

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

|                                    |                                                                                          |               |                 |      |                |            |
|------------------------------------|------------------------------------------------------------------------------------------|---------------|-----------------|------|----------------|------------|
| Property Reference                 | S8570 v2                                                                                 |               |                 |      | Issued on Date | 14/07/2021 |
| Assessment Reference               | V1 Air test                                                                              | Prop Type Ref | Conversion Flat |      |                |            |
| Property                           | 55 , Newton Street, Manchester, M11ET                                                    |               |                 |      |                |            |
|                                    |                                                                                          |               |                 |      |                |            |
| SAP Rating                         | 80 C                                                                                     | DER           | 22.60           | TER  | 17.09          |            |
| Environmental                      | 79 C                                                                                     | % DER<TER     | -32.25          |      |                |            |
| CO <sub>2</sub> Emissions (t/year) | 2.34                                                                                     | DFEE          | 74.79           | TFEE | 57.17          |            |
| General Requirements Compliance    | Fail                                                                                     | % DFEE<TFEE   | -30.83          |      |                |            |
|                                    |                                                                                          |               |                 |      |                |            |
| Assessor Details                   | Mr. Peter Kinsella, Base Energy Services Ltd, Tel: 0151 933 0328, peter@baseenergy.co.uk |               |                 |      | Assessor ID    | L770-0002  |
| 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

Ground-floor flat, total floor area 115 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:Mains gas  
Fuel factor:1.00 (mains gas)  
Target Carbon Dioxide Emission Rate (TER) 17.09 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 22.60 kgCO<sub>2</sub>/m<sup>2</sup>Fail  
Excess emissions =5.51 kgCO<sub>2</sub>/m<sup>2</sup> (32.2%)

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.2 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)74.8 kWh/m<sup>2</sup>/yrFail  
Excess energy =17.6 kWh/m<sup>2</sup>/yr (30.8%)

#### 2 Fabric U-values

| Element       | Average          | Highest          |      |
|---------------|------------------|------------------|------|
| External wall | 0.30 (max. 0.30) | 0.34 (max. 0.70) | OK   |
| Party wall    | 0.00 (max. 0.20) | -                | OK   |
| Floor         | 0.22 (max. 0.25) | 0.22 (max. 0.70) | OK   |
| Roof          | 0.17 (max. 0.20) | 0.18 (max. 0.35) | OK   |
| Openings      | 2.05 (max. 2.00) | 3.00 (max. 3.30) | Fail |

#### 2a Thermal bridging

Thermal bridging calculated using default y-value of 0.15

#### 3 Air permeability

Air permeability at 50 pascals: 10.00 (design value)  
Maximum 10.0 OK

#### 4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas  
Data from manufacturer  
tbc tbc

Efficiency: 89.0% SEDBUK2009

Minimum: 88.0% OK

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: Yes OK

#### 6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK  
Independent timer for DHW OK

Boiler interlock Yes OK

#### 7 Low energy lights

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

#### 8 Mechanical ventilation

Continuous extract system (decentralised)  
Specific fan power: 0.1900  
Maximum 0.7 OK

#### 9 Summertime temperature

Overheating risk (North West England): Not significant OK

Based on:

Overshading: Average  
Windows facing North East: 13.39 m<sup>2</sup>, No overhang  
Windows facing South East: 8.69 m<sup>2</sup>, No overhang  
Windows facing North West: 0.94 m<sup>2</sup>, No overhang  
Air change rate: 4.00 ach  
Blinds/curtains: None

#### 10 Key features

Party wall U-value 0.00 W/m<sup>2</sup>K

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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<br>(m <sup>2</sup> ) | Storey height<br>(m)                        | Volume<br>(m <sup>3</sup> ) |
|----------------------------------------------------------|---------------------------|---------------------------------------------|-----------------------------|
| Ground floor                                             | 29.0000 (1b)              | x 2.4600 (2b)                               | = 71.3400 (1b) - (3b)       |
| First floor                                              | 31.5600 (1c)              | x 3.2000 (2c)                               | = 100.9920 (1c) - (3c)      |
| Second floor                                             | 28.3300 (1d)              | x 3.0400 (2d)                               | = 86.1232 (1d) - (3d)       |
| Third floor                                              | 25.7000 (1e)              | x 2.3000 (2e)                               | = 59.1100 (1e) - (3e)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e) ... (1n) | 114.5900                  |                                             | (4)                         |
| Dwelling volume                                          |                           | (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = | 317.5652 (5)                |

#### 2. Ventilation rate

|                                                      |                              |        |        |        | main<br>heating | +      | secondary<br>heating | +      | other  | =      | total                       | m3 per hour  |
|------------------------------------------------------|------------------------------|--------|--------|--------|-----------------|--------|----------------------|--------|--------|--------|-----------------------------|--------------|
| Number of chimneys                                   |                              |        |        |        | 0               | +      | 0                    | +      | 0      | =      | 0 * 40 =                    | 0.0000 (6a)  |
| Number of open flues                                 |                              |        |        |        | 0               | +      | 0                    | +      | 0      | =      | 0 * 20 =                    | 0.0000 (6b)  |
| Number of intermittent fans                          |                              |        |        |        |                 |        |                      |        |        |        | 0 * 10 =                    | 0.0000 (7a)  |
| Number of passive vents                              |                              |        |        |        |                 |        |                      |        |        |        | 0 * 10 =                    | 0.0000 (7b)  |
| Number of flueless gas fires                         |                              |        |        |        |                 |        |                      |        |        |        | 0 * 40 =                    | 0.0000 (7c)  |
|                                                      |                              |        |        |        |                 |        |                      |        |        |        |                             |              |
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(7a)+(7b)+(7c) = |        |        |        |                 |        |                      |        |        |        | 0.0000 / (5) =              | 0.0000 (8)   |
| Pressure test                                        |                              |        |        |        |                 |        |                      |        |        |        | Yes                         |              |
| Measured/design AP50                                 |                              |        |        |        |                 |        |                      |        |        |        | 10.0000                     |              |
| Infiltration rate                                    |                              |        |        |        |                 |        |                      |        |        |        | 0.5000                      | (18)         |
| Number of sides sheltered                            |                              |        |        |        |                 |        |                      |        |        |        | 2                           | (19)         |
|                                                      |                              |        |        |        |                 |        |                      |        |        |        |                             |              |
| Shelter factor                                       |                              |        |        |        |                 |        |                      |        |        |        | (20) = 1 - [0.075 x (19)] = | 0.8500 (20)  |
| Infiltration rate adjusted to include shelter factor |                              |        |        |        |                 |        |                      |        |        |        | (21) = (18) x (20) =        | 0.4250 (21)  |
|                                                      |                              |        |        |        |                 |        |                      |        |        |        |                             |              |
| Wind speed                                           | Jan                          | Feb    | Mar    | Apr    | May             | Jun    | Jul                  | Aug    | Sep    | Oct    | Nov                         | Dec          |
| Wind factor                                          | 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)  |
| Adj infilt rate                                      | 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) |
|                                                      | 0.5419                       | 0.5313 | 0.5206 | 0.4675 | 0.4569          | 0.4038 | 0.4038               | 0.3931 | 0.4250 | 0.4569 | 0.4781                      | 0.4994 (22b) |
| Mechanical extract ventilation - decentralised       |                              |        |        |        |                 |        |                      |        |        |        |                             |              |
| If mechanical ventilation:                           | 0.5000 (23a)                 |        |        |        |                 |        |                      |        |        |        |                             |              |
| Effective ac                                         | 0.7919                       | 0.7813 | 0.7706 | 0.7175 | 0.7069          | 0.6538 | 0.6538               | 0.6431 | 0.6750 | 0.7069 | 0.7281                      | 0.7494 (25)  |

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

| Element                                                             | Gross<br>m2    | Openings<br>m2 | NetArea<br>m2  | U-value<br>W/m2K       | A x U<br>W/K   | K-value<br>kJ/m2K | A x K<br>kJ/K  |                |                |                |                |                     |
|---------------------------------------------------------------------|----------------|----------------|----------------|------------------------|----------------|-------------------|----------------|----------------|----------------|----------------|----------------|---------------------|
| Opening Type 1 (Uw = 1.40)                                          |                |                | 13.3100        | 1.3258                 | 17.6458        |                   | (27)           |                |                |                |                |                     |
| Opening Type 2                                                      |                |                | 2.1400         | 2.8500                 | 6.0990         |                   | (26a)          |                |                |                |                |                     |
| existing (Uw = 2.70)                                                |                |                | 9.7100         | 2.4368                 | 23.6616        |                   | (27)           |                |                |                |                |                     |
| new door                                                            |                |                | 4.6200         | 1.8000                 | 8.3160         |                   | (26a)          |                |                |                |                |                     |
| Opening Type 3 (Uw = 3.00)                                          |                |                | 2.0200         | 2.6786                 | 5.4107         |                   | (27a)          |                |                |                |                |                     |
| Heat Loss Floor 1                                                   |                |                | 27.6800        | 0.2200                 | 6.0896         |                   | (28a)          |                |                |                |                |                     |
| Heat Loss Floor 2                                                   |                |                | 1.3200         | 0.2100                 | 0.2772         |                   | (28b)          |                |                |                |                |                     |
| External Wall 1                                                     | 111.0000       | 29.7800        | 81.2200        | 0.3400                 | 27.6148        |                   | (29a)          |                |                |                |                |                     |
| refuge wall                                                         | 5.9000         |                | 5.9000         | 0.3000                 | 1.7700         |                   | (29a)          |                |                |                |                |                     |
| Party wall commercial                                               | 25.6000        |                | 25.6000        | 0.1800                 | 4.6080         |                   | (29a)          |                |                |                |                |                     |
| Pitched                                                             | 39.2000        | 2.0200         | 37.1800        | 0.1651                 | 6.1398         |                   | (30)           |                |                |                |                |                     |
| External Roof 3                                                     | 3.7000         |                | 3.7000         | 0.1800                 | 0.6660         |                   | (30)           |                |                |                |                |                     |
| Total net area of external elements Aum(A, m2)                      |                |                | 214.4000       |                        |                |                   | (31)           |                |                |                |                |                     |
| Fabric heat loss, W/K = Sum (A x U)                                 |                |                |                | (26) ... (30) + (32) = | 108.2985       |                   | (33)           |                |                |                |                |                     |
| Party Wall 1                                                        |                |                | 70.2000        | 0.0000                 | 0.0000         |                   | (32)           |                |                |                |                |                     |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                   |                |                |                |                        |                |                   | 100.0000 (35)  |                |                |                |                |                     |
| Thermal bridges (Default value 0.150 * total exposed area)          |                |                |                |                        |                |                   | 32.1600 (36)   |                |                |                |                |                     |
| Total fabric heat loss                                              |                |                |                |                        |                | (33) + (36) =     | 140.4585 (37)  |                |                |                |                |                     |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |                |                |                |                        |                |                   |                |                |                |                |                |                     |
| (38)m                                                               | Jan<br>82.9857 | Feb<br>81.8723 | Mar<br>80.7588 | Apr<br>75.1915         | May<br>74.0780 | Jun<br>68.5107    | Jul<br>68.5107 | Aug<br>67.3973 | Sep<br>70.7376 | Oct<br>74.0780 | Nov<br>76.3050 | Dec<br>78.5319 (38) |
| Heat transfer coeff                                                 | 223.4443       | 222.3308       | 221.2173       | 215.6500               | 214.5366       | 208.9692          | 208.9692       | 207.8558       | 211.1962       | 214.5366       | 216.7635       | 218.9904 (39)       |
| Average = Sum(39)m / 12 =                                           |                |                |                |                        |                |                   |                |                |                |                |                | 215.3717 (39)       |
| HLP                                                                 | Jan<br>1.9499  | Feb<br>1.9402  | Mar<br>1.9305  | Apr<br>1.8819          | May<br>1.8722  | Jun<br>1.8236     | Jul<br>1.8236  | Aug<br>1.8139  | Sep<br>1.8431  | Oct<br>1.8722  | Nov<br>1.8916  | Dec<br>1.9111 (40)  |
| HLP (average)                                                       |                |                |                |                        |                |                   |                |                |                |                |                | 1.8795 (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 | 2.8397 (42) |
|-------------------|-------------|

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

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |                                    |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------------------|
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |          | 101.6440 (43)                      |
|                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                                |
| Daily hot water use                                             | 111.8084 | 107.7427 | 103.6769 | 99.6111  | 95.5454  | 91.4796  | 91.4796  | 95.5454  | 99.6111  | 103.6769 | 107.7427 | 111.8084 (44)                      |
| Energy conte                                                    | 165.8087 | 145.0173 | 149.6449 | 130.4640 | 125.1833 | 108.0237 | 100.0998 | 114.8660 | 116.2379 | 135.4641 | 147.8696 | 160.5768 (45)                      |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          |          |          | Total = Sum (45)m = 1599.2562 (45) |
| Distribution loss (46)m = 0.15 x (45)m                          | 24.8713  | 21.7526  | 22.4467  | 19.5696  | 18.7775  | 16.2036  | 15.0150  | 17.2299  | 17.4357  | 20.3196  | 22.1804  | 24.0865 (46)                       |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |          |          |                                    |
| 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)                        |
| Volume factor from Table 2a                                     |          |          |          |          |          |          |          |          |          |          |          | 0.9283 (52)                        |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (53)                        |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          | 0.8683 (55)                        |
| Total storage loss                                              | 26.9176  | 24.3126  | 26.9176  | 26.0493  | 26.9176  | 26.0493  | 26.9176  | 26.9176  | 26.0493  | 26.9176  | 26.0493  | 26.9176 (56)                       |
| If cylinder contains dedicated solar storage                    | 26.9176  | 24.3126  | 26.9176  | 26.0493  | 26.9176  | 26.0493  | 26.9176  | 26.9176  | 26.0493  | 26.9176  | 26.0493  | 26.9176 (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 | 215.9886 | 190.3412 | 199.8248 | 179.0253 | 175.3633 | 156.5850 | 150.2798 | 165.0460 | 164.7992 | 185.6440 | 196.4309 | 210.7568 (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                                                 | 215.9886 | 190.3412 | 199.8248 | 179.0253 | 175.3633 | 156.5850 | 150.2798 | 165.0460 | 164.7992 | 185.6440 | 196.4309 | 210.7568 (64)                      |
| Heat gains from water heating, kWh/month                        | 95.2754  | 84.4773  | 89.9009  | 82.2283  | 81.7674  | 74.7669  | 73.4272  | 78.3369  | 77.4981  | 85.1858  | 88.0157  | 93.5358 (65)                       |
| Total per year (kWh/year) = Sum (64)m = 2190.0848 (64)          |          |          |          |          |          |          |          |          |          |          |          |                                    |

#### 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                                                                               | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 24.7852   | 22.0140   | 17.9030   | 13.5537   | 10.1316   | 8.5535    | 9.2424    | 12.0136   | 16.1246   | 20.4739   | 23.8960   | 25.4741 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 277.9927  | 280.8774  | 273.6080  | 258.1325  | 238.5974  | 220.2371  | 207.9713  | 205.0866  | 212.3560  | 227.8315  | 247.3666  | 265.7269 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987 (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)                                 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 (71) |
| Water heating gains (Table 5)                                                       | 128.0583  | 125.7103  | 120.8345  | 114.2060  | 109.9025  | 103.8429  | 98.6924   | 105.2916  | 107.6363  | 114.4970  | 122.2440  | 125.7201 (72)  |
| Total internal gains                                                                | 499.4324  | 497.1979  | 480.9418  | 454.4884  | 427.2276  | 401.2297  | 384.5024  | 390.9880  | 404.7130  | 431.3986  | 462.1028  | 485.5173 (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   |
|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| Northeast | 8.0500     | 11.2829                        | 0.6300                            | 0.7000                             | 0.7700                       | 27.7581 (75) |
| Southeast | 4.3200     | 36.7938                        | 0.6300                            | 0.7000                             | 0.7700                       | 48.5770 (77) |
| Northwest | 0.9400     | 11.2829                        | 0.6300                            | 0.7000                             | 0.7700                       | 3.2413 (81)  |
| Northeast | 0.5600     | 16.3666                        | 0.7600                            | 0.7000                             | 1.0000                       | 4.3883 (82)  |
| Southeast | 0.9000     | 39.9751                        | 0.7600                            | 0.7000                             | 1.0000                       | 17.2261 (82) |
| Southwest | 0.5600     | 26.0000                        | 0.7600                            | 0.7000                             | 1.0000                       | 6.9713 (82)  |
| Northeast | 5.3400     | 11.2829                        | 0.7600                            | 0.7000                             | 0.7700                       | 22.2131 (75) |
| Southeast | 4.3700     | 36.7938                        | 0.7600                            | 0.7000                             | 0.7700                       | 59.2791 (77) |

|             |          |          |           |           |           |           |           |           |           |          |          |               |
|-------------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|---------------|
| Solar gains | 189.6543 | 347.2104 | 537.2321  | 766.5742  | 948.3670  | 980.3489  | 929.0442  | 787.8998  | 616.0041  | 400.6962 | 231.6104 | 159.3999 (83) |
| Total gains | 689.0867 | 844.4083 | 1018.1739 | 1221.0626 | 1375.5946 | 1381.5786 | 1313.5466 | 1178.8878 | 1020.7172 | 832.0949 | 693.7132 | 644.9172 (84) |

#### 7. Mean internal temperature (heating season)

|                                                                             |                           |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Thl (C) |                           |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 14.2454                   | 14.3168 | 14.3888 | 14.7603 | 14.8369 | 15.2322 | 15.2322 | 15.3138 | 15.0716 | 14.8369 | 14.6845 | 14.5351      |
| alpha                                                                       | 1.9497                    | 1.9545  | 1.9593  | 1.9840  | 1.9891  | 2.0155  | 2.0155  | 2.0209  | 2.0048  | 1.9891  | 1.9790  | 1.9690       |
| util living area                                                            | 0.9695                    | 0.9539  | 0.9254  | 0.8684  | 0.7791  | 0.6575  | 0.5447  | 0.5970  | 0.7767  | 0.9070  | 0.9574  | 0.9731 (86)  |
| MIT                                                                         | 17.2676                   | 17.6108 | 18.2244 | 19.0754 | 19.8494 | 20.4578 | 20.7422 | 20.6802 | 20.1650 | 19.1603 | 18.0897 | 17.2403 (87) |
| Th 2                                                                        | 19.3669                   | 19.3735 | 19.3801 | 19.4132 | 19.4199 | 19.4535 | 19.4535 | 19.4603 | 19.4400 | 19.4199 | 19.4065 | 19.3933 (88) |
| util rest of house                                                          | 0.9636                    | 0.9450  | 0.9101  | 0.8395  | 0.7250  | 0.5614  | 0.3984  | 0.4551  | 0.6999  | 0.8804  | 0.9476  | 0.9679 (89)  |
| MIT 2                                                                       | 14.6101                   | 15.1009 | 15.9751 | 17.1789 | 18.2310 | 19.0162 | 19.3197 | 19.2771 | 18.6870 | 17.3275 | 15.8017 | 14.5763 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         | 0.2083 (91)  |
| MIT                                                                         | 15.1637                   | 15.6238 | 16.4436 | 17.5740 | 18.5681 | 19.3165 | 19.6160 | 19.5694 | 18.9949 | 17.7093 | 16.2783 | 15.1313 (92) |
| Temperature adjustment                                                      |                           |         |         |         |         |         |         |         |         |         |         | -0.1500      |
| adjusted MIT                                                                | 15.0137                   | 15.4738 | 16.2936 | 17.4240 | 18.4181 | 19.1665 | 19.4660 | 19.4194 | 18.8449 | 17.5593 | 16.1283 | 14.9813 (93) |

#### 8. Space heating requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

|                      | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep       | Oct       | Nov          | Dec       |       |
|----------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------|-----------|--------------|-----------|-------|
| Utilisation          | 0.9355    | 0.9090    | 0.8648    | 0.7885    | 0.6808    | 0.5400   | 0.3997   | 0.4506   | 0.6610    | 0.8324    | 0.9131       | 0.9423    | (94)  |
| Useful gains         | 644.6691  | 767.5306  | 880.5227  | 962.7829  | 936.5711  | 746.0396 | 525.0715 | 531.1485 | 674.7321  | 692.6614  | 633.4607     | 607.7172  | (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     |           |           |           |           |           |          |          |          |           |           |              |           |       |
|                      | 2393.9100 | 2350.8702 | 2166.5194 | 1838.1968 | 1441.2747 | 954.2667 | 598.9029 | 627.5981 | 1002.1021 | 1493.0204 | 1957.0107    | 2360.9964 | (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    |           |           |           |           |           |          |          |          |           |           |              |           |       |
|                      | 1301.4352 | 1064.0043 | 956.7816  | 630.2980  | 375.4995  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 595.4671  | 952.9561     | 1304.4397 | (98)  |
| Space heating        |           |           |           |           |           |          |          |          |           |           |              |           |       |
| Space heating per m2 |           |           |           |           |           |          |          |          |           |           |              |           |       |
|                      |           |           |           |           |           |          |          |          |           |           | (98) / (4) = | 62.6659   | (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 %)                      | 89.9000   | (206) |
| Efficiency of secondary/supplementary heating system, %               | 0.0000    | (208) |
| Space heating requirement                                             | 7987.6323 | (211) |

|                                                  | Jan       | Feb       | Mar       | Apr      | May      | Jun    | Jul    | Aug    | Sep    | Oct      | Nov       | Dec       |       |
|--------------------------------------------------|-----------|-----------|-----------|----------|----------|--------|--------|--------|--------|----------|-----------|-----------|-------|
| Space heating requirement                        | 1301.4352 | 1064.0043 | 956.7816  | 630.2980 | 375.4995 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 595.4671 | 952.9561  | 1304.4397 | (98)  |
| Space heating efficiency (main heating system 1) | 89.9000   | 89.9000   | 89.9000   | 89.9000  | 89.9000  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 89.9000  | 89.9000   | 89.9000   | (210) |
| Space heating fuel (main heating system)         | 1447.6476 | 1183.5420 | 1064.2732 | 701.1102 | 417.6857 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 662.3661 | 1060.0179 | 1450.9896 | (211) |
| Water heating requirement                        | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000   | 0.0000    | 0.0000    | (215) |

|                                   |          |          |          |          |          |          |          |          |          |          |          |           |       |
|-----------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| Water heating                     |          |          |          |          |          |          |          |          |          |          |          |           |       |
| Water heating requirement         | 215.9886 | 190.3412 | 199.8248 | 179.0253 | 175.3633 | 156.5850 | 150.2798 | 165.0460 | 164.7992 | 185.6440 | 196.4309 | 210.7568  | (64)  |
| Efficiency of water heater        | 88.3091  | 88.2059  | 87.9763  | 87.4516  | 86.4181  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 87.2747  | 87.9966  | 79.8000   | (216) |
| Fuel for water heating, kWh/month | 244.5826 | 215.7918 | 227.1350 | 204.7135 | 202.9243 | 196.2218 | 188.3206 | 206.8246 | 206.5152 | 212.7123 | 223.2255 | 238.5619  | (219) |
| Water heating fuel used           |          |          |          |          |          |          |          |          |          |          |          | 2567.5289 | (219) |
| Annual totals kWh/year            |          |          |          |          |          |          |          |          |          |          |          |           |       |
| Space heating fuel - main system  |          |          |          |          |          |          |          |          |          |          |          | 7987.6323 | (211) |
| Space heating fuel - secondary    |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215) |

#### Electricity for pumps and fans:

|                                                                                          |  |                  |
|------------------------------------------------------------------------------------------|--|------------------|
| (MEV)Decentralised, Database: total watage = 6.9920, total flow = 32.0000, SFP = 0.2185) |  |                  |
| mechanical ventilation fans (SFP = 0.2185)                                               |  | 84.6534 (230a)   |
| central heating pump                                                                     |  | 30.0000 (230c)   |
| main heating flue fan                                                                    |  | 45.0000 (230e)   |
| Total electricity for the above, kWh/year                                                |  | 159.6534 (231)   |
| Electricity for lighting (calculated in Appendix L)                                      |  | 437.7147 (232)   |
| Total delivered energy for all uses                                                      |  | 11152.5293 (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               | 7987.6323       | 0.2160                     | 1725.3286             | (261) |
| Space heating - secondary                   | 0.0000          | 0.0000                     | 0.0000                | (263) |
| Water heating (other fuel)                  | 2567.5289       | 0.2160                     | 554.5862              | (264) |
| Space and water heating                     |                 |                            | 2279.9148             | (265) |
| Pumps and fans                              | 159.6534        | 0.5190                     | 82.8601               | (267) |
| Energy for lighting                         | 437.7147        | 0.5190                     | 227.1740              | (268) |
| Total CO2, kg/year                          |                 |                            | 2589.9489             | (272) |
| Dwelling Carbon Dioxide Emission Rate (DER) |                 |                            | 22.6000               | (273) |

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

|                                                                                 |     |          |     |
|---------------------------------------------------------------------------------|-----|----------|-----|
| DER                                                                             |     | 22.6000  | ZC1 |
| Total Floor Area                                                                | TFA | 114.5900 |     |
| Assumed number of occupants                                                     | N   | 2.8397   |     |
| CO2 emission factor in Table 12 for electricity displaced from grid             | EF  | 0.5190   |     |
| CO2 emissions from appliances, equation (L14)                                   |     | 14.3758  | ZC2 |
| CO2 emissions from cooking, equation (L16)                                      |     | 1.6332   | ZC3 |
| Total CO2 emissions                                                             |     | 38.6091  | 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                                                               |     | 38.6091  | 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<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 29.0000 (1b)              | x 2.4600 (2b)                   | = 71.3400 (1b) - (3b)       |
| First floor                                            | 31.5600 (1c)              | x 3.2000 (2c)                   | = 100.9920 (1c) - (3c)      |
| Second floor                                           | 28.3300 (1d)              | x 3.0400 (2d)                   | = 86.1232 (1d) - (3d)       |
| Third floor                                            | 25.7000 (1e)              | x 2.3000 (2e)                   | = 59.1100 (1e) - (3e)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 114.5900                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 317.5652 (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                                               |                 |                      |                             |       | 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) = 0.1260 (8) |
| Pressure test                                                             |                 |                      |                             |       | Yes                        |
| Measured/design AP50                                                      |                 |                      |                             |       | 5.0000                     |
| Infiltration rate                                                         |                 |                      |                             |       | 0.3760 (18)                |
| Number of sides sheltered                                                 |                 |                      |                             |       | 2 (19)                     |
| Shelter factor                                                            |                 |                      | (20) = 1 - [0.075 x (19)] = |       | 0.8500 (20)                |
| Infiltration rate adjusted to include shelter factor                      |                 |                      | (21) = (18) x (20) =        |       | 0.3196 (21)                |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate | 0.4074 | 0.3995 | 0.3915 | 0.3515 | 0.3435 | 0.3036 | 0.3036 | 0.2956 | 0.3196 | 0.3435 | 0.3595 | 0.3755 (22b) |
| Effective ac    | 0.5830 | 0.5798 | 0.5766 | 0.5618 | 0.5590 | 0.5461 | 0.5461 | 0.5437 | 0.5511 | 0.5590 | 0.5646 | 0.5705 (25)  |

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

| Element                                                         | Gross<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 Semi-glazed door                                            |                         |                            | 6.7600                    | 1.2000                        | 8.1120       |                                | (26a)         |
| TER Opening Type (Uw = 1.40)                                    |                         |                            | 20.1200                   | 1.3258                        | 26.6742      |                                | (27)          |
| TER Room Window (Uw = 1.70)                                     |                         |                            | 1.7700                    | 1.5918                        | 2.8174       |                                | (27a)         |
| Heat Loss Floor 1                                               |                         |                            | 27.6800                   | 0.1300                        | 3.5984       |                                | (28a)         |
| Heat Loss Floor 2                                               |                         |                            | 1.3200                    | 0.1300                        | 0.1716       |                                | (28b)         |
| External Wall 1                                                 | 111.0000                | 26.8800                    | 84.1200                   | 0.1800                        | 15.1416      |                                | (29a)         |
| refuge wall                                                     | 5.9000                  |                            | 5.9000                    | 0.1800                        | 1.0620       |                                | (29a)         |
| Party wall commercial                                           | 25.6000                 |                            | 25.6000                   | 0.1800                        | 4.6080       |                                | (29a)         |
| Pitched                                                         | 39.2000                 | 1.7700                     | 37.4300                   | 0.1300                        | 4.8659       |                                | (30)          |
| External Roof 3                                                 | 3.7000                  |                            | 3.7000                    | 0.1300                        | 0.4810       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )     |                         |                            | 214.4000                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                             |                         |                            |                           | (26)...(30) + (32) =          | 67.5322      |                                | (33)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K  |                         |                            |                           |                               |              |                                | 250.0000 (35) |
| Thermal bridges (User defined value 0.050 * total exposed area) |                         |                            |                           |                               |              |                                | 10.7200 (36)  |
| Total fabric heat loss                                          |                         |                            |                           |                               |              | (33) + (36) =                  | 78.2522 (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                     | 61.0970  | 60.7592  | 60.4281  | 58.8730  | 58.5820  | 57.2275  | 57.2275  | 56.9767  | 57.7492  | 58.5820  | 59.1706  | 59.7860 (38)  |
| Heat transfer coeff       | 139.3491 | 139.0113 | 138.6802 | 137.1251 | 136.8342 | 135.4797 | 135.4797 | 135.2289 | 136.0014 | 136.8342 | 137.4228 | 138.0381 (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 137.1237 (39) |
|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| HLP                       | 1.2161   | 1.2131   | 1.2102   | 1.1967   | 1.1941   | 1.1823   | 1.1823   | 1.1801   | 1.1869   | 1.1941   | 1.1993   | 1.2046 (40)   |
| HLP (average)             |          |          |          |          |          |          |          |          |          |          |          | 1.1966 (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                        |          |          |          |          |          |          |          |          |          |          |          | 2.8397 (42)   |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Average daily hot water use (litres/day) |          |          |          |          |          |          |          |          |          |          |          | 101.6440 (43) |
|                                          | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| Daily hot water use                      | 111.8084 | 107.7427 | 103.6769 | 99.6111  | 95.5454  | 91.4796  | 91.4796  | 95.5454  | 99.6111  | 103.6769 | 107.7427 | 111.8084 (44) |
| Energy conte                             | 165.8087 | 145.0173 | 149.6449 | 130.4640 | 125.1833 | 108.0237 | 100.0998 | 114.8660 | 116.2379 | 135.4641 | 147.8696 | 160.5768 (45) |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |                                   |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------------------|
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 1599.2562 (45) |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |          |                                   |
|                                                                 | 24.8713  | 21.7526  | 22.4467  | 19.5696  | 18.7775  | 16.2036  | 15.0150  | 17.2299  | 17.4357  | 20.3196  | 22.1804  | 24.0865 (46)                      |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |          |          |                                   |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |          | 150.0000 (47)                     |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |          |          | 1.3938 (48)                       |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)                       |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          | 0.7527 (55)                       |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |          |          |                                   |
|                                                                 | 23.3325  | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325 (56)                      |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |          |                                   |
|                                                                 | 23.3325  | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325 (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 |          |          |          |          |          |          |          |          |          |          |          |                                   |
|                                                                 | 212.4036 | 187.1030 | 196.2398 | 175.5559 | 171.7782 | 153.1155 | 146.6947 | 161.4609 | 161.3297 | 182.0590 | 192.9615 | 207.1717 (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                                                 |          |          |          |          |          |          |          |          |          |          |          |                                   |
|                                                                 | 212.4036 | 187.1030 | 196.2398 | 175.5559 | 171.7782 | 153.1155 | 146.6947 | 161.4609 | 161.3297 | 182.0590 | 192.9615 | 207.1717 (64)                     |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |          |          |                                   |
|                                                                 | 92.4073  | 81.8868  | 87.0328  | 79.4528  | 78.8994  | 71.9914  | 70.5591  | 75.4689  | 74.7226  | 82.3177  | 85.2401  | 90.6677 (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                                                                               | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874  | 141.9874 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 25.0414   | 22.2415   | 18.0880   | 13.6938   | 10.2363   | 8.6419    | 9.3379    | 12.1377   | 16.2912   | 20.6855   | 24.1430   | 25.7374 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 277.9927  | 280.8774  | 273.6080  | 258.1325  | 238.5974  | 220.2371  | 207.9713  | 205.0866  | 212.3560  | 227.8315  | 247.3666  | 265.7269 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987   | 37.1987 (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)                                 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 | -113.5899 (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 124.2034  | 121.8554  | 116.9796  | 110.3511  | 106.0476  | 99.9880   | 94.8375   | 101.4367  | 103.7814  | 110.6421  | 118.3891  | 121.8652 (72)  |
| Total internal gains                                                                | 495.8336  | 493.5705  | 477.2719  | 450.7736  | 423.4774  | 397.4632  | 380.7430  | 387.2573  | 401.0248  | 427.7553  | 458.4949  | 481.9257 (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   |          |               |  |
|-------------|----------|----------|----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|---------------|--|
| Northeast   |          |          |          |           | 11.7000    | 11.2829                        | 0.6300                            | 0.7000                             | 0.7700                       | 40.3441 (75) |          |               |  |
| Southeast   |          |          |          |           | 7.6000     | 36.7938                        | 0.6300                            | 0.7000                             | 0.7700                       | 85.4595 (77) |          |               |  |
| Northwest   |          |          |          |           | 0.8200     | 11.2829                        | 0.6300                            | 0.7000                             | 0.7700                       | 2.8275 (81)  |          |               |  |
| Northeast   |          |          |          |           | 0.4900     | 16.3666                        | 0.6300                            | 0.7000                             | 1.0000                       | 3.1830 (82)  |          |               |  |
| Southeast   |          |          |          |           | 0.7900     | 39.9751                        | 0.6300                            | 0.7000                             | 1.0000                       | 12.5342 (82) |          |               |  |
| Southwest   |          |          |          |           | 0.4900     | 26.0000                        | 0.6300                            | 0.7000                             | 1.0000                       | 5.0565 (82)  |          |               |  |
|             |          |          |          |           |            |                                |                                   |                                    |                              |              |          |               |  |
| Solar gains | 149.4049 | 273.5400 | 423.4064 | 604.6000  | 748.4792   | 773.9584                       | 733.3566                          | 621.5981                           | 485.6178                     | 315.7094     | 182.4568 | 125.5728 (83) |  |
| Total gains | 645.2385 | 767.1105 | 900.6783 | 1055.3736 | 1171.9566  | 1171.4216                      | 1114.0996                         | 1008.8554                          | 886.6425                     | 743.4648     | 640.9517 | 607.4985 (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                                                                         | 57.1058                   | 57.2445 | 57.3812 | 58.0320 | 58.1554 | 58.7368 | 58.7368 | 58.8457 | 58.5114 | 58.1554 | 57.9063 | 57.6481      |
| alpha                                                                       | 4.8071                    | 4.8163  | 4.8254  | 4.8688  | 4.8770  | 4.9158  | 4.9158  | 4.9230  | 4.9008  | 4.8770  | 4.8604  | 4.8432       |
| util living area                                                            | 0.9985                    | 0.9962  | 0.9884  | 0.9568  | 0.8621  | 0.6875  | 0.5233  | 0.5934  | 0.8532  | 0.9794  | 0.9967  | 0.9989 (86)  |
| MIT                                                                         | 19.6371                   | 19.8058 | 20.0915 | 20.4722 | 20.7868 | 20.9497 | 20.9893 | 20.9809 | 20.8519 | 20.4350 | 19.9673 | 19.6105 (87) |
| Th 2                                                                        | 19.9072                   | 19.9095 | 19.9118 | 19.9227 | 19.9247 | 19.9342 | 19.9342 | 19.9359 | 19.9305 | 19.9247 | 19.9206 | 19.9163 (88) |
| util rest of house                                                          | 0.9980                    | 0.9949  | 0.9842  | 0.9402  | 0.8126  | 0.5936  | 0.4026  | 0.4676  | 0.7811  | 0.9687  | 0.9953  | 0.9985 (89)  |
| MIT 2                                                                       | 18.0913                   | 18.3391 | 18.7559 | 19.3047 | 19.7186 | 19.9016 | 19.9304 | 19.9282 | 19.8108 | 19.2629 | 18.5835 | 18.0587 (90) |
| Living area fraction                                                        |                           |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         | 0.2083 (91)  |
| MIT                                                                         | 18.4133                   | 18.6446 | 19.0341 | 19.5479 | 19.9411 | 20.1199 | 20.1510 | 20.1475 | 20.0276 | 19.5071 | 18.8717 | 18.3820 (92) |
| Temperature adjustment                                                      |                           |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.4133                   | 18.6446 | 19.0341 | 19.5479 | 19.9411 | 20.1199 | 20.1510 | 20.1475 | 20.0276 | 19.5071 | 18.8717 | 18.3820 (93) |

#### 8. Space heating requirement

|                   |           |           |           |           |           |          |          |          |          |           |           |                |
|-------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|-----------|----------------|
| Utilisation       | 0.9968    | 0.9926    | 0.9794    | 0.9330    | 0.8135    | 0.6111   | 0.4278   | 0.4937   | 0.7887   | 0.9630    | 0.9933    | 0.9976 (94)    |
| Useful gains      | 643.1919  | 761.4185  | 882.0932  | 984.6149  | 953.3554  | 715.8031 | 476.6475 | 498.1219 | 699.3277 | 715.9335  | 636.6328  | 606.0485 (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  | 1966.6772 | 1910.6546 | 1738.2343 | 1460.0944 | 1127.6661 | 747.8339 | 481.0829 | 506.7739 | 806.1677 | 1218.7945 | 1617.7044 | 1957.6522 (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 |           |           |           |           |           |          |          |          |          |           |           |                |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

|                      |          |          |          |          |          |        |        |        |        |          |              |                |
|----------------------|----------|----------|----------|----------|----------|--------|--------|--------|--------|----------|--------------|----------------|
| Space heating        | 984.6731 | 772.2867 | 636.9689 | 342.3452 | 129.6871 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 374.1286 | 706.3716     | 1005.5932 (98) |
| Space heating per m2 |          |          |          |          |          |        |        |        |        |          |              | 4952.0545 (98) |
|                      |          |          |          |          |          |        |        |        |        |          | (98) / (4) = | 43.2154 (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 %)                      |           |          |          |          |          |          |          |          |          |          |          | 93.5000 (206)   |
| Efficiency of secondary/supplementary heating system, %               |           |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
| Space heating requirement                                             |           |          |          |          |          |          |          |          |          |          |          | 5296.3149 (211) |
|                                                                       | Jan       | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                             | 984.6731  | 772.2867 | 636.9689 | 342.3452 | 129.6871 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 374.1286 | 706.3716 | 1005.5932 (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)                              | 1053.1263 | 825.9751 | 681.2502 | 366.1446 | 138.7028 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 400.1375 | 755.4777 | 1075.5007 (211) |
| Water heating requirement                                             | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                         |           |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                             | 212.4036  | 187.1030 | 196.2398 | 175.5559 | 171.7782 | 153.1155 | 146.6947 | 161.4609 | 161.3297 | 182.0590 | 192.9615 | 207.1717 (64)   |
| Efficiency of water heater (217)m                                     | 88.3969   | 88.1938  | 87.7295  | 86.5655  | 84.0763  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 86.6949  | 87.9692  | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                     | 240.2839  | 212.1500 | 223.6874 | 202.8013 | 204.3123 | 191.8741 | 183.8280 | 202.3320 | 202.1676 | 209.9996 | 219.3512 | 234.1625 (219)  |
| Water heating fuel used                                               |           |          |          |          |          |          |          |          |          |          |          | 2526.9498 (219) |
| Annual totals kWh/year                                                |           |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system                                      |           |          |          |          |          |          |          |          |          |          |          | 5296.3149 (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)                   |           |          |          |          |          |          |          |          |          |          |          | 442.2386 (232)  |
| Total delivered energy for all uses                                   |           |          |          |          |          |          |          |          |          |          |          | 8340.5034 (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                                                                     | 5296.3149          | 0.2160                        | 1144.0040 (261)          |
| Space heating - secondary                                                                         | 0.0000             | 0.0000                        | 0.0000 (263)             |
| Water heating (other fuel)                                                                        | 2526.9498          | 0.2160                        | 545.8212 (264)           |
| Space and water heating                                                                           |                    |                               | 1689.8252 (265)          |
| Pumps and fans                                                                                    | 75.0000            | 0.5190                        | 38.9250 (267)            |
| Energy for lighting                                                                               | 442.2386           | 0.5190                        | 229.5218 (268)           |
| Total CO2, kg/m2/year                                                                             |                    |                               | 1958.2720 (272)          |
| Emissions per m2 for space and water heating                                                      |                    |                               | 14.7467 (272a)           |
| Fuel factor (mains gas)                                                                           |                    |                               | 1.0000                   |
| Emissions per m2 for lighting                                                                     |                    |                               | 2.0030 (272b)            |
| Emissions per m2 for pumps and fans                                                               |                    |                               | 0.3397 (272c)            |
| Target Carbon Dioxide Emission Rate (TER) = (14.7467 * 1.00) + 2.0030 + 0.3397, rounded to 2 d.p. |                    |                               | 17.0900 (273)            |