

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



| | | | | | |
|--|---|-----------------------|--------------------|-----------------------|------------|
| Property Reference | 5016-SUST-HP-ANNEX | | | Issued on Date | 05/05/2021 |
| Assessment Reference | 001 | Prop Type Ref | 5016-SUST-HP-ANNEX | | |
| Property | Annex, 14 , 14 Rushmoor Lane, Backwell, Bristol, BS48 3BN | | | | |
| SAP Rating | 78 C | DER | 24.90 | TER | 24.90 |
| Environmental | 78 C | % DER<TER | 0.01 | | |
| CO₂ Emissions (t/year) | 2.32 | DFEE | 49.05 | TFEE | 57.65 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 14.91 | | |
| Assessor Details | Mr. Michael Andrews, Energy Saving Experts Ltd, Tel: 01225 862266, mike@energy-saving-experts.com | | | Assessor ID | N388-0001 |
| Client | | | | | |

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

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

DWELLING AS DESIGNED

Detached House, total floor area 121 m²

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

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 24.90 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 24.90 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.1 kWh/m²/yrOK

2 Fabric U-values

| Element | Average | Highest | |
|---------------|------------------|------------------|----|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (max. 2.00) | 1.40 (max. 3.30) | OK |

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Electric underfloor heating - Electric
Underfloor heating in thin screed (standard tariff)

Secondary heating system: None

5 Cylinder insulation

Hot water storage Nominal cylinder loss: 1.61 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: No primary pipework

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Severn Valley): Medium OK

Based on:

Overshading: Average
Windows facing North: 6.46 m², No overhang
Windows facing East: 9.46 m², No overhang
Windows facing South: 1.51 m², No overhang
Windows facing West: 12.84 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Photovoltaic array 2.10 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|-------------------|--|
| Ground floor | 69.0700 (1b) | 2.4500 (2b) | 169.2215 (1b) - (3b) |
| First floor | 52.3000 (1c) | 1.8500 (2c) | 96.7550 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 121.3700 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 265.9765 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour | | | | | | | |
|---|--------------|-------------------|-----------------------------|-----------------|-------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) | | | | | | | |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) | | | | | | | |
| Number of intermittent fans | | | | 2 * 10 = | 20.0000 (7a) | | | | | | | |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) | | | | | | | |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 20.0000 / (5) = | 0.0752 (8) | | | | | | | |
| Pressure test | | | | Yes | | | | | | | | |
| Measured/design AP50 | | | | 5.0000 | | | | | | | | |
| Infiltration rate | | | | 0.3252 (18) | | | | | | | | |
| Number of sides sheltered | | | | 1 (19) | | | | | | | | |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.9250 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.3008 (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 | 0.3835 | 0.3760 | 0.3685 | 0.3309 | 0.3234 | 0.2858 | 0.2858 | 0.2782 | 0.3008 | 0.3234 | 0.3384 | 0.3534 (22b) |
| Effective ac | 0.5735 | 0.5707 | 0.5679 | 0.5547 | 0.5523 | 0.5408 | 0.5408 | 0.5387 | 0.5452 | 0.5523 | 0.5573 | 0.5625 (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 and doors (Uw = 1.40) | | | 30.2700 | 1.3258 | 40.1307 | | (27) | | | | | |
| Heat Loss Floor 1 | | | 69.0700 | 0.1300 | 8.9791 | | (28a) | | | | | |
| External Wall 1 | 128.9300 | 30.2700 | 98.6600 | 0.1800 | 17.7588 | | (29a) | | | | | |
| External Wall 2 | 6.5500 | | 6.5500 | 0.1800 | 1.1790 | | (29a) | | | | | |
| External Roof 1 | 83.5000 | | 83.5000 | 0.1300 | 10.8550 | | (30) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 288.0500 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = 78.9026 | | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 100.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 19.9364 (36) | | | | | |
| Total fabric heat loss | | | | | | | (33) + (36) = 98.8390 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 50.3414 | Feb 50.0908 | Mar 49.8451 | Apr 48.6910 | May 48.4751 | Jun 47.4699 | Jul 47.4699 | Aug 47.2838 | Sep 47.8571 | Oct 48.4751 | Nov 48.9119 | Dec 49.3686 (38) |
| Heat transfer coeff | 149.1804 | 148.9298 | 148.6841 | 147.5300 | 147.3141 | 146.3089 | 146.3089 | 146.1228 | 146.6961 | 147.3141 | 147.7509 | 148.2075 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 147.5290 (39) |
| HLP | Jan 1.2291 | Feb 1.2271 | Mar 1.2250 | Apr 1.2155 | May 1.2138 | Jun 1.2055 | Jul 1.2055 | Aug 1.2039 | Sep 1.2087 | Oct 1.2138 | Nov 1.2174 | Dec 1.2211 (40) |
| HLP (average) | | | | | | | | | | | | 1.2155 (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 | | | | | | | | | | | | 2.8685 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 102.3258 (43) |
| Daily hot water use | 112.5584 | 108.4654 | 104.3723 | 100.2793 | 96.1863 | 92.0932 | 92.0932 | 96.1863 | 100.2793 | 104.3723 | 108.4654 | 112.5584 (44) |
| Energy conte | 166.9209 | 145.9901 | 150.6487 | 131.3392 | 126.0230 | 108.7483 | 100.7713 | 115.6365 | 117.0176 | 136.3727 | 148.8615 | 161.6539 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1609.9836 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |
| Water storage loss: | 25.0381 | 21.8985 | 22.5973 | 19.7009 | 18.9035 | 16.3122 | 15.1157 | 17.3455 | 17.5526 | 20.4559 | 22.3292 | 24.2481 (46) |
| Store volume | | | | | | | | | | | | 150.0000 (47) |
| b) If manufacturer declared loss factor is not known : | | | | | | | | | | | | |
| Hot water storage loss factor from Table 2 (kWh/litre/day) | | | | | | | | | | | | 0.0115 (51) |

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| | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Volume factor from Table 2a | | | | | | | | | | | | 0.9283 (52) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.6000 (53) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 0.9648 (55) |
| Total storage loss | 29.9084 | 27.0140 | 29.9084 | 28.9436 | 29.9084 | 28.9436 | 29.9084 | 29.9084 | 28.9436 | 29.9084 | 28.9436 | 29.9084 (56) |
| If cylinder contains dedicated solar storage | 29.9084 | 27.0140 | 29.9084 | 28.9436 | 29.9084 | 28.9436 | 29.9084 | 29.9084 | 28.9436 | 29.9084 | 28.9436 | 29.9084 (57) |
| Primary loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (59) |
| Total heat required for water heating calculated for each month | 196.8293 | 173.0041 | 180.5571 | 160.2828 | 155.9315 | 137.6919 | 130.6797 | 145.5449 | 145.9612 | 166.2811 | 177.8051 | 191.5624 (62) |
| Solar input | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (63) |
| Output from w/h | 196.8293 | 173.0041 | 180.5571 | 160.2828 | 155.9315 | 137.6919 | 130.6797 | 145.5449 | 145.9612 | 166.2811 | 177.8051 | 191.5624 (64) |
| Heat gains from water heating, kWh/month | 79.4279 | 70.1529 | 74.0174 | 66.8252 | 65.8294 | 59.3137 | 57.4332 | 62.3759 | 62.0632 | 69.2707 | 72.6513 | 77.6767 (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 | 143.4228 | 143.4228 | 143.4228 | 143.4228 | 143.4228 | 143.4228 | 143.4228 | 143.4228 | 143.4228 | 143.4228 | 143.4228 | 143.4228 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 25.5850 | 22.7244 | 18.4807 | 13.9911 | 10.4585 | 8.8295 | 9.5406 | 12.4012 | 16.6449 | 21.1345 | 24.6671 | 26.2961 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 286.9861 | 289.9641 | 282.4596 | 266.4834 | 246.3163 | 227.3621 | 214.6995 | 211.7215 | 219.2260 | 235.2022 | 255.3693 | 274.3235 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 37.3423 | 37.3423 | 37.3423 | 37.3423 | 37.3423 | 37.3423 | 37.3423 | 37.3423 | 37.3423 | 37.3423 | 37.3423 | 37.3423 (69) |
| Pumps, fans | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -114.7382 | -114.7382 | -114.7382 | -114.7382 | -114.7382 | -114.7382 | -114.7382 | -114.7382 | -114.7382 | -114.7382 | -114.7382 | -114.7382 (71) |
| Water heating gains (Table 5) | 106.7579 | 104.3942 | 99.4858 | 92.8127 | 88.4804 | 82.3802 | 77.1951 | 83.8385 | 86.1990 | 93.1057 | 100.9046 | 104.4041 (72) |
| Total internal gains | 485.3559 | 483.1096 | 466.4529 | 439.3141 | 411.2820 | 384.5986 | 367.4621 | 373.9881 | 388.0967 | 415.4693 | 446.9679 | 471.0506 (73) |

6. Solar gains

| | | | | | | | | | | | | |
|-------------|----------|--------------------------|-----------------------------|------------------------------|------------------------|--------------|-----------|-----------|-----------|----------|----------|---------------|
| [Jan] | Area m2 | Solar flux Table 6a W/m2 | g Specific data or Table 6b | FF Specific data or Table 6c | Access factor Table 6d | Gains W | | | | | | |
| North | 6.4600 | 10.6334 | 0.7200 | 0.7000 | 0.7700 | 23.9921 (74) | | | | | | |
| East | 9.4600 | 19.6403 | 0.7200 | 0.7000 | 0.7700 | 64.8937 (76) | | | | | | |
| South | 1.5100 | 46.7521 | 0.7200 | 0.7000 | 0.7700 | 24.6571 (78) | | | | | | |
| West | 12.8400 | 19.6403 | 0.7200 | 0.7000 | 0.7700 | 88.0798 (80) | | | | | | |
| Solar gains | 201.6226 | 385.4805 | 622.1695 | 902.0300 | 1110.0165 | 1140.4832 | 1083.9222 | 926.4068 | 720.5778 | 453.2178 | 249.5642 | 167.1049 (83) |
| Total gains | 686.9785 | 868.5901 | 1088.6225 | 1341.3441 | 1521.2986 | 1525.0818 | 1451.3843 | 1300.3949 | 1108.6745 | 868.6871 | 696.5321 | 638.1555 (84) |

7. Mean internal temperature (heating season)

| | | | | | | | | | | | | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | | | | | | | | | | | | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| tau | 22.5994 | 22.6374 | 22.6749 | 22.8522 | 22.8857 | 23.0429 | 23.0429 | 23.0723 | 22.9821 | 22.8857 | 22.8181 | 22.7478 |
| alpha | 2.5066 | 2.5092 | 2.5117 | 2.5235 | 2.5257 | 2.5362 | 2.5362 | 2.5382 | 2.5321 | 2.5257 | 2.5212 | 2.5165 |
| util living area | 0.9710 | 0.9486 | 0.9021 | 0.8096 | 0.6779 | 0.5303 | 0.4103 | 0.4651 | 0.6836 | 0.8805 | 0.9558 | 0.9756 (86) |
| MIT | 18.9329 | 19.2010 | 19.6303 | 20.1391 | 20.5281 | 20.7561 | 20.8420 | 20.8214 | 20.6190 | 20.0653 | 19.3963 | 18.8816 (87) |
| Th 2 | 19.8968 | 19.8984 | 19.9000 | 19.9076 | 19.9090 | 19.9156 | 19.9156 | 19.9168 | 19.9131 | 19.9090 | 19.9061 | 19.9031 (88) |
| util rest of house | 0.9664 | 0.9407 | 0.8871 | 0.7808 | 0.6303 | 0.4601 | 0.3201 | 0.3717 | 0.6180 | 0.8554 | 0.9476 | 0.9717 (89) |
| MIT 2 | 17.1233 | 17.5110 | 18.1258 | 18.8405 | 19.3576 | 19.6401 | 19.7284 | 19.7137 | 19.4925 | 18.7597 | 17.8037 | 17.0531 (90) |
| Living area fraction | | | | | | | | | | | | fLA = Living area / (4) = 0.4025 (91) |
| Ext temp. | 17.8516 | 18.1912 | 18.7313 | 19.3632 | 19.8287 | 20.0893 | 20.1766 | 20.1595 | 19.9459 | 19.2852 | 18.4447 | 17.7891 (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 |
| adjusted MIT | 17.8516 | 18.1912 | 18.7313 | 19.3632 | 19.8287 | 20.0893 | 20.1766 | 20.1595 | 19.9459 | 19.2852 | 18.4447 | 17.7891 (93) |

8. Space heating requirement

| | | | | | | | | | | | | |
|----------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|-----------|---------------------------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Useful gains | 655.9628 | 803.2550 | 944.4119 | 1025.4571 | 953.1448 | 719.7394 | 497.4176 | 511.9669 | 687.5778 | 727.8395 | 649.9380 | 613.5485 (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 | 2021.6359 | 1979.4523 | 1818.6006 | 1543.6299 | 1197.4705 | 803.1321 | 523.2915 | 549.3520 | 857.5663 | 1279.4478 | 1676.1865 | 2014.0001 (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 | 1016.0607 | 790.4046 | 650.3964 | 373.0844 | 181.7783 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 410.3966 | 738.8989 | 1041.9360 (98) |
| Space heating | | | | | | | | | | | | 5202.9559 (98) |
| Space heating per m2 | | | | | | | | | | | | (98) / (4) = 42.8686 (99) |

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|-----------|----------|----------|----------|----------|----------|----------|----------|------------|----------|----------|-----------|------------------|
| 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 %) | | | | | | | | | | | | | 100.0000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 5202.9559 (211) |
| Space heating requirement | 1016.0607 | 790.4046 | 650.3964 | 373.0844 | 181.7783 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 410.3966 | 738.8989 | 1041.9360 | (98) |
| Space heating efficiency (main heating system 1) | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 100.0000 | 100.0000 | 100.0000 | (210) |
| Space heating fuel (main heating system) | 1016.0607 | 790.4046 | 650.3964 | 373.0844 | 181.7783 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 410.3966 | 738.8989 | 1041.9360 | (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 | 196.8293 | 173.0041 | 180.5571 | 160.2828 | 155.9315 | 137.6919 | 130.6797 | 145.5449 | 145.9612 | 166.2811 | 177.8051 | 191.5624 | (64) |
| Efficiency of water heater (217)m | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | (216) |
| Fuel for water heating, kWh/month | 196.8293 | 173.0041 | 180.5571 | 160.2828 | 155.9315 | 137.6919 | 130.6797 | 145.5449 | 145.9612 | 166.2811 | 177.8051 | 191.5624 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 1962.1310 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 5202.9559 (211) |
| Space heating fuel - secondary | | | | | | | | | | | | | 0.0000 (215) |
| Electricity for pumps and fans: | | | | | | | | | | | | | |
| Total electricity for the above, kWh/year | | | | | | | | | | | | | 0.0000 (231) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | | | 451.8395 (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | |
| PV Unit 0 (0.80 * 2.10 * 1068 * 1.00) = | | | | | | | | | -1794.3584 | | | | -1794.3584 (233) |
| Total delivered energy for all uses | | | | | | | | | | | | | 5822.5680 (238) |

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

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|---|-----------------|----------------------------|-----------------------|-------|
| Space heating - main system 1 | 5202.9559 | 0.5190 | 2700.3341 | (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (263) |
| Water heating | 1962.1310 | 0.5190 | 1018.3460 | (264) |
| Space and water heating | | | 3718.6801 | (265) |
| Pumps and fans | 0.0000 | 0.0000 | 0.0000 | (267) |
| Energy for lighting | 451.8395 | 0.5190 | 234.5047 | (268) |
| Energy saving/generation technologies | | | | |
| PV Unit (0.90*22.30 + 0.10*8.72) | -1794.3584 | 0.5190 | -931.2720 | (269) |
| Total CO2, kg/year | | | 3021.9128 | (272) |
| Dwelling Carbon Dioxide Emission Rate (DER) | | | 24.9000 | (273) |

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

| | DER | | |
|---|-----|-----|-------------|
| Total Floor Area | | TFA | 121.3700 |
| Assumed number of occupants | | N | 2.8685 |
| CO2 emission factor in Table 12 for electricity displaced from grid | | EF | 0.5190 |
| CO2 emissions from appliances, equation (L14) | | | 14.0119 ZC2 |
| CO2 emissions from cooking, equation (L16) | | | 1.5477 ZC3 |
| Total CO2 emissions | | | 40.4595 ZC4 |
| Residual CO2 emissions offset from biofuel CHP | | | 0.0000 ZC5 |
| Additional allowable electricity generation, kWh/m ² /year | | | 0.0000 ZC6 |
| Resulting CO2 emissions offset from additional allowable electricity generation | | | 0.0000 ZC7 |
| Net CO2 emissions | | | 40.4595 ZC8 |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|-------------------|--|
| Ground floor | 69.0700 (1b) | x 2.4500 (2b) | = 169.2215 (1b) - (3b) |
| First floor | 52.3000 (1c) | x 1.8500 (2c) | = 96.7550 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 121.3700 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 265.9765 (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 | | | | 4 * 10 = | 40.0000 (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) = | | | | 40.0000 / (5) = | 0.1504 (8) | | | | | | | |
| Pressure test | | | | Yes | | | | | | | | |
| Measured/design AP50 | | | | 5.0000 | | | | | | | | |
| Infiltration rate | | | | 0.4004 (18) | | | | | | | | |
| Number of sides sheltered | | | | 1 (19) | | | | | | | | |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.9250 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.3704 (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 | 0.4722 | 0.4630 | 0.4537 | 0.4074 | 0.3981 | 0.3518 | 0.3518 | 0.3426 | 0.3704 | 0.3981 | 0.4167 | 0.4352 (22b) |
| Effective ac | 0.6115 | 0.6072 | 0.6029 | 0.5830 | 0.5793 | 0.5619 | 0.5619 | 0.5587 | 0.5686 | 0.5793 | 0.5868 | 0.5947 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K | | | | | |
|--|----------------------|-------------------------|------------------------|----------------------------|------------------------------|-----------------------------|----------------------------|-------------|-------------|-------------|-------------|------------------|
| TER Opening Type (U _w = 1.40) | | | 30.2700 | 1.3258 | 40.1307 | | (27) | | | | | |
| Heat Loss Floor 1 | | | 69.0700 | 0.1300 | 8.9791 | | (28a) | | | | | |
| External Wall 1 | 128.9300 | 30.2700 | 98.6600 | 0.1800 | 17.7588 | | (29a) | | | | | |
| External Wall 2 | 6.5500 | | 6.5500 | 0.1800 | 1.1790 | | (29a) | | | | | |
| External Roof 1 | 83.5000 | | 83.5000 | 0.1300 | 10.8550 | | (30) | | | | | |
| Total net area of external elements A _{um} (A, m ²) | | | 288.0500 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = 78.9026 | | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 250.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 15.7557 (36) | | | | | |
| Total fabric heat loss | | | | | | | (33) + (36) = 94.6583 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 53.6719 | Feb 53.2919 | Mar 52.9194 | Apr 51.1700 | May 50.8426 | Jun 49.3189 | Jul 49.3189 | Aug 49.0367 | Sep 49.9058 | Oct 50.8426 | Nov 51.5048 | Dec 52.1971 (38) |
| Heat transfer coeff | 148.3302 | 147.9502 | 147.5777 | 145.8283 | 145.5009 | 143.9772 | 143.9772 | 143.6950 | 144.5641 | 145.5009 | 146.1631 | 146.8554 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 145.8267 (39) |
| HLP | Jan 1.2221 | Feb 1.2190 | Mar 1.2159 | Apr 1.2015 | May 1.1988 | Jun 1.1863 | Jul 1.1863 | Aug 1.1839 | Sep 1.1911 | Oct 1.1988 | Nov 1.2043 | Dec 1.2100 (40) |
| HLP (average) | | | | | | | | | | | | 1.2015 (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 | | | | | | | | | | | | 2.8685 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 102.3258 (43) |
| Daily hot water use | 112.5584 | 108.4654 | 104.3723 | 100.2793 | 96.1863 | 92.0932 | 92.0932 | 96.1863 | 100.2793 | 104.3723 | 108.4654 | 112.5584 (44) |
| Energy conte | 166.9209 | 145.9901 | 150.6487 | 131.3392 | 126.0230 | 108.7483 | 100.7713 | 115.6365 | 117.0176 | 136.3727 | 148.8615 | 161.6539 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1609.9836 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | 24.2481 (46) |
| Water storage loss: | | | | | | | | | | | | 150.0000 (47) |
| Store volume | | | | | | | | | | | | 1.3938 (48) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 0.5400 (49) |
| Temperature factor from Table 2b | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 93.5000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 5672.2217 (211) |
| Space heating requirement | 1082.7573 | 835.4503 | 662.8570 | 328.9503 | 112.9271 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 397.7174 | 775.9707 | 1106.8971 | (98) |
| Space heating efficiency (main heating system 1) | 93.5000 | 93.5000 | 93.5000 | 93.5000 | 93.5000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 93.5000 | 93.5000 | 93.5000 | (210) |
| Space heating fuel (main heating system) | 1158.0292 | 893.5298 | 708.9380 | 351.8185 | 120.7777 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 425.3662 | 829.9152 | 1183.8472 | (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 | 213.5158 | 188.0758 | 197.2436 | 176.4310 | 172.6179 | 153.8401 | 147.3662 | 162.2314 | 162.1094 | 182.9676 | 193.9533 | 208.2488 | (64) |
| Efficiency of water heater (217)m | 88.5444 | 88.3238 | 87.8002 | 86.4531 | 83.7143 | 79.8000 | 79.8000 | 79.8000 | 79.8000 | 86.8315 | 88.1368 | 88.6185 | (217) |
| Fuel for water heating, kWh/month | 241.1397 | 212.9389 | 224.6504 | 204.0770 | 206.1988 | 192.7821 | 184.6694 | 203.2975 | 203.1447 | 210.7158 | 220.0594 | 234.9949 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 2538.6686 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 5672.2217 (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) | | | | | | | | | | | | | 451.8395 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 8737.7298 (238) |

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

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |
|---|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1 | 5672.2217 | 0.2160 | 1225.1999 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 2538.6686 | 0.2160 | 548.3524 (264) |
| Space and water heating | | | 1773.5523 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 451.8395 | 0.5190 | 234.5047 (268) |
| Total CO2, kg/m2/year | | | 2046.9820 (272) |
| Emissions per m2 for space and water heating | | | 14.6128 (272a) |
| Fuel factor (electricity) | | | 1.5500 |
| Emissions per m2 for lighting | | | 1.9321 (272b) |
| Emissions per m2 for pumps and fans | | | 0.3207 (272c) |
| Target Carbon Dioxide Emission Rate (TER) = (14.6128 * 1.55) + 1.9321 + 0.3207, rounded to 2 d.p. | | | 24.9000 (273) |