

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)

|                                    |                                                                        |               |                   |      |                |            |
|------------------------------------|------------------------------------------------------------------------|---------------|-------------------|------|----------------|------------|
| Property Reference                 | Honey Pot Lodge                                                        |               |                   |      | Issued on Date | 07/03/2022 |
| Assessment Reference               | As Built Final                                                         | Prop Type Ref | Detached bungalow |      |                |            |
| Property                           | 21 THE DRIVE, WEST END, SOUTHAMPTON, SO30 3AN                          |               |                   |      |                |            |
|                                    |                                                                        |               |                   |      |                |            |
| SAP Rating                         | 76 C                                                                   | DER           | 25.53             | TER  | 31.46          |            |
| Environmental                      | 78 C                                                                   | % DER<TER     | 18.84             |      |                |            |
| CO <sub>2</sub> Emissions (t/year) | 2.00                                                                   | DFEE          | 66.20             | TFEE | 73.04          |            |
| General Requirements Compliance    | Pass                                                                   | % DFEE<TFEE   | 9.36              |      |                |            |
|                                    |                                                                        |               |                   |      |                |            |
| Assessor Details                   | Mr. Malcolm Maclean, SRE Limited, Tel: 01730 710044, malcolm@sre.co.uk |               |                   |      | Assessor ID    | V497-0002  |
| Client                             | L Thompson Construction Management Ltd, LTHO                           |               |                   |      |                |            |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)

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

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

#### DWELLING AS BUILT

Detached Bungalow, total floor area 93 m<sup>2</sup>

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) 31.46 kgCO<sub>2</sub>/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 25.53 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)73.0 kWh/m<sup>2</sup>/yr

Dwelling Fabric Energy Efficiency (DFEE)66.2 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

| Element       | Average          | Highest          |    |
|---------------|------------------|------------------|----|
| External wall | 0.17 (max. 0.30) | 0.17 (max. 0.70) | OK |
| Floor         | 0.10 (max. 0.25) | 0.10 (max. 0.70) | OK |
| Roof          | 0.16 (max. 0.20) | 0.16 (max. 0.35) | OK |
| Openings      | 1.51 (max. 2.00) | 1.80 (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: | 3.81 (measured in this dwelling) |    |
| Maximum                         | 10.0                             | OK |

#### 4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric  
GD Midea MHC-V4W/D2N8-B MHC-04

Secondary heating system: None

#### 5 Cylinder insulation

|                             |                                      |    |
|-----------------------------|--------------------------------------|----|
| Hot water storage           | Measured cylinder loss: 1.75 kWh/day |    |
| Permitted by DBSCG 2.24     | OK                                   |    |
| Primary pipework insulated: | Yes                                  | OK |

#### 6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK  
Independent timer for DHW OK

#### 7 Low energy lights

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

#### 8 Mechanical ventilation

Not applicable

#### 9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

|                       |                                    |
|-----------------------|------------------------------------|
| Overshading:          | Average                            |
| Windows facing North: | 15.90 m <sup>2</sup> , No overhang |
| Windows facing East:  | 1.92 m <sup>2</sup> , No overhang  |
| Windows facing South: | 4.02 m <sup>2</sup> , No overhang  |
| Windows facing West:  | 8.40 m <sup>2</sup> , No overhang  |
| Air change rate:      | 6.00 ach                           |
| Blinds/curtains:      | None                               |

#### 10 Key features

|                     |                                      |
|---------------------|--------------------------------------|
| Floor U-value       | 0.10 W/m <sup>2</sup> K              |
| Roof window U-value | 0.83 W/m <sup>2</sup> K              |
| Air permeability    | 3.8 m <sup>3</sup> /m <sup>2</sup> h |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 93.0000 (1b)              | x 2.6800 (2b)                   | = 249.2400 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 93.0000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 249.2400 (5)              |

#### 2. Ventilation rate

|                                                      | main<br>heating              | secondary<br>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) = |                      |       |       | Air changes per hour       |
| Pressure test                                        |                              |                      |       |       | 30.0000 / (5) = 0.1204 (8) |
| Measured/design AP50                                 |                              |                      |       |       | Yes                        |
| Infiltration rate                                    |                              |                      |       |       | 3.8100                     |
| Number of sides sheltered                            |                              |                      |       |       | 0.3109 (18)                |
|                                                      |                              |                      |       |       | 1 (19)                     |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =  |                      |       |       | 0.9250 (20)                |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =         |                      |       |       | 0.2876 (21)                |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac    | 0.3666 | 0.3594 | 0.3522 | 0.3163 | 0.3091 | 0.2732 | 0.2732 | 0.2660 | 0.2876 | 0.3091 | 0.3235 | 0.3379 (22b) |
| Effective ac    | 0.5672 | 0.5646 | 0.5620 | 0.5500 | 0.5478 | 0.5373 | 0.5373 | 0.5354 | 0.5413 | 0.5478 | 0.5523 | 0.5571 (25)  |

#### 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Window (Uw = 1.40)                                             |                         |                            | 10.2900                   | 1.3258                        | 13.6420      |                                | (27)          |
| Door                                                           |                         |                            | 2.1000                    | 1.8000                        | 3.7800       |                                | (26)          |
| Bifold doors (Uw = 1.70)                                       |                         |                            | 19.9500                   | 1.5918                        | 31.7556      |                                | (27)          |
| Rooflight (Uw = 0.83)                                          |                         |                            | 4.9500                    | 0.8033                        | 3.9765       |                                | (27a)         |
| Heat Loss Floor 1                                              |                         |                            | 93.0000                   | 0.1000                        | 9.3000       |                                | (28a)         |
| External Wall 1                                                | 119.4600                | 32.3400                    | 87.1200                   | 0.1700                        | 14.8104      |                                | (29a)         |
| External Roof 1                                                | 109.0000                | 4.9500                     | 104.0500                  | 0.1600                        | 16.6480      |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 321.4600                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            | (26)...(30) + (32) =      |                               | 93.9125      |                                | (33)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                | 100.0000 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)     |                         |                            |                           |                               |              |                                | 22.4816 (36)  |
| Total fabric heat loss                                         |                         |                            |                           |                               |              | (33) + (36) =                  | 116.3941 (37) |

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

|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| (38)m                     | 46.6524  | 46.4377  | 46.2273  | 45.2391  | 45.0542  | 44.1935  | 44.1935  | 44.0341  | 44.5250  | 45.0542  | 45.4282  | 45.8193 (38)  |
| Heat transfer coeff       | 163.0465 | 162.8319 | 162.6215 | 161.6332 | 161.4483 | 160.5876 | 160.5876 | 160.4282 | 160.9192 | 161.4483 | 161.8224 | 162.2134 (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 161.6324 (39) |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.7532 | 1.7509 | 1.7486 | 1.7380 | 1.7360 | 1.7267 | 1.7267 | 1.7250 | 1.7303 | 1.7360 | 1.7400 | 1.7442 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.7380 (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                                           |          |          |          |          |          |          |         |          |          |                    |              | 2.6646 (42)    |
|-------------------------------------------------------------|----------|----------|----------|----------|----------|----------|---------|----------|----------|--------------------|--------------|----------------|
| Average daily hot water use (litres/day)                    |          |          |          |          |          |          |         |          |          |                    |              | 97.4842 (43)   |
|                                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul     | Aug      | Sep      | Oct                | Nov          | Dec            |
| Daily hot water use                                         | 107.2326 | 103.3332 | 99.4339  | 95.5345  | 91.6351  | 87.7358  | 87.7358 | 91.6351  | 95.5345  | 99.4339            | 103.3332     | 107.2326 (44)  |
| Energy conte                                                | 159.0228 | 139.0824 | 143.5206 | 125.1247 | 120.0601 | 103.6028 | 96.0032 | 110.1651 | 111.4808 | 129.9201           | 141.8180     | 154.0051 (45)  |
| Energy content (annual)                                     |          |          |          |          |          |          |         |          |          | Total = Sum(45)m = |              | 1533.8058 (45) |
| Distribution loss (46)m = 0.15 x (45)m                      |          |          |          |          |          |          |         |          |          |                    |              |                |
| 23.8534                                                     | 20.8624  | 21.5281  | 18.7687  | 18.0090  | 15.5404  | 14.4005  | 16.5248 | 16.7221  | 19.4880  | 21.2727            | 23.1008 (46) |                |
| Water storage loss:                                         |          |          |          |          |          |          |         |          |          |                    |              |                |
| Store volume                                                |          |          |          |          |          |          |         |          |          |                    |              | 200.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day): |          |          |          |          |          |          |         |          |          |                    |              | 1.7500 (48)    |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)   |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          | 0.9450 (55)   |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 29.2950  | 26.4600  | 29.2950  | 28.3500  | 29.2950  | 28.3500  | 29.2950  | 29.2950  | 28.3500  | 29.2950  | 28.3500  | 29.2950 (56)  |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 29.2950  | 26.4600  | 29.2950  | 28.3500  | 29.2950  | 28.3500  | 29.2950  | 29.2950  | 28.3500  | 29.2950  | 28.3500  | 29.2950 (57)  |
| Primary loss                                                    | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624 (59)  |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 211.5802 | 186.5536 | 196.0780 | 175.9867 | 172.6175 | 154.4648 | 148.5606 | 162.7225 | 162.3428 | 182.4775 | 192.6800 | 206.5625 (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                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 211.5802 | 186.5536 | 196.0780 | 175.9867 | 172.6175 | 154.4648 | 148.5606 | 162.7225 | 162.3428 | 182.4775 | 192.6800 | 206.5625 (64) |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | 94.9210  | 84.2219  | 89.7665  | 82.2936  | 81.9659  | 75.1375  | 73.9670  | 78.6758  | 77.7570  | 85.2444  | 87.8441  | 93.2526 (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                                                                               | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 21.7965   | 19.3594   | 15.7441   | 11.9193   | 8.9098    | 7.5221    | 8.1279    | 10.5649   | 14.1802   | 18.0050   | 21.0145   | 22.4022 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 244.4900  | 247.0270  | 240.6338  | 227.0233  | 209.8424  | 193.6949  | 182.9074  | 180.3703  | 186.7636  | 200.3741  | 217.5549  | 233.7024 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230 (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)                                 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 127.5820  | 125.3301  | 120.6539  | 114.2966  | 110.1692  | 104.3577  | 99.4180   | 105.7471  | 107.9958  | 114.5758  | 122.0057  | 125.3396 (72)  |
| Total internal gains                                                                |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 456.8374  | 454.6855  | 440.0008  | 416.2082  | 391.8905  | 368.5436  | 353.4222  | 359.6512  | 371.9085  | 395.9238  | 423.5440  | 444.4132 (73)  |

#### 6. Solar gains

| [Jan]       |          |          |           |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |           |          | Access<br>factor<br>Table 6d | Gains<br>W    |
|-------------|----------|----------|-----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|-----------|----------|------------------------------|---------------|
| North       |          |          |           |           | 1.2000     | 10.6334                        | 0.6300                            | 0.7000                             |           |          | 0.7700                       | 3.8996 (74)   |
| East        |          |          |           |           | 1.9200     | 19.6403                        | 0.6300                            | 0.7000                             |           |          | 0.7700                       | 11.5245 (76)  |
| South       |          |          |           |           | 4.0200     | 46.7521                        | 0.6300                            | 0.7000                             |           |          | 0.7700                       | 57.4379 (78)  |
| West        |          |          |           |           | 3.1500     | 19.6403                        | 0.6300                            | 0.7000                             |           |          | 0.7700                       | 18.9073 (80)  |
| East        |          |          |           |           | 1.7800     | 26.2379                        | 0.5700                            | 0.7000                             |           |          | 1.0000                       | 16.7712 (82)  |
| South       |          |          |           |           | 3.1700     | 45.6416                        | 0.5700                            | 0.7000                             |           |          | 1.0000                       | 51.9559 (82)  |
| North       |          |          |           |           | 14.7000    | 10.6334                        | 0.6300                            | 0.7000                             |           |          | 0.7700                       | 47.7706 (74)  |
| West        |          |          |           |           | 5.2500     | 19.6403                        | 0.6300                            | 0.7000                             |           |          | 0.7700                       | 31.5122 (80)  |
|             |          |          |           |           |            |                                |                                   |                                    |           |          |                              |               |
| Solar gains | 239.7793 | 441.3740 | 684.0928  | 970.0826  | 1189.7022  | 1224.1532                      | 1162.4672                         | 993.5660                           | 783.1389  | 510.1387 | 293.3765                     | 201.1088 (83) |
| Total gains | 696.6167 | 896.0595 | 1124.0935 | 1386.2908 | 1581.5927  | 1592.6968                      | 1515.8894                         | 1353.2173                          | 1155.0474 | 906.0625 | 716.9205                     | 645.5219 (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                                                                         | 15.8441 | 15.8650 | 15.8856 | 15.9827 | 16.0010 | 16.0868 | 16.0868 | 16.1027 | 16.0536 | 16.0010 | 15.9640 | 15.9255      |
| alpha                                                                       | 2.0563  | 2.0577  | 2.0590  | 2.0655  | 2.0667  | 2.0725  | 2.0725  | 2.0735  | 2.0702  | 2.0667  | 2.0643  | 2.0617       |
| util living area                                                            | 0.9542  | 0.9249  | 0.8730  | 0.7806  | 0.6562  | 0.5205  | 0.4095  | 0.4619  | 0.6609  | 0.8485  | 0.9337  | 0.9603 (86)  |
| Tweekday                                                                    | 16.1620 | 16.6101 | 17.3081 | 18.1311 | 18.7702 | 19.1504 | 19.2835 | 19.2622 | 18.9715 | 18.1023 | 16.9775 | 16.0758      |
| Tweekend                                                                    | 19.3307 | 19.5342 | 19.8544 | 20.2406 | 20.5578 | 20.7626 | 20.8503 | 20.8292 | 20.6477 | 20.2119 | 19.6948 | 19.2904      |
| 24 / 16                                                                     | 4       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0            |
| 24 / 9                                                                      | 8       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0            |
| 16 / 9                                                                      | 14      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 20           |
| MIT                                                                         | 19.9769 | 18.7326 | 19.2319 | 19.8142 | 20.3175 | 20.6353 | 20.7690 | 20.7364 | 20.4499 | 19.7837 | 18.9619 | 19.2060 (87) |
| Th 2                                                                        | 19.5030 | 19.5046 | 19.5062 | 19.5137 | 19.5151 | 19.5217 | 19.5217 | 19.5229 | 19.5192 | 19.5151 | 19.5123 | 19.5093 (88) |
| util rest of house                                                          | 0.9460  | 0.9119  | 0.8510  | 0.7423  | 0.5954  | 0.4300  | 0.2902  | 0.3391  | 0.5762  | 0.8122  | 0.9199  | 0.9532 (89)  |
| Tweekday                                                                    | 16.1620 | 16.6101 | 17.3081 | 18.1311 | 18.7702 | 19.1504 | 19.2835 | 19.2622 | 18.9715 | 18.1023 | 16.9775 | 16.0758      |
| Tweekend                                                                    | 16.1620 | 16.6101 | 17.3081 | 18.1311 | 18.7702 | 19.1504 | 19.2835 | 19.2622 | 18.9715 | 18.1023 | 16.9775 | 16.0758      |
| MIT 2                                                                       | 17.4553 | 16.6101 | 17.3081 | 18.1311 | 18.7702 | 19.1504 | 19.2835 | 19.2622 | 18.9715 | 18.1023 | 16.9775 | 16.0758 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 18.2218 | 17.2553 | 17.8929 | 18.6428 | 19.2405 | 19.6018 | 19.7350 | 19.7103 | 19.4209 | 18.6134 | 17.5807 | 17.0273 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.2218 | 17.2553 | 17.8929 | 18.6428 | 19.2405 | 19.6018 | 19.7350 | 19.7103 | 19.4209 | 18.6134 | 17.5807 | 17.0273 (93) |

#### 8. Space heating requirement

|                  |          |          |          |          |          |          |          |          |          |          |          |               |
|------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Utilisation      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| Useful gains     | 652.8840 | 793.3020 | 922.3376 | 992.0927 | 921.6378 | 693.4674 | 468.0078 | 481.9056 | 657.9498 | 710.3862 | 641.5649 | 604.5147 (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 |          |          |          |          |          |          |          |          |          |          |          |               |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                                  |           |           |           |           |           |          |          |          |          |           |              |                |
|----------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|--------------|----------------|
| Month fraction                   | 2269.8974 | 2011.8371 | 1852.7263 | 1574.7526 | 1217.4070 | 803.2289 | 503.4474 | 531.0719 | 856.2336 | 1293.7555 | 1696.0193    | 2080.7654 (97) |
| Space heating kWh                | 1.0000    | 1.0000    | 1.0000    | 1.0000    | 1.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000    | 1.0000       | 1.0000 (97a)   |
| Space heating requirement        | 1203.0580 | 818.8556  | 692.2092  | 419.5151  | 220.0523  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 434.0268  | 759.2071     | 1098.3305 (98) |
| Space heating requirement        |           |           |           |           |           |          |          |          |          |           |              | 5645.2545 (98) |
| Space heating requirement per m2 |           |           |           |           |           |          |          |          |          |           | (98) / (4) = | 60.7017 (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 %)                      |           |          |          |          |          |          |          |          |          |          |          | 199.6403 (206)  |
| Efficiency of secondary/supplementary heating system, %               |           |          |          |          |          |          |          |          |          |          |          | 100.0000 (208)  |
| Space heating requirement                                             |           |          |          |          |          |          |          |          |          |          |          | 2827.7130 (211) |
| Jan                                                                   | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                 |
| Space heating requirement                                             | 1203.0580 | 818.8556 | 692.2092 | 419.5151 | 220.0523 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 434.0268 | 759.2071 | 1098.3305 (98)  |
| Space heating efficiency (main heating system 1)                      | 199.6403  | 199.6403 | 199.6403 | 199.6403 | 199.6403 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.6403 | 199.6403 | 199.6403 (210)  |
| Space heating fuel (main heating system)                              | 602.6128  | 410.1655 | 346.7282 | 210.1355 | 110.2244 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 217.4044 | 380.2875 | 550.1547 (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                                             | 211.5802  | 186.5536 | 196.0780 | 175.9867 | 172.6175 | 154.4648 | 148.5606 | 162.7225 | 162.3428 | 182.4775 | 192.6800 | 206.5625 (64)   |
| Efficiency of water heater                                            | 157.9850  | 157.9850 | 157.9850 | 157.9850 | 157.9850 | 157.9850 | 157.9850 | 157.9850 | 157.9850 | 157.9850 | 157.9850 | 157.9850 (216)  |
| Fuel for water heating, kWh/month                                     | 133.9243  | 118.0831 | 124.1118 | 111.3946 | 109.2620 | 97.7718  | 94.0346  | 102.9987 | 102.7584 | 115.5031 | 121.9609 | 130.7482 (219)  |
| Water heating fuel used                                               |           |          |          |          |          |          |          |          |          |          |          | 1362.5514 (219) |
| Annual totals kWh/year                                                |           |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system                                      |           |          |          |          |          |          |          |          |          |          |          | 2827.7130 (211) |
| Space heating fuel - secondary                                        |           |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Electricity for pumps and fans:                                       |           |          |          |          |          |          |          |          |          |          |          | 0.0000 (231)    |
| Total electricity for the above, kWh/year                             |           |          |          |          |          |          |          |          |          |          |          | 384.9323 (232)  |
| Electricity for lighting (calculated in Appendix L)                   |           |          |          |          |          |          |          |          |          |          |          | 4575.1966 (238) |
| Total delivered energy for all uses                                   |           |          |          |          |          |          |          |          |          |          |          |                 |

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

|                                             |           |                 |                 |
|---------------------------------------------|-----------|-----------------|-----------------|
|                                             | Energy    | Emission factor | Emissions       |
|                                             | kWh/year  | kg CO2/kWh      | kg CO2/year     |
| Space heating - main system 1               | 2827.7130 | 0.5190          | 1467.5830 (261) |
| Space heating - secondary                   | 0.0000    | 0.5190          | 0.0000 (263)    |
| Water heating (other fuel)                  | 1362.5514 | 0.5190          | 707.1642 (264)  |
| Space and water heating                     |           |                 | 2174.7472 (265) |
| Pumps and fans                              | 0.0000    | 0.0000          | 0.0000 (267)    |
| Energy for lighting                         | 384.9323  | 0.5190          | 199.7799 (268)  |
| Total CO2, kg/year                          |           |                 | 2374.5271 (272) |
| Dwelling Carbon Dioxide Emission Rate (DER) |           |                 | 25.5300 (273)   |

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

|                                                                                 |     |             |
|---------------------------------------------------------------------------------|-----|-------------|
| DER                                                                             |     | 25.5300 ZC1 |
| Total Floor Area                                                                | TFA | 93.0000     |
| Assumed number of occupants                                                     | N   | 2.6646      |
| CO2 emission factor in Table 12 for electricity displaced from grid             | EF  | 0.5190      |
| CO2 emissions from appliances, equation (L14)                                   |     | 15.5785 ZC2 |
| CO2 emissions from cooking, equation (L16)                                      |     | 1.9672 ZC3  |
| Total CO2 emissions                                                             |     | 43.0757 ZC4 |
| Residual CO2 emissions offset from biofuel CHP                                  |     | 0.0000 ZC5  |
| Additional allowable electricity generation, kWh/m²/year                        |     | 0.0000 ZC6  |
| Resulting CO2 emissions offset from additional allowable electricity generation |     | 0.0000 ZC7  |
| Net CO2 emissions                                                               |     | 43.0757 ZC8 |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 93.0000 (1b)              | x 2.6800 (2b)                   | = 249.2400 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 93.0000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 249.2400 (5)              |

#### 2. Ventilation rate

|                                                      | main<br>heating              | secondary<br>heating | other | total | m <sup>3</sup> 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) = 0.1204 (8) |
| Pressure test                                        |                              |                      |       |       | Yes                        |
| Measured/design AP50                                 |                              |                      |       |       | 5.0000                     |
| Infiltration rate                                    |                              |                      |       |       | 0.3704 (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) =         |                      |       |       | 0.3426 (21)                |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac    | 0.4368 | 0.4282 | 0.4197 | 0.3768 | 0.3683 | 0.3255 | 0.3255 | 0.3169 | 0.3426 | 0.3683 | 0.3854 | 0.4025 (22b) |
| Effective ac    | 0.5954 | 0.5917 | 0.5881 | 0.5710 | 0.5678 | 0.5530 | 0.5530 | 0.5502 | 0.5587 | 0.5678 | 0.5743 | 0.5810 (25)  |

#### 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K                 | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|------------------------------|--------------------------------|---------------|
| TER Opaque door                                                |                         |                            | 2.1000                    | 1.0000                        | 2.1000                       |                                | (26)          |
| TER Opening Type (Uw = 1.40)                                   |                         |                            | 18.1800                   | 1.3258                        | 24.1023                      |                                | (27)          |
| TER Room Window (Uw = 1.70)                                    |                         |                            | 2.9800                    | 1.5918                        | 4.7434                       |                                | (27a)         |
| Heat Loss Floor 1                                              |                         |                            | 93.0000                   | 0.1300                        | 12.0900                      |                                | (28a)         |
| External Wall 1                                                | 119.4600                | 20.2800                    | 99.1800                   | 0.1800                        | 17.8524                      |                                | (29a)         |
| External Roof 1                                                | 109.0000                | 2.9800                     | 106.0200                  | 0.1300                        | 13.7826                      |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 321.4600                  |                               |                              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           |                               | (26)...(30) + (32) = 74.6707 |                                | (33)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                              |                                | 250.0000 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)     |                         |                            |                           |                               |                              |                                | 18.4348 (36)  |
| Total fabric heat loss                                         |                         |                            |                           |                               |                              | (33) + (36) =                  | 93.1055 (37)  |

|                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|---------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |          |          |          |          |          |          |          |          |          |          |          |               |
| (38)m                                                               | 48.9709  | 48.6663  | 48.3676  | 46.9649  | 46.7024  | 45.4807  | 45.4807  | 45.2544  | 45.9513  | 46.7024  | 47.2333  | 47.7884 (38)  |
| Heat transfer coeff                                                 | 142.0765 | 141.7718 | 141.4731 | 140.0704 | 139.8079 | 138.5862 | 138.5862 | 138.3599 | 139.0568 | 139.8079 | 140.3389 | 140.8939 (39) |
| Average = Sum(39)m / 12 =                                           |          |          |          |          |          |          |          |          |          |          |          | 140.0691 (39) |
| HLP                                                                 | 1.5277   | 1.5244   | 1.5212   | 1.5061   | 1.5033   | 1.4902   | 1.4902   | 1.4877   | 1.4952   | 1.5033   | 1.5090   | 1.5150 (40)   |
| HLP (average)                                                       |          |          |          |          |          |          |          |          |          |          |          | 1.5061 (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                                           |          |          |          |          |          |          |         |          |          |          |          | 2.6646 (42)                       |
| Average daily hot water use (litres/day)                    |          |          |          |          |          |          |         |          |          |          |          | 97.4842 (43)                      |
| Daily hot water use                                         | 107.2326 | 103.3332 | 99.4339  | 95.5345  | 91.6351  | 87.7358  | 87.7358 | 91.6351  | 95.5345  | 99.4339  | 103.3332 | 107.2326 (44)                     |
| Energy conte                                                | 159.0228 | 139.0824 | 143.5206 | 125.1247 | 120.0601 | 103.6028 | 96.0032 | 110.1651 | 111.4808 | 129.9201 | 141.8180 | 154.0051 (45)                     |
| Energy content (annual)                                     |          |          |          |          |          |          |         |          |          |          |          | Total = Sum(45)m = 1533.8058 (45) |
| Distribution loss (46)m = 0.15 x (45)m                      |          |          |          |          |          |          |         |          |          |          |          |                                   |
| 23.8534                                                     | 20.8624  | 21.5281  | 18.7687  | 18.0090  | 15.5404  | 14.4005  | 16.5248 | 16.7221  | 19.4880  | 21.2727  | 23.1008  | (46)                              |
| Water storage loss:                                         |          |          |          |          |          |          |         |          |          |          |          |                                   |
| Store volume                                                |          |          |          |          |          |          |         |          |          |          |          | 200.0000 (47)                     |
| a) If manufacturer declared loss factor is known (kWh/day): |          |          |          |          |          |          |         |          |          |          |          | 1.6525 (48)                       |
| Temperature factor from Table 2b                            |          |          |          |          |          |          |         |          |          |          |          | 0.5400 (49)                       |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          | 0.8924 (55)   |
| Total storage loss                                              | 27.6637  | 24.9865  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637 (56)  |
| If cylinder contains dedicated solar storage                    | 27.6637  | 24.9865  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637 (57)  |
| Primary loss                                                    | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624 (59)  |
| Total heat required for water heating calculated for each month | 209.9489 | 185.0801 | 194.4466 | 174.4080 | 170.9862 | 152.8861 | 146.9293 | 161.0912 | 160.7641 | 180.8462 | 191.1013 | 204.9312 (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                                                 | 209.9489 | 185.0801 | 194.4466 | 174.4080 | 170.9862 | 152.8861 | 146.9293 | 161.0912 | 160.7641 | 180.8462 | 191.1013 | 204.9312 (64) |
| Heat gains from water heating, kWh/month                        | 93.6160  | 83.0431  | 88.4614  | 81.0306  | 80.6609  | 73.8746  | 72.6619  | 77.3707  | 76.4940  | 83.9393  | 86.5811  | 91.9476 (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                                                                               | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | 133.2299  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 21.7965   | 19.3594   | 15.7441   | 11.9193   | 8.9098    | 7.5221    | 8.1279    | 10.5649   | 14.1802   | 18.0050   | 21.0145   | 22.4022   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 244.4900  | 247.0270  | 240.6338  | 227.0233  | 209.8424  | 193.6949  | 182.9074  | 180.3703  | 186.7636  | 200.3741  | 217.5549  | 233.7024  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | 36.3230   | (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)                                 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | -106.5839 | (71) |
| Water heating gains (Table 5)                                                       | 125.8279  | 123.5760  | 118.8998  | 112.5425  | 108.4151  | 102.6036  | 97.6639   | 103.9929  | 106.2417  | 112.8216  | 120.2515  | 123.5854  | (72) |
| Total internal gains                                                                | 458.0833  | 455.9314  | 441.2466  | 417.4540  | 393.1364  | 369.7895  | 354.6680  | 360.8971  | 373.1544  | 397.1697  | 424.7899  | 445.6591  | (73) |

#### 6. Solar gains

| [Jan]       |          |          |          |           | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d |          | Gains<br>W   |               |
|-------------|----------|----------|----------|-----------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|----------|--------------|---------------|
| North       |          |          |          |           | 9.5600                 | 10.6334                                    | 0.6300                            | 0.7000                             | 0.7700                       |          | 31.0672 (74) |               |
| East        |          |          |          |           | 1.1500                 | 19.6403                                    | 0.6300                            | 0.7000                             | 0.7700                       |          | 6.9027 (76)  |               |
| South       |          |          |          |           | 2.4200                 | 46.7521                                    | 0.6300                            | 0.7000                             | 0.7700                       |          | 34.5771 (78) |               |
| West        |          |          |          |           | 5.0500                 | 19.6403                                    | 0.6300                            | 0.7000                             | 0.7700                       |          | 30.3117 (80) |               |
| East        |          |          |          |           | 1.0700                 | 26.2379                                    | 0.6300                            | 0.7000                             | 1.0000                       |          | 11.1428 (82) |               |
| South       |          |          |          |           | 1.9100                 | 45.6416                                    | 0.6300                            | 0.7000                             | 1.0000                       |          | 34.5999 (82) |               |
|             |          |          |          |           |                        |                                            |                                   |                                    |                              |          |              |               |
| Solar gains | 148.6013 | 273.5784 | 423.9568 | 600.8239  | 736.3497               | 757.4188                                   | 719.3579                          | 615.1956                           | 485.2415                     | 316.1991 | 181.8291     | 124.6260 (83) |
| Total gains | 606.6846 | 729.5098 | 865.2034 | 1018.2779 | 1129.4861              | 1127.2083                                  | 1074.0260                         | 976.0927                           | 858.3959                     | 713.3687 | 606.6190     | 570.2851 (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                                                                         | 45.4567 | 45.5544 | 45.6506 | 46.1078 | 46.1943 | 46.6016 | 46.6016 | 46.6778 | 46.4439                   | 46.1943 | 46.0196 | 45.8383      |
| alpha                                                                       | 4.0304  | 4.0370  | 4.0434  | 4.0739  | 4.0796  | 4.1068  | 4.1068  | 4.1119  | 4.0963                    | 4.0796  | 4.0680  | 4.0559       |
| util living area                                                            | 0.9969  | 0.9932  | 0.9821  | 0.9458  | 0.8553  | 0.6981  | 0.5423  | 0.6080  | 0.8458                    | 0.9713  | 0.9940  | 0.9976 (86)  |
| MIT                                                                         | 19.3297 | 19.5271 | 19.8634 | 20.3061 | 20.6829 | 20.9049 | 20.9740 | 20.9591 | 20.7782                   | 20.2779 | 19.7225 | 19.2974 (87) |
| Th 2                                                                        | 19.6668 | 19.6692 | 19.6716 | 19.6829 | 19.6850 | 19.6949 | 19.6949 | 19.6967 | 19.6911                   | 19.6850 | 19.6807 | 19.6763 (88) |
| util rest of house                                                          | 0.9959  | 0.9907  | 0.9754  | 0.9244  | 0.7984  | 0.5887  | 0.3938  | 0.4562  | 0.7621                    | 0.9560  | 0.9915  | 0.9968 (89)  |
| MIT 2                                                                       | 17.4815 | 17.7707 | 18.2592 | 18.8925 | 19.3868 | 19.6356 | 19.6865 | 19.6816 | 19.5195                   | 18.8677 | 18.0646 | 17.4406 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.3040 (91)  |
| MIT                                                                         | 18.0433 | 18.3046 | 18.7468 | 19.3222 | 19.7808 | 20.0214 | 20.0779 | 20.0699 | 19.9021                   | 19.2963 | 18.5686 | 18.0050 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.0433 | 18.3046 | 18.7468 | 19.3222 | 19.7808 | 20.0214 | 20.0779 | 20.0699 | 19.9021                   | 19.2963 | 18.5686 | 18.0050 (93) |

#### 8. Space heating requirement

|                                  |           |           |           |           |           |          |          |          |          |           |           |           |       |
|----------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|-----------|-----------|-------|
| Utilisation                      | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep      | Oct       | Nov       | Dec       |       |
| Useful gains                     | 602.9130  | 720.0127  | 838.2556  | 933.6772  | 907.2405  | 697.1542 | 471.9288 | 490.5764 | 667.9302 | 677.4898  | 599.4297  | 567.4980  | (94)  |
| 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                 | 1952.6024 | 1900.3972 | 1732.5994 | 1459.8371 | 1129.7621 | 751.3380 | 481.9895 | 507.7687 | 806.8230 | 1215.8167 | 1609.4867 | 1945.0399 | (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                | 1004.1689 | 793.2184  | 665.3918  | 378.8352  | 165.5560  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 400.5152  | 727.2410  | 1024.8912 | (98)  |
| Space heating                    |           |           |           |           |           |          |          |          |          |           |           | 5159.8176 | (98)  |
| Space heating per m <sup>2</sup> |           |           |           |           |           |          |          |          |          |           |           | 55.4819   | (99)  |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)                      |           |          |          |          |          |          |          |          |          |          |          |           | 93.5000   | (206)  |
| Efficiency of secondary/supplementary heating system, %               |           |          |          |          |          |          |          |          |          |          |          |           | 0.0000    | (208)  |
| Space heating requirement                                             |           |          |          |          |          |          |          |          |          |          |          |           | 5518.5215 | (211)  |
|                                                                       | Jan       | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |           |        |
| Space heating requirement                                             | 1004.1689 | 793.2184 | 665.3918 | 378.8352 | 165.5560 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 400.5152 | 727.2410 | 1024.8912 | (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)                              | 1073.9774 | 848.3619 | 711.6490 | 405.1713 | 177.0652 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 428.3585 | 777.7979 | 1096.1403 | (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                                             | 209.9489  | 185.0801 | 194.4466 | 174.4080 | 170.9862 | 152.8861 | 146.9293 | 161.0912 | 160.7641 | 180.8462 | 191.1013 | 204.9312  | (64)      |        |
| Efficiency of water heater (217)m                                     | 88.4492   | 88.2611  | 87.8366  | 86.8297  | 84.7280  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 86.8764  | 88.0434  | 88.5221   | (216)     |        |
| Fuel for water heating, kWh/month                                     | 237.3667  | 209.6962 | 221.3732 | 200.8621 | 201.8061 | 191.5866 | 184.1219 | 201.8686 | 201.4588 | 208.1650 | 217.0535 | 231.5028  | (219)     |        |
| Water heating fuel used                                               |           |          |          |          |          |          |          |          |          |          |          | 2506.8616 | (219)     |        |
| Annual totals kWh/year                                                |           |          |          |          |          |          |          |          |          |          |          |           |           |        |
| Space heating fuel - main system                                      |           |          |          |          |          |          |          |          |          |          |          |           | 5518.5215 | (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)                   |           |          |          |          |          |          |          |          |          |          |          |           | 384.9323  | (232)  |
| Total delivered energy for all uses                                   |           |          |          |          |          |          |          |          |          |          |          |           | 8485.3154 | (238)  |

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

|                                                                                                   | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------------------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                                                                     | 5518.5215          | 0.2160                        | 1192.0006 (261)          |
| Space heating - secondary                                                                         | 0.0000             | 0.0000                        | 0.0000 (263)             |
| Water heating (other fuel)                                                                        | 2506.8616          | 0.2160                        | 541.4821 (264)           |
| Space and water heating                                                                           |                    |                               | 1733.4827 (265)          |
| Pumps and fans                                                                                    | 75.0000            | 0.5190                        | 38.9250 (267)            |
| Energy for lighting                                                                               | 384.9323           | 0.5190                        | 199.7799 (268)           |
| Total CO2, kg/m2/year                                                                             |                    |                               | 1972.1876 (272)          |
| Emissions per m2 for space and water heating                                                      |                    |                               | 18.6396 (272a)           |
| Fuel factor (electricity)                                                                         |                    |                               | 1.5500                   |
| Emissions per m2 for lighting                                                                     |                    |                               | 2.1482 (272b)            |
| Emissions per m2 for pumps and fans                                                               |                    |                               | 0.4185 (272c)            |
| Target Carbon Dioxide Emission Rate (TER) = (18.6396 * 1.55) + 2.1482 + 0.4185, rounded to 2 d.p. |                    |                               | 31.4600 (273)            |