

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Built)



|                                          |                                                                        |                       |                       |                    |           |
|------------------------------------------|------------------------------------------------------------------------|-----------------------|-----------------------|--------------------|-----------|
| <b>Property Reference</b>                | 285 West End Road                                                      |                       | <b>Issued on Date</b> | 26/10/2022         |           |
| <b>Assessment Reference</b>              | AB                                                                     | <b>Prop Type Ref</b>  |                       |                    |           |
| <b>Property</b>                          | 285 West End Road, West End, SOUTHAMPTON, SO18 3BW                     |                       |                       |                    |           |
| <b>SAP Rating</b>                        | 85 B                                                                   | <b>DER</b>            | 16.30                 | <b>TER</b>         | 16.89     |
| <b>Environmental</b>                     | 87 B                                                                   | <b>% DER&lt;TER</b>   | 3.49                  |                    |           |
| <b>CO<sub>2</sub> Emissions (t/year)</b> | 1.25                                                                   | <b>DFEE</b>           | 42.24                 | <b>TFEE</b>        | 50.36     |
| <b>General Requirements Compliance</b>   | Pass                                                                   | <b>% DFEE&lt;TFEE</b> | 16.14                 |                    |           |
| <b>Assessor Details</b>                  | Mr. Thomas McMahon, SAeasy Ltd, Tel: 0114 321 2037, info@sapeasy.co.uk |                       |                       | <b>Assessor ID</b> | r863-0001 |
| <b>Client</b>                            |                                                                        |                       |                       |                    |           |

### SUMMARY FOR INPUT DATA FOR New Build (As Built)

#### Criterion 1 – Achieving the TER and TFEE rate

##### 1a TER and DER

|                                             |                  |                                   |      |
|---------------------------------------------|------------------|-----------------------------------|------|
| Fuel for main heating                       | Mains gas        |                                   |      |
| Fuel factor                                 | 1.00 (mains gas) |                                   |      |
| Target Carbon Dioxide Emission Rate (TER)   | 16.89            | kgCO <sub>2</sub> /m <sup>2</sup> |      |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.30            | kgCO <sub>2</sub> /m <sup>2</sup> | Pass |
|                                             | -0.59 (-3.5%)    | kgCO <sub>2</sub> /m <sup>2</sup> |      |

##### 1b TFEE and DFEE

|                                          |               |                        |      |
|------------------------------------------|---------------|------------------------|------|
| Target Fabric Energy Efficiency (TFEE)   | 50.36         | kWh/m <sup>2</sup> /yr |      |
| Dwelling Fabric Energy Efficiency (DFEE) | 42.24         | kWh/m <sup>2</sup> /yr |      |
|                                          | -8.2 (-16.3%) | kWh/m <sup>2</sup> /yr | Pass |

#### Criterion 2 – Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

| Element       | Average          | Highest          |      |
|---------------|------------------|------------------|------|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | Pass |
| Party wall    | 0.00 (max. 0.20) | -                | Pass |
| Floor         | 0.16 (max. 0.25) | 0.16 (max. 0.70) | Pass |
| Roof          | 0.11 (max. 0.20) | 0.13 (max. 0.35) | Pass |
| Openings      | 1.40 (max. 2.00) | 1.40 (max. 3.30) | Pass |

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

|                                |                                  |      |
|--------------------------------|----------------------------------|------|
| Air permeability at 50 pascals | 4.69 (measured in this dwelling) |      |
| Maximum                        | 10.0                             | Pass |

##### Limiting System Efficiencies

##### 4 Heating efficiency

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Built)



Main heating system

Boiler system with radiators or underfloor - Mains gas  
Data from database  
Worcester Greenstar 36CDi Compact ErP  
Combi boiler  
Efficiency: 89.8% SEDBUK2009  
Minimum: 88.0%

Pass

Secondary heating system

None

### 5 Cylinder insulation

Hot water storage

No cylinder

### 6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

### 7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

### 8 Mechanical ventilation

Not applicable

## Criterion 3 – Limiting the effects of heat gains in summer

### 9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

8.75 m<sup>2</sup>, No overhang

Windows facing South

9.71 m<sup>2</sup>, No overhang

Air change rate

2.50 ach

Blinds/curtains

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

## Criterion 4 – Building performance consistent with DER and DFEE rate

### Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m<sup>2</sup>K

Pass

### Air permeability and pressure testing

#### 3 Air permeability

Air permeability at 50 pascals

4.69 (measured in this dwelling)

Maximum

10.0

Pass

### 10 Key features

Party wall U-value

0.00

W/m<sup>2</sup>K

Roof U-value

0.11

W/m<sup>2</sup>K

Thermal bridging y-value

0.036

W/m<sup>2</sup>K

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

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



|                                    |                                                                        |               |       |                |            |
|------------------------------------|------------------------------------------------------------------------|---------------|-------|----------------|------------|
| Property Reference                 | 285 West End Road                                                      |               |       | Issued on Date | 26/10/2022 |
| Assessment Reference               | AB                                                                     | Prop Type Ref |       |                |            |
| Property                           | 285 West End Road, West End, SOUTHAMPTON, SO18 3BW                     |               |       |                |            |
|                                    |                                                                        |               |       |                |            |
| SAP Rating                         | 85 B                                                                   | DER           | 16.30 | TER            | 16.89      |
| Environmental                      | 87 B                                                                   | % DER<TER     | 3.49  |                |            |
| CO <sub>2</sub> Emissions (t/year) | 1.25                                                                   | DFEE          | 42.24 | TFEE           | 50.36      |
| General Requirements Compliance    | Pass                                                                   | % DFEE<TFEE   | 16.14 |                |            |
|                                    |                                                                        |               |       |                |            |
| Assessor Details                   | Mr. Thomas McMahon, SAeasy Ltd, Tel: 0114 321 2037, info@sapeasy.co.uk |               |       | Assessor ID    | r863-0001  |
| Client                             |                                                                        |               |       |                |            |

# 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

Semi-Detached House, total floor area 101 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) 16.89 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 16.30 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.4 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)42.2 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

| Element       | Average          | Highest          |    |
|---------------|------------------|------------------|----|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall    | 0.00 (max. 0.20) | -                | OK |
| Floor         | 0.16 (max. 0.25) | 0.16 (max. 0.70) | OK |
| Roof          | 0.11 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings      | 1.40 (max. 2.00) | 1.40 (max. 3.30) | OK |

#### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

#### 3 Air permeability

Air permeability at 50 pascals: 4.69 (measured in this dwelling)  
Maximum 10.0 OK

#### 4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas  
Data from database  
Worcester Greenstar 36CDi Compact ErP  
Combi boiler  
Efficiency: 89.8% SEDBUK2009  
Minimum: 88.0% OK

#### Secondary heating system:

None

#### 5 Cylinder insulation

Hot water storage No cylinder

#### 6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

#### Hot water controls:

No cylinder

#### Boiler interlock

Yes

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: 8.75 m<sup>2</sup>, No overhang  
Windows facing South: 9.71 m<sup>2</sup>, No overhang  
Air change rate: 2.50 ach  
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

#### 10 Key features

Party wall U-value 0.00 W/m<sup>2</sup>K  
Roof U-value 0.11 W/m<sup>2</sup>K  
Thermal bridging y-value 0.036 W/m<sup>2</sup>K

# 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                                           | 50.4000 (1b)              | x 2.4000 (2b)                   | = 120.9600 (1b) - (3b)      |
| First floor                                            | 50.4000 (1c)              | x 2.6000 (2c)                   | = 131.0400 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 100.8000                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 252.0000 (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                            | +                    | 1     | =     | 1 * 20 = 20.0000 (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) = |                      |       |       | 60.0000 / (5) = 0.2381 (8) |
| Pressure test                                        |                              |                      |       |       | Yes                        |
| Measured/design AP50                                 |                              |                      |       |       | 4.6900                     |
| Infiltration rate                                    |                              |                      |       |       | 0.4726 (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) =         |                      |       |       | 0.4017 (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 | 0.5122 | 0.5021 | 0.4921 | 0.4419 | 0.4318 | 0.3816 | 0.3816 | 0.3716 | 0.4017 | 0.4318 | 0.4519 | 0.4720 (22b) |
| Effective ac    | 0.6312 | 0.6261 | 0.6211 | 0.5976 | 0.5932 | 0.5728 | 0.5728 | 0.5690 | 0.5807 | 0.5932 | 0.6021 | 0.6114 (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 |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| W (Uw = 1.40)                                                  |                         |                            | 18.4600                   | 1.3258                        | 24.4735      |                                | (27)          |
| D                                                              |                         |                            | 1.8900                    | 1.4000                        | 2.6460       |                                | (26a)         |
| Ground floor                                                   |                         |                            | 50.4000                   | 0.1600                        | 8.0640       |                                | (28a)         |
| External wall                                                  | 111.2100                | 20.3500                    | 90.8600                   | 0.1800                        | 16.3548      |                                | (29a)         |
| Joisted roof                                                   | 49.7600                 |                            | 49.7600                   | 0.1100                        | 5.4736       |                                | (30)          |
| Flat roof                                                      | 0.6300                  |                            | 0.6300                    | 0.1300                        | 0.0819       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 212.0000                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            | (26)...(30) + (32) =      |                               | 57.0938      |                                | (33)          |
| Party wall                                                     |                         |                            | 41.8400                   | 0.0000                        | 0.0000       |                                | (32)          |
| 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)     |                         |                            |                           |                               |              |                                | 7.6305 (36)   |
| Total fabric heat loss                                         |                         |                            |                           |                               |              | (33) + (36) =                  | 64.7243 (37)  |

|                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|---------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |          |          |          |          |          |          |          |          |          |          |          |               |
| (38)m                                                               | 52.4874  | 52.0639  | 51.6487  | 49.6987  | 49.3339  | 47.6355  | 47.6355  | 47.3210  | 48.2897  | 49.3339  | 50.0719  | 50.8435 (38)  |
| Heat transfer coeff                                                 | 117.2117 | 116.7881 | 116.3730 | 114.4230 | 114.0581 | 112.3598 | 112.3598 | 112.0452 | 113.0139 | 114.0581 | 114.7962 | 115.5678 (39) |
| Average = Sum(39)m / 12 =                                           |          |          |          |          |          |          |          |          |          |          |          | 114.4212 (39) |
| HLP                                                                 | 1.1628   | 1.1586   | 1.1545   | 1.1351   | 1.1315   | 1.1147   | 1.1147   | 1.1116   | 1.1212   | 1.1315   | 1.1389   | 1.1465 (40)   |
| HLP (average)                                                       |          |          |          |          |          |          |          |          |          |          |          | 1.1351 (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                        |          |          |          |          |          |          |         |          |          |                    |          | 2.7468 (42)    |
| Average daily hot water use (litres/day) |          |          |          |          |          |          |         |          |          |                    |          | 99.4367 (43)   |
| Daily hot water use                      | 109.3804 | 105.4029 | 101.4255 | 97.4480  | 93.4705  | 89.4930  | 89.4930 | 93.4705  | 97.4480  | 101.4255           | 105.4029 | 109.3804 (44)  |
| Energy conte                             | 162.2080 | 141.8681 | 146.3952 | 127.6309 | 122.4649 | 105.6779 | 97.9261 | 112.3716 | 113.7137 | 132.5223           | 144.6585 | 157.0897 (45)  |
| Energy content (annual)                  |          |          |          |          |          |          |         |          |          | Total = Sum(45)m = |          | 1564.5268 (45) |
| Distribution loss (46)m = 0.15 x (45)m   | 24.3312  | 21.2802  | 21.9593  | 19.1446  | 18.3697  | 15.8517  | 14.6889 | 16.8557  | 17.0571  | 19.8783            | 21.6988  | 23.5635 (46)   |
| Water storage loss:                      |          |          |          |          |          |          |         |          |          |                    |          |                |
| Total storage loss                       |          |          |          |          |          |          |         |          |          |                    |          |                |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



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

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| If cylinder contains dedicated solar storage                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)   |
| Combi loss                                                      | 27.5638  | 24.8945  | 27.5500  | 26.6336  | 27.4975  | 26.5830  | 27.4519  | 27.4815  | 26.6106  | 27.5266  | 26.6606  | 0.0000 (57)   |
| Total heat required for water heating calculated for each month | 189.7718 | 166.7626 | 173.9452 | 154.2645 | 149.9624 | 132.2608 | 125.3780 | 139.8531 | 140.3243 | 160.0489 | 171.3191 | 184.6453 (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                                                 | 189.7718 | 166.7626 | 173.9452 | 154.2645 | 149.9624 | 132.2608 | 125.3780 | 139.8531 | 140.3243 | 160.0489 | 171.3191 | 184.6453 (64) |
| Heat gains from water heating, kWh/month                        | 60.8251  | 53.3948  | 55.5639  | 49.0957  | 47.5940  | 41.7836  | 39.4234  | 44.2339  | 44.4624  | 50.9453  | 54.7641  | 59.1212 (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                                                                               | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 23.3939   | 20.7783   | 16.8980   | 12.7929   | 9.5628    | 8.0734    | 8.7235    | 11.3392   | 15.2194   | 19.3246   | 22.5546   | 24.0441   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 257.6146  | 260.2879  | 253.5514  | 239.2103  | 221.1072  | 204.0928  | 192.7262  | 190.0529  | 196.7894  | 211.1305  | 229.2336  | 246.2480  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | (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)                                 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | (71) |
| Water heating gains (Table 5)                                                       | 81.7542   | 79.4565   | 74.6827   | 68.1884   | 63.9704   | 58.0328   | 52.9884   | 59.4542   | 61.7534   | 68.4749   | 76.0612   | 79.4640   | (72) |
| Total internal gains                                                                | 429.9649  | 427.7248  | 412.3342  | 387.3937  | 361.8425  | 337.4011  | 321.6403  | 328.0485  | 340.9644  | 366.1321  | 395.0516  | 416.9583  | (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       |          |          |          |          | 8.7500     | 10.6334                        | 0.7600                            | 0.7000                             | 0.7700                       |          |          | 34.3024       |
| South       |          |          |          |          | 9.7100     | 46.7521                        | 0.7600                            | 0.7000                             | 0.7700                       |          |          | 167.3651 (78) |
|             |          |          |          |          |            |                                |                                   |                                    |                              |          |          |               |
| Solar gains | 201.6675 | 339.6546 | 460.5476 | 573.5457 | 652.2471   | 653.7699                       | 627.5661                          | 566.6297                           | 498.6635                     | 373.6766 | 240.7012 | 173.2150 (83) |
| Total gains | 631.6324 | 767.3794 | 872.8819 | 960.9394 | 1014.0896  | 991.1710                       | 949.2064                          | 894.6782                           | 839.6279                     | 739.8088 | 635.7528 | 590.1733 (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                                                                         | 59.7210 | 59.9376 | 60.1514 | 61.1765 | 61.3722 | 62.2999 | 62.2999 | 62.4748 | 61.9393 | 61.3722 | 60.9776 | 60.5705 |              |
| alpha                                                                       | 4.9814  | 4.9958  | 5.0101  | 5.0784  | 5.0915  | 5.1533  | 5.1533  | 5.1650  | 5.1293  | 5.0915  | 5.0652  | 5.0380  |              |
| util living area                                                            | 0.9976  | 0.9932  | 0.9819  | 0.9463  | 0.8540  | 0.6813  | 0.5120  | 0.5614  | 0.8044  | 0.9640  | 0.9943  | 0.9983  | (86)         |
| MIT                                                                         | 19.7662 | 19.9599 | 20.2270 | 20.5561 | 20.8180 | 20.9589 | 20.9922 | 20.9877 | 20.9022 | 20.5578 | 20.1004 | 19.7392 | (87)         |
| Th 2                                                                        | 19.9499 | 19.9533 | 19.9566 | 19.9722 | 19.9752 | 19.9889 | 19.9889 | 19.9914 | 19.9836 | 19.9752 | 19.9692 | 19.9630 | (88)         |
| util rest of house                                                          | 0.9968  | 0.9910  | 0.9756  | 0.9271  | 0.8044  | 0.5912  | 0.3990  | 0.4457  | 0.7265  | 0.9472  | 0.9920  | 0.9977  | (89)         |
| MIT 2                                                                       | 18.8300 | 19.0253 | 19.2915 | 19.6209 | 19.8554 | 19.9706 | 19.9869 | 19.9880 | 19.9321 | 19.6306 | 19.1788 | 18.8136 | (90)         |
| Living area fraction                                                        | 18.9844 | 19.1794 | 19.4458 | 19.7752 | 20.0142 | 20.1336 | 20.1528 | 20.1530 | 20.0921 | 19.7836 | 19.3308 | 18.9663 | (92)         |
| Temperature adjustment                                                      | 18.9844 | 19.1794 | 19.4458 | 19.7752 | 20.0142 | 20.1336 | 20.1528 | 20.1530 | 20.0921 | 19.7836 | 19.3308 | 18.9663 | (93)         |

#### 8. Space heating requirement

|                      |           |           |           |           |          |          |          |          |          |           |           |           |       |
|----------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-------|
| Utilisation          | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct       | Nov       | Dec       |       |
| Useful gains         | 628.9144  | 758.7229  | 848.1100  | 886.5877  | 817.9482 | 599.5395 | 396.5107 | 415.9447 | 617.8091 | 697.7578  | 629.4126  | 588.3359  | (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     | 1721.1887 | 1667.6702 | 1506.5469 | 1244.3724 | 948.3071 | 621.7545 | 399.1881 | 420.5009 | 677.1963 | 1047.4593 | 1404.0525 | 1706.5099 | (97)  |
| Month fracti         | 1.0000    | 1.0000    | 1.0000    | 1.0000    | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000   | 1.0000    | 1.0000    | 1.0000    | (97a) |
| Space heating kWh    | 812.6521  | 610.8126  | 489.8770  | 257.6050  | 96.9871  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 260.1779  | 557.7408  | 831.9215  | (98)  |
| Space heating        |           |           |           |           |          |          |          |          |          |           |           | 3917.7738 | (98)  |
| Space heating per m2 |           |           |           |           |          |          |          |          |          |           |           | 38.8668   | (99)  |

#### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



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

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

|                                                                       |          |          |          |          |          |          |          |          |          |          |          |           |                 |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (201)    |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          |           | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |           | 90.7000 (206)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (208)    |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          |           | 4319.4860 (211) |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |                 |
| Space heating requirement                                             | 812.6521 | 610.8126 | 489.8770 | 257.6050 | 96.9871  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 260.1779 | 557.7408 | 831.9215  | (98)            |
| Space heating efficiency (main heating system 1)                      | 90.7000  | 90.7000  | 90.7000  | 90.7000  | 90.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 90.7000  | 90.7000  | 90.7000   | (210)           |
| Space heating fuel (main heating system)                              | 895.9780 | 673.4427 | 540.1070 | 284.0187 | 106.9317 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 286.8555 | 614.9292 | 917.2232  | (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                                             | 189.7718 | 166.7626 | 173.9452 | 154.2645 | 149.9624 | 132.2608 | 125.3780 | 139.8531 | 140.3243 | 160.0489 | 171.3191 | 184.6453  | (64)            |
| Efficiency of water heater (217)m                                     | 90.1563  | 90.0846  | 89.9492  | 89.6306  | 88.9788  | 87.9000  | 87.9000  | 87.9000  | 87.9000  | 89.6128  | 90.0261  | 90.1782   | (217)           |
| Fuel for water heating, kWh/month                                     | 210.4919 | 185.1179 | 193.3816 | 172.1114 | 168.5372 | 150.4674 | 142.6371 | 159.1048 | 159.6408 | 178.6005 | 190.2993 | 204.7560  | (219)           |
| Water heating fuel used                                               |          |          |          |          |          |          |          |          |          |          |          | 2115.1458 | (219)           |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          | 4319.4860 | (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)                   |          |          |          |          |          |          |          |          |          |          |          | 413.1441  | (232)           |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          | 6922.7759 | (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               | 4319.4860          | 0.2160                        | 933.0090 (261)           |
| Space heating - secondary                   | 0.0000             | 0.0000                        | 0.0000 (263)             |
| Water heating (other fuel)                  | 2115.1458          | 0.2160                        | 456.8715 (264)           |
| Space and water heating                     |                    |                               | 1389.8805 (265)          |
| Pumps and fans                              | 75.0000            | 0.5190                        | 38.9250 (267)            |
| Energy for lighting                         | 413.1441           | 0.5190                        | 214.4218 (268)           |
| Total CO2, kg/year                          |                    |                               | 1643.2273 (272)          |
| Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 16.3000 (273)            |

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

|                                                                                 |     |          |     |
|---------------------------------------------------------------------------------|-----|----------|-----|
| DER                                                                             |     | 16.3000  | ZC1 |
| Total Floor Area                                                                | TFA | 100.8000 |     |
| Assumed number of occupants                                                     | N   | 2.7468   |     |
| CO2 emission factor in Table 12 for electricity displaced from grid             | EF  | 0.5190   |     |
| CO2 emissions from appliances, equation (L14)                                   |     | 15.1445  | ZC2 |
| CO2 emissions from cooking, equation (L16)                                      |     | 1.8346   | ZC3 |
| Total CO2 emissions                                                             |     | 33.2791  | 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                                                               |     | 33.2791  | 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                                           | 50.4000 (1b)              | x 2.4000 (2b)                   | = 120.9600 (1b) - (3b)      |
| First floor                                            | 50.4000 (1c)              | x 2.6000 (2c)                   | = 131.0400 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 100.8000                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 252.0000 (5)              |

#### 2. Ventilation rate

|                                                                           |        |        |        |        |        |        |        |        |        | main                        | secondary | other  | total | m3 per hour |   |          |              |
|---------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------|-----------|--------|-------|-------------|---|----------|--------------|
|                                                                           |        |        |        |        |        |        |        |        |        | heating                     | heating   |        |       |             |   |          |              |
| Number of chimneys                                                        |        |        |        |        |        |        |        |        |        | 0                           | +         | 0      | +     | 0           | = | 0 * 40 = | 0.0000 (6a)  |
| Number of open flues                                                      |        |        |        |        |        |        |        |        |        | 0                           | +         | 0      | +     | 0           | = | 0 * 20 = | 0.0000 (6b)  |
| Number of intermittent fans                                               |        |        |        |        |        |        |        |        |        |                             |           |        |       |             |   | 4 * 10 = | 40.0000 (7a) |
| Number of passive vents                                                   |        |        |        |        |        |        |        |        |        |                             |           |        |       |             |   | 0 * 10 = | 0.0000 (7b)  |
| Number of flueless gas fires                                              |        |        |        |        |        |        |        |        |        |                             |           |        |       |             |   | 0 * 40 = | 0.0000 (7c)  |
|                                                                           |        |        |        |        |        |        |        |        |        | Air changes per hour        |           |        |       |             |   |          |              |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = |        |        |        |        |        |        |        |        |        | 40.0000 / (5) =             |           |        |       |             |   |          | 0.1587 (8)   |
| Pressure test                                                             |        |        |        |        |        |        |        |        |        | Yes                         |           |        |       |             |   |          |              |
| Measured/design AP50                                                      |        |        |        |        |        |        |        |        |        |                             |           |        |       |             |   |          | 5.0000       |
| Infiltration rate                                                         |        |        |        |        |        |        |        |        |        |                             |           |        |       |             |   |          | 0.4087 (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) =        |           |        |       |             |   |          | 0.3474 (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                                                           | 0.4430 | 0.4343 | 0.4256 | 0.3822 | 0.3735 | 0.3300 | 0.3300 | 0.3214 | 0.3474 | 0.3735                      | 0.3908    | 0.4082 | (22b) |             |   |          |              |
| Effective ac                                                              | 0.5981 | 0.5943 | 0.5906 | 0.5730 | 0.5697 | 0.5545 | 0.5545 | 0.5516 | 0.5604 | 0.5697                      | 0.5764    | 0.5833 | (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  |                |                |                |                |                |      |
|---------------------------------------------------------------------|----------------|----------------|----------------|----------------------|----------------|-------------------|----------------|----------------|----------------|----------------|----------------|----------------|------|
| TER Semi-glazed door                                                |                |                | 1.8900         | 1.2000               | 2.2680         |                   |                | (26a)          |                |                |                |                |      |
| TER Opening Type (Uw = 1.40)                                        |                |                | 18.4600        | 1.3258               | 24.4735        |                   |                | (27)           |                |                |                |                |      |
| Ground floor                                                        |                |                | 50.4000        | 0.1300               | 6.5520         |                   |                | (28a)          |                |                |                |                |      |
| External wall                                                       | 111.2100       | 20.3500        | 90.8600        | 0.1800               | 16.3548        |                   |                | (29a)          |                |                |                |                |      |
| Joisted roof                                                        | 49.7600        |                | 49.7600        | 0.1300               | 6.4688         |                   |                | (30)           |                |                |                |                |      |
| Flat roof                                                           | 0.6300         |                | 0.6300         | 0.1300               | 0.0819         |                   |                | (30)           |                |                |                |                |      |
| Total net area of external elements Aum(A, m2)                      |                |                | 212.0000       |                      |                |                   |                | (31)           |                |                |                |                |      |
| Fabric heat loss, W/K = Sum (A x U)                                 |                |                |                | (26)...(30) + (32) = | 56.1990        |                   |                | (33)           |                |                |                |                |      |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                   |                |                |                |                      |                |                   | 250.0000       | (35)           |                |                |                |                |      |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)          |                |                |                |                      |                |                   | 9.9260         | (36)           |                |                |                |                |      |
| Total fabric heat loss                                              |                |                |                |                      |                | (33) + (36) =     | 66.1250        | (37)           |                |                |                |                |      |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |                |                |                |                      |                |                   |                |                |                |                |                |                |      |
| (38)m                                                               | Jan<br>49.7386 | Feb<br>49.4218 | Mar<br>49.1113 | Apr<br>47.6527       | May<br>47.3798 | Jun<br>46.1094    | Jul<br>46.1094 | Aug<br>45.8742 | Sep<br>46.5988 | Oct<br>47.3798 | Nov<br>47.9319 | Dec<br>48.5090 | (38) |
| Heat transfer coeff                                                 | 115.8636       | 115.5468       | 115.2362       | 113.7777             | 113.5048       | 112.2344          | 112.2344       | 111.9992       | 112.7237       | 113.5048       | 114.0568       | 114.6340       | (39) |
| Average = Sum(39)m / 12 =                                           |                |                |                |                      |                |                   |                |                |                |                |                | 113.7764       | (39) |
| HLP                                                                 | Jan<br>1.1494  | Feb<br>1.1463  | Mar<br>1.1432  | Apr<br>1.1287        | May<br>1.1260  | Jun<br>1.1134     | Jul<br>1.1134  | Aug<br>1.1111  | Sep<br>1.1183  | Oct<br>1.1260  | Nov<br>1.1315  | Dec<br>1.1372  | (40) |
| HLP (average)                                                       |                |                |                |                      |                |                   |                |                |                |                |                | 1.1287         | (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                        |              |              |              |             |             |             |             |             |             |                    |              | 2.7468 (42)       |
| Average daily hot water use (litres/day) |              |              |              |             |             |             |             |             |             |                    |              | 99.4367 (43)      |
| Daily hot water use                      | Jan 109.3804 | Feb 105.4029 | Mar 101.4255 | Apr 97.4480 | May 93.4705 | Jun 89.4930 | Jul 89.4930 | Aug 93.4705 | Sep 97.4480 | Oct 101.4255       | Nov 105.4029 | Dec 109.3804 (44) |
| Energy conte                             | 162.2080     | 141.8681     | 146.3952     | 127.6309    | 122.4649    | 105.6779    | 97.9261     | 112.3716    | 113.7137    | 132.5223           | 144.6585     | 157.0897 (45)     |
| Energy content (annual)                  |              |              |              |             |             |             |             |             |             | Total = Sum(45)m = |              | 1564.5268 (45)    |
| Distribution loss (46)m = 0.15 x (45)m   | 24.3312      | 21.2802      | 21.9593      | 19.1446     | 18.3697     | 15.8517     | 14.6889     | 16.8557     | 17.0571     | 19.8783            | 21.6988      | 23.5635 (46)      |
| Water storage loss:                      |              |              |              |             |             |             |             |             |             |                    |              |                   |
| Total storage loss                       | 0.0000       | 0.0000       | 0.0000       | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000             | 0.0000       | 0.0000 (56)       |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| If cylinder contains dedicated solar storage                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)   |
| Combi loss                                                      | 50.9589  | 46.0274  | 50.9589  | 48.0565  | 47.6316  | 44.1336  | 45.6047  | 47.6316  | 48.0565  | 50.9589  | 49.3151  | 50.9589 (61)  |
| Total heat required for water heating calculated for each month | 213.1669 | 187.8955 | 197.3541 | 175.6874 | 170.0964 | 149.8114 | 143.5308 | 160.0032 | 161.7702 | 183.4812 | 193.9736 | 208.0487 (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                                                 | 213.1669 | 187.8955 | 197.3541 | 175.6874 | 170.0964 | 149.8114 | 143.5308 | 160.0032 | 161.7702 | 183.4812 | 193.9736 | 208.0487 (64) |
| Heat gains from water heating, kWh/month                        | 66.6739  | 58.6780  | 61.4161  | 54.4514  | 52.6275  | 46.1713  | 43.9616  | 49.2714  | 49.8239  | 56.8034  | 60.4277  | 64.9721 (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                                                                               | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405  | 137.3405 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 23.3939   | 20.7783   | 16.8980   | 12.7929   | 9.5628    | 8.0734    | 8.7235    | 11.3392   | 15.2194   | 19.3246   | 22.5546   | 24.0441 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 257.6146  | 260.2879  | 253.5514  | 239.2103  | 221.1072  | 204.0928  | 192.7262  | 190.0529  | 196.7894  | 211.1305  | 229.2336  | 246.2480 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340   | 36.7340 (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)                                 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 | -109.8724 (71) |
| Water heating gains (Table 5)                                                       | 89.6154   | 87.3184   | 82.5486   | 75.6269   | 70.7358   | 64.1268   | 59.0882   | 66.2251   | 69.1999   | 76.3487   | 83.9274   | 87.3280 (72)   |
| Total internal gains                                                                | 437.8261  | 435.5867  | 420.2001  | 394.8322  | 368.6080  | 343.4951  | 327.7400  | 334.8193  | 348.4109  | 374.0059  | 402.9178  | 424.8223 (73)  |

#### 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g                            |          | FF                           |          | Access<br>factor |          | Gains         |
|-------------|----------|----------|----------|------------|--------------------------------|------------------------------|----------|------------------------------|----------|------------------|----------|---------------|
|             |          |          |          |            |                                | Specific data<br>or Table 6b |          | Specific data<br>or Table 6c |          | Table 6d         |          | W             |
| North       |          |          |          | 8.7500     | 10.6334                        | 0.6300                       |          | 0.7000                       |          | 0.7700           |          | 28.4349 (74)  |
| South       |          |          |          | 9.7100     | 46.7521                        | 0.6300                       |          | 0.7000                       |          | 0.7700           |          | 138.7369 (78) |
| -----       |          |          |          |            |                                |                              |          |                              |          |                  |          |               |
| Solar gains | 167.1718 | 281.5558 | 381.7698 | 475.4392   | 540.6785                       | 541.9408                     | 520.2193 | 469.7062                     | 413.3658 | 309.7583         | 199.5286 | 143.5862 (83) |
| Total gains | 604.9979 | 717.1425 | 801.9699 | 870.2714   | 909.2865                       | 885.4359                     | 847.9593 | 804.5255                     | 761.7767 | 683.7642         | 602.4464 | 568.4084 (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                                                                         | 60.4159 | 60.5815 | 60.7448 | 61.5235 | 61.6714 | 62.3695 | 62.3695 | 62.5005 | 62.0987 | 61.6714 | 61.3729 | 61.0639      |
| alpha                                                                       | 5.0277  | 5.0388  | 5.0497  | 5.1016  | 5.1114  | 5.1580  | 5.1580  | 5.1667  | 5.1399  | 5.1114  | 5.0915  | 5.0709       |
| util living area                                                            | 0.9980  | 0.9949  | 0.9871  | 0.9623  | 0.8919  | 0.7394  | 0.5669  | 0.6158  | 0.8457  | 0.9732  | 0.9955  | 0.9986 (86)  |
| MIT                                                                         | 19.7597 | 19.9308 | 20.1797 | 20.4956 | 20.7711 | 20.9403 | 20.9877 | 20.9814 | 20.8748 | 20.5181 | 20.0786 | 19.7315 (87) |
| Th 2                                                                        | 19.9607 | 19.9632 | 19.9657 | 19.9774 | 19.9796 | 19.9899 | 19.9899 | 19.9918 | 19.9859 | 19.9796 | 19.9752 | 19.9705 (88) |
| util rest of house                                                          | 0.9973  | 0.9932  | 0.9824  | 0.9478  | 0.8498  | 0.6497  | 0.4447  | 0.4930  | 0.7744  | 0.9601  | 0.9937  | 0.9981 (89)  |
| MIT 2                                                                       | 18.3078 | 18.5591 | 18.9220 | 19.3807 | 19.7507 | 19.9491 | 19.9852 | 19.9840 | 19.8849 | 19.4202 | 18.7841 | 18.2737 (90) |
| Living area fraction                                                        | 18.5473 | 18.7854 | 19.1295 | 19.5647 | 19.9191 | 20.1126 | 20.1506 | 20.1485 | 20.0482 | 19.6014 | 18.9977 | 18.5142 (92) |
| Temperature adjustment                                                      | 18.5473 | 18.7854 | 19.1295 | 19.5647 | 19.9191 | 20.1126 | 20.1506 | 20.1485 | 20.0482 | 19.6014 | 18.9977 | 18.5142 (93) |
| adjusted MIT                                                                |         |         |         |         |         |         |         |         |         |         |         |              |

#### 8. Space heating requirement

|                      |           |           |           |           |          |          |          |          |          |              |           |                |
|----------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|--------------|-----------|----------------|
| Utilisation          | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct          | Nov       | Dec            |
| Useful gains         | 602.5272  | 710.2305  | 783.7144  | 818.2747  | 770.0774 | 585.7395 | 394.1614 | 412.7336 | 593.7627 | 652.0017     | 597.0447  | 566.6869 (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     | 1650.7443 | 1604.4159 | 1455.3795 | 1213.4020 | 932.9018 | 618.7039 | 398.5003 | 419.8324 | 670.5062 | 1021.6971    | 1357.0108 | 1640.8989 (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    | 779.8735  | 600.8925  | 499.7188  | 284.4916  | 121.1413 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 275.0534     | 547.1756  | 799.2137 (98)  |
| Space heating        |           |           |           |           |          |          |          |          |          |              |           | 3907.5605 (98) |
| Space heating per m2 |           |           |           |           |          |          |          |          |          | (98) / (4) = |           | 38.7655 (99)   |

#### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

|                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 93.4000 (206)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          | 4183.6836 (211) |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                             | 779.8735 | 600.8925 | 499.7188 | 284.4916 | 121.1413 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 275.0534 | 547.1756 | 799.2137 (98)   |
| Space heating efficiency (main heating system 1)                      | 93.4000  | 93.4000  | 93.4000  | 93.4000  | 93.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 93.4000  | 93.4000  | 93.4000 (210)   |
| Space heating fuel (main heating system)                              | 834.9823 | 643.3539 | 535.0309 | 304.5949 | 129.7016 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 294.4897 | 585.8411 | 855.6892 (211)  |
| Water heating requirement                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating requirement                                             | 213.1669 | 187.8955 | 197.3541 | 175.6874 | 170.0964 | 149.8114 | 143.5308 | 160.0032 | 161.7702 | 183.4812 | 193.9736 | 208.0487 (64)   |
| Efficiency of water heater (217)m                                     | 88.0234  | 87.7703  | 87.2915  | 86.2579  | 84.2136  | 80.3000  | 80.3000  | 80.3000  | 80.3000  | 86.0682  | 87.5190  | 80.3000 (216)   |
| Fuel for water heating, kWh/month                                     | 242.1707 | 214.0765 | 226.0862 | 203.6769 | 201.9820 | 186.5647 | 178.7432 | 199.2567 | 201.4573 | 213.1812 | 221.6360 | 88.1109 (217)   |
| Water heating fuel used                                               |          |          |          |          |          |          |          |          |          |          |          | 236.1213 (219)  |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          | 2524.9525 (219) |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          | 4183.6836 (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)                   |          |          |          |          |          |          |          |          |          |          |          | 413.1441 (232)  |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          | 7196.7801 (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                                                                     | 4183.6836          | 0.2160                        | 903.6757 (261)           |
| Space heating - secondary                                                                         | 0.0000             | 0.0000                        | 0.0000 (263)             |
| Water heating (other fuel)                                                                        | 2524.9525          | 0.2160                        | 545.3897 (264)           |
| Space and water heating                                                                           |                    |                               | 1449.0654 (265)          |
| Pumps and fans                                                                                    | 75.0000            | 0.5190                        | 38.9250 (267)            |
| Energy for lighting                                                                               | 413.1441           | 0.5190                        | 214.4218 (268)           |
| Total CO2, kg/m2/year                                                                             |                    |                               | 1702.4122 (272)          |
| Emissions per m2 for space and water heating                                                      |                    |                               | 14.3756 (272a)           |
| Fuel factor (mains gas)                                                                           |                    |                               | 1.0000                   |
| Emissions per m2 for lighting                                                                     |                    |                               | 2.1272 (272b)            |
| Emissions per m2 for pumps and fans                                                               |                    |                               | 0.3862 (272c)            |
| Target Carbon Dioxide Emission Rate (TER) = (14.3756 * 1.00) + 2.1272 + 0.3862, rounded to 2 d.p. |                    |                               | 16.8900 (273)            |