | 62.8781 | 58.7233 | 52.8761 | 47.9101 | 54.2772 | 56.5426 | 63.1639 | 70.6357 | 73.9882 | (72) |
| Total internal gains | 614.7027 | 609.5196 | 585.2034 | 547.7526 | 509.4262 | 475.4448 | 455.9207 | 465.2065 | 487.0854 | 524.7596 | 566.4030 | 597.8896 | (73) |

6. Solar gains

| | | | | | | | | | | | | | |
|-------------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|-----------|----------|----------|----------|----------|----------|------|
| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b g | Specific data or Table 6c FF | Access factor Table 6d | Gains W | | | | | | | |
| East | 5.9910 | 23.7288 | 0.5000 | 0.0000 | 0.7700 | 54.7313 (76) | | | | | | | |
| West | 5.9360 | 23.7288 | 0.5000 | 0.0000 | 0.7700 | 54.2289 (80) | | | | | | | |
| Solar gains | 108.9602 | 189.4214 | 309.9615 | 474.2749 | 556.9895 | 608.6565 | 573.0558 | 498.2369 | 385.2730 | 240.1730 | 137.1839 | 86.6500 | (83) |
| Total gains | 723.6629 | 798.9410 | 895.1649 | 1022.0275 | 1066.4156 | 1084.1013 | 1028.9765 | 963.4434 | 872.3584 | 764.9326 | 703.5869 | 684.5396 | (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 | 37.6963 | 37.9778 | 38.0685 | 38.4971 | 38.4971 | 38.7335 | 38.6565 | 38.8088 | 38.6565 | 38.4148 | 38.3307 | 38.0685 | |
| alpha | 3.5131 | 3.5319 | 3.5379 | 3.5665 | 3.5665 | 3.5822 | 3.5771 | 3.5873 | 3.5771 | 3.5610 | 3.5554 | 3.5379 | |
| util living area | 0.9597 | 0.9432 | 0.8989 | 0.7977 | 0.6465 | 0.4584 | 0.3195 | 0.3301 | 0.5834 | 0.8261 | 0.9324 | 0.9640 | (86) |
| MIT | 19.6674 | 19.8398 | 20.1872 | 20.5887 | 20.8529 | 20.9679 | 20.9935 | 20.9931 | 20.9253 | 20.6199 | 20.1098 | 19.6619 | (87) |
| Th 2 | 20.0776 | 20.0838 | 20.0858 | 20.0950 | 20.0950 | 20.1001 | 20.0984 | 20.1017 | 20.0984 | 20.0933 | 20.0915 | 20.0858 | (88) |
| util rest of house | 0.9526 | 0.9335 | 0.8818 | 0.7657 | 0.5947 | 0.3908 | 0.2413 | 0.2474 | 0.5110 | 0.7887 | 0.9187 | 0.9575 | (89) |
| MIT 2 | 18.8784 | 19.0510 | 19.3874 | 19.7675 | 19.9948 | 20.0839 | 20.0965 | 20.0997 | 20.0569 | 19.8040 | 19.3234 | 18.8799 | (90) |
| Living area fraction | | | | | | | | | | | | fLA = Living area / (4) = | |
| MIT | 19.0373 | 19.2099 | 19.5485 | 19.9329 | 20.1676 | 20.2619 | 20.2771 | 20.2796 | 20.2318 | 19.9683 | 19.4818 | 19.0374 | (92) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 | |
| adjusted MIT | 18.8873 | 19.0599 | 19.3985 | 19.7829 | 20.0176 | 20.1119 | 20.1271 | 20.1296 | 20.0818 | 19.8183 | 19.3318 | 18.8874 | (93) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|----------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|---------------------------|
| Utilisation | 0.9410 | 0.9202 | 0.8666 | 0.7536 | 0.5900 | 0.3917 | 0.2438 | 0.2500 | 0.5096 | 0.7757 | 0.9046 | 0.9466 | (94) |
| Useful gains | 680.9718 | 735.1528 | 775.7676 | 770.1566 | 629.2157 | 424.6762 | 250.8440 | 240.8367 | 444.5809 | 593.3586 | 636.4562 | 647.9603 | (95) |
| Ext temp. | 5.0000 | 5.4000 | 7.1000 | 9.5000 | 12.6000 | 15.4000 | 17.4000 | 17.5000 | 15.0000 | 11.7000 | 8.1000 | 5.2000 | (96) |
| Heat loss rate W | | | | | | | | | | | | | |
| | 1316.3955 | 1285.2418 | 1154.3954 | 954.4536 | 688.5016 | 434.6880 | 252.0889 | 242.1175 | 469.7421 | 755.1566 | 1047.0573 | 1284.7603 | (97) |
| 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) |
| Space heating kWh | | | | | | | | | | | | | |
| | 472.7552 | 369.6599 | 281.6991 | 132.6939 | 44.1088 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 120.3777 | 295.6328 | 473.7792 | (98) |
| Space heating | | | | | | | | | | | | | |
| | | | | | | | | | | | | 2190.7064 | (98) |
| Space heating per m2 | | | | | | | | | | | | | (98) / (4) = 23.2707 (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 %) | | | | | | | | | | | | | 90.5000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 2420.6701 (211) |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Space heating requirement | 472.7552 | 369.6599 | 281.6991 | 132.6939 | 44.1088 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 120.3777 | 295.6328 | 473.7792 | (98) |
| Space heating efficiency (main heating system 1) | 90.5000 | 90.5000 | 90.5000 | 90.5000 | 90.5000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 90.5000 | 90.5000 | 90.5000 | (210) |
| Space heating fuel (main heating system) | 522.3814 | 408.4639 | 311.2697 | 146.6231 | 48.7390 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 133.0140 | 326.6661 | 523.5129 | (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 | 146.5771 | 111.7019 | 88.8341 | 41.0412 | 17.8670 | 0.0000 | 0.0000 | 19.1474 | 43.7697 | 88.7446 | 123.3210 | 146.8130 | (64) |
| Efficiency of water heater | 89.7216 | 89.7367 | 89.7116 | 89.7231 | 89.5537 | 87.3000 | 87.3000 | 87.3000 | 87.3000 | 89.1138 | 89.5340 | 89.7220 | (217) |
| (217)m | 89.7216 | 89.7367 | 89.7116 | 89.7231 | 89.5537 | 87.3000 | 87.3000 | 87.3000 | 87.3000 | 89.1138 | 89.5340 | 89.7220 | (217) |
| Fuel for water heating, kWh/month | 163.3687 | 124.4774 | 99.0219 | 45.7420 | 19.9512 | 0.0000 | 0.0000 | 21.9329 | 50.1371 | 99.5857 | 137.7366 | 163.6310 | (219) |
| | | | | | | | | | | | | 925.5843 | (219) |
| Water heating fuel used | | | | | | | | | | | | | |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2420.6701 (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) |
| pump for solar water heating | | | | | | | | | | | | | 50.0000 (230g) |
| Total electricity for the above, kWh/year | | | | | | | | | | | | | 125.0000 (231) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | | | 425.6046 (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | |
| PV Unit 0 (0.80 * 2.50 * 1205 * 0.80) = | | | | | | | | | | -1927.6103 | | | -1927.6103 (233) |
| Total delivered energy for all uses | | | | | | | | | | | | | 1969.2487 (238) |

10a. Fuel costs - using BEDF prices (500)

| | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year | |
|---------------------------------------|---------------|------------------|------------------|-------|
| Space heating - main system 1 | 2420.6701 | 3.6300 | 87.8703 | (240) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (242) |
| Water heating (other fuel) | 925.5843 | 3.6300 | 33.5987 | (247) |
| Pumps and fans for heating | 75.0000 | 19.4400 | 14.5800 | (249) |
| Pump for solar water heating | 50.0000 | 19.4400 | 9.7200 | (249) |
| Energy for lighting | 425.6046 | 19.4400 | 82.7375 | (250) |
| Additional standing charges | | | 95.0000 | (251) |
| Energy saving/generation technologies | | | | |
| PV Unit | -1927.6103 | 19.4400 | -374.7274 | (252) |
| Total energy cost | | | -51.2209 | (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 | 2420.6701 | 0.2160 | 522.8647 | (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (263) |
| Water heating (other fuel) | 925.5843 | 0.2160 | 199.9262 | (264) |
| Space and water heating | | | 722.7909 | (265) |
| Pumps and fans | 125.0000 | 0.5190 | 64.8750 | (267) |
| Energy for lighting | 425.6046 | 0.5190 | 220.8888 | (268) |
| Energy saving/generation technologies | | | | |
| PV Unit | -1927.6103 | 0.5190 | -1000.4297 | (269) |
| Total kg/year | | | 8.1250 | (272) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

 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 | 2420.6701 | 1.2200 | 2953.2175 | (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (263) |
| Water heating (other fuel) | 925.5843 | 1.2200 | 1129.2128 | (264) |
| Space and water heating | | | 4082.4303 | (265) |
| Pumps and fans | 125.0000 | 3.0700 | 383.7500 | (267) |
| Energy for lighting | 425.6046 | 3.0700 | 1306.6062 | (268) |
| Energy saving/generation technologies | | | | |
| PV Unit | -1927.6103 | 3.0700 | -5917.7636 | (269) |
| Primary energy kWh/year | | | -144.9770 | (272) |
| Primary energy kWh/m2/year | | | -1.5400 | (273) |

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)



| | | | |
|-----------------------------|-----------------|-----------------------|------------|
| Property Reference | 044 - PRJ012620 | Issued on Date | 18/08/2022 |
| Assessment Reference | 044 M | Prop Type Ref | Clover |
| Property | Plot 44 | | |

| | | | | | |
|--|------|-----------------------|-------|-------------|-------|
| SAP Rating | 85 B | DER | 15.36 | TER | 16.33 |
| Environmental | 88 B | % DER<TER | 5.96 | | |
| CO₂ Emissions (t/year) | 1.20 | DFEE | 38.35 | TFEE | 44.43 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 13.68 | | |

| | | | |
|-------------------------|--|--------------------|-----------|
| Assessor Details | Mr. Michael Jukes, Michael Jukes, Tel: 02033971373, michael@briaryenergy.co.uk | Assessor ID | T850-0001 |
|-------------------------|--|--------------------|-----------|

| | |
|---------------|--|
| 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 | Mains gas | | |
| Fuel factor | 1.00 (mains gas) | | |
| Target Carbon Dioxide Emission Rate (TER) | 16.33 | kgCO ₂ /m ² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.36 | kgCO ₂ /m ² | Pass |
| | -0.97 (-5.9%) | kgCO ₂ /m ² | |

1b TFEE and DFEE

| | | | |
|--|---------------|------------------------|------|
| Target Fabric Energy Efficiency (TFEE) | 44.43 | kWh/m ² /yr | |
| Dwelling Fabric Energy Efficiency (DFEE) | 38.35 | kWh/m ² /yr | |
| | -6.0 (-13.5%) | kWh/m ² /yr | Pass |

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

| Element | Average | Highest | |
|---------------|------------------|------------------|------|
| External wall | 0.25 (max. 0.30) | 0.25 (max. 0.70) | Pass |
| Party wall | 0.00 (max. 0.20) | - | Pass |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | Pass |
| Roof | 0.10 (max. 0.20) | 0.10 (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 | 5.01 (design value) | |
| Maximum | 10.0 | Pass |

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)



Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (South East England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

5.99 m², No overhang

Windows facing West

5.94 m², No overhang

Air change rate

3.87 ach

Blinds/curtains

Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.01 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K