

# Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



## SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 1 , 18, Parkside Road  
READING, RG30 2DB

Contact: Matthew Carter  
Energy Calculations Limited  
[mcarter@energycalculations.co.uk](mailto:mcarter@energycalculations.co.uk)

Report Issue Date: 16/08/2021

EXCELLENCE  
IN ENERGY  
ASSESSMENT

# PREDICTED ENERGY ASSESSMENT

Energy Calculations Ltd  
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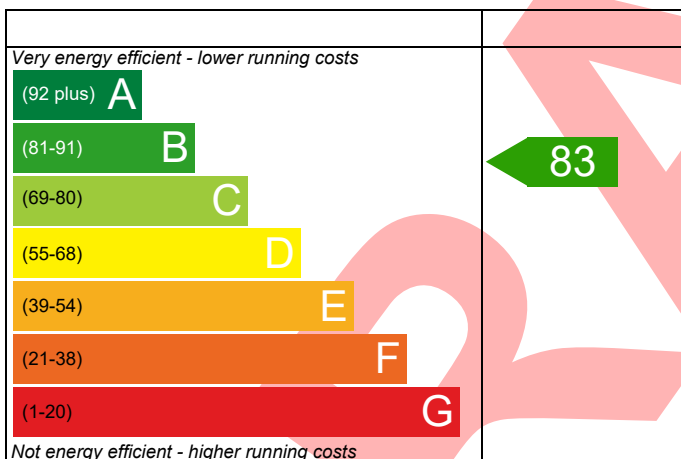
Flat 1 , 18, Parkside Road,  
READING,  
RG30 2DB

Dwelling type: Flat, End-Terrace  
Date of assessment: 16/08/2021  
Produced by: Energy Calculations Limited  
Total floor area: 70 m<sup>2</sup>

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.

## Energy Efficiency Rating

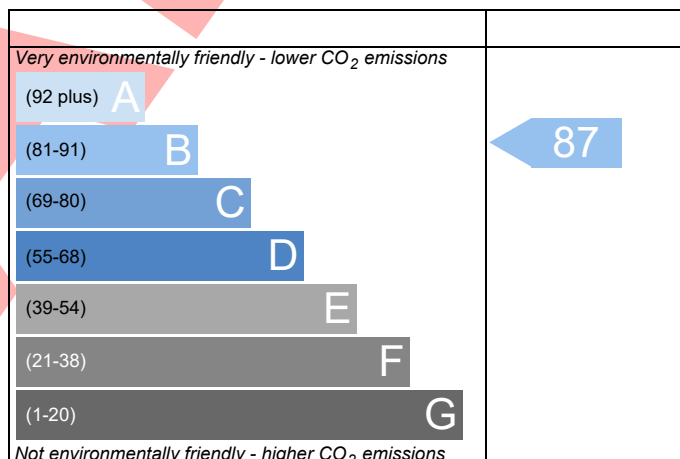


England

EU Directive  
2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

## Environmental Impact (CO<sub>2</sub>) Rating



England

EU Directive  
2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

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

# THERMAL BRIDGING

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## Calculation Type: New Build (As Designed)

|                                    |                                                                                                      |                |             |
|------------------------------------|------------------------------------------------------------------------------------------------------|----------------|-------------|
| Property Reference                 | 015722                                                                                               | Issued on Date | 16/08/2021  |
| Assessment Reference               | 004                                                                                                  | Prop Type Ref  |             |
| Property                           | Flat 1 , 18, Parkside Road, READING, RG30 2DB                                                        |                |             |
| SAP Rating                         | 83 B                                                                                                 | DER            | 17.89       |
| Environmental                      | 87 B                                                                                                 | TER            | 29.47       |
| CO <sub>2</sub> Emissions (t/year) | 1.06                                                                                                 | % DER<TER      | 39.29       |
| General Requirements Compliance    | Pass                                                                                                 | DFEE           | 58.41       |
|                                    |                                                                                                      | TFEE           | 58.58       |
|                                    |                                                                                                      | % DFEE<TFEE    | 0.29        |
| Assessor Details                   | Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk |                | Assessor ID |
|                                    |                                                                                                      |                | 7869-0001   |
| Client                             |                                                                                                      |                |             |

|               | Junction detail                                                  | Source Type         | Psi (W/mK) | Length (m) | Result | Reference |
|---------------|------------------------------------------------------------------|---------------------|------------|------------|--------|-----------|
| External wall | E2 Other lintels (including other steel lintels)                 | Table K1 - Approved | 0.300      | 11.80      | 3.54   |           |
| External wall | E3 Sill                                                          | Table K1 - Approved | 0.040      | 11.80      | 0.47   |           |
| External wall | E4 Jamb                                                          | Table K1 - Approved | 0.050      | 32.20      | 1.61   |           |
| External wall | E5 Ground floor (normal)                                         | Table K1 - Approved | 0.160      | 30.46      | 4.87   |           |
| External wall | E7 Party floor between dwellings (in blocks of flats)            | Table K1 - Approved | 0.070      | 30.46      | 2.13   |           |
| External wall | E14 Flat roof                                                    | Table K1 - Default  | 0.080      | 8.50       | 0.68   |           |
| External wall | E16 Corner (normal)                                              | Table K1 - Approved | 0.090      | 7.40       | 0.67   |           |
| External wall | E17 Corner (inverted – internal area greater than external area) | Table K1 - Approved | -0.090     | 2.37       | -0.21  |           |
| Party wall    | P1 Party wall - Ground floor                                     | Table K1 - Default  | 0.160      | 5.11       | 0.82   |           |

Total: **14.58** W/mK:  
Y-Value: **0.099** W/m²K:

# FULL SAP CALCULATION PRINTOUT

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|                                    |                                                                                                      |               |       |                |            |
|------------------------------------|------------------------------------------------------------------------------------------------------|---------------|-------|----------------|------------|
| Property Reference                 | 015722                                                                                               |               |       | Issued on Date | 16/08/2021 |
| Assessment Reference               | 004                                                                                                  | Prop Type Ref |       |                |            |
| Property                           | Flat 1 , 18, Parkside Road, READING, RG30 2DB                                                        |               |       |                |            |
|                                    |                                                                                                      |               |       |                |            |
| SAP Rating                         | 83 B                                                                                                 | DER           | 17.89 | TER            | 29.47      |
| Environmental                      | 87 B                                                                                                 | % DER<TER     | 39.29 |                |            |
| CO <sub>2</sub> Emissions (t/year) | 1.06                                                                                                 | DFEE          | 58.41 | TFEE           | 58.58      |
| General Requirements Compliance    | Pass                                                                                                 | % DFEE<TFEE   | 0.29  |                |            |
|                                    |                                                                                                      |               |       |                |            |
| Assessor Details                   | Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk |               |       | Assessor ID    | 7869-0001  |
| Client                             |                                                                                                      |               |       |                |            |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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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 70 m<sup>2</sup>

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

#### 1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 29.47 kgCO<sub>2</sub>/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 17.89 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.6 kWh/m<sup>2</sup>/yr

Dwelling Fabric Energy Efficiency (DFEE)58.4 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

| Element       | Average          | Highest          |    |
|---------------|------------------|------------------|----|
| External wall | 0.21 (max. 0.30) | 0.22 (max. 0.70) | OK |
| Party wall    | 0.00 (max. 0.20) | -                | OK |
| Floor         | 0.14 (max. 0.25) | 0.14 (max. 0.70) | OK |
| Roof          | 0.14 (max. 0.20) | 0.14 (max. 0.35) | OK |
| Openings      | 1.40 (max. 2.00) | 1.40 (max. 3.30) | OK |

#### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

#### 3 Air permeability

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

#### 4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric  
Panasonic WH-MDC05F3E5

Secondary heating system: None

#### 5 Cylinder insulation

|                             |                                      |    |
|-----------------------------|--------------------------------------|----|
| Hot water storage           | Measured cylinder loss: 1.86 kWh/day |    |
| Permitted by DBSCG 2.30     | OK                                   |    |
| Primary pipework insulated: | Yes                                  | OK |

#### 6 Controls

|                         |                                   |    |
|-------------------------|-----------------------------------|----|
| Space heating controls: | Time and temperature zone control | OK |
|-------------------------|-----------------------------------|----|

Hot water controls:

|                           |    |
|---------------------------|----|
| Cylinderstat              | OK |
| Independent timer for DHW | OK |

#### 7 Low energy lights

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

#### 8 Mechanical ventilation

Not applicable

#### 9 Summertime temperature

|                                   |        |    |
|-----------------------------------|--------|----|
| Overheating risk (Thames Valley): | Slight | OK |
|-----------------------------------|--------|----|

Based on:

|                       |                                   |
|-----------------------|-----------------------------------|
| Overshading:          | Average                           |
| Windows facing North: | 9.33 m <sup>2</sup> , No overhang |
| Windows facing East:  | 5.12 m <sup>2</sup> , No overhang |
| Windows facing West:  | 6.24 m <sup>2</sup> , No overhang |
| Air change rate:      | 6.00 ach                          |
| Blinds/curtains:      | None                              |

#### 10 Key features

|                    |                         |
|--------------------|-------------------------|
| Party wall U-value | 0.00 W/m <sup>2</sup> K |
| Photovoltaic array | 300.00 kWh/Year         |

# FULL SAP CALCULATION PRINTOUT

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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                                           | 70.0000 (1b)              | x 2.4000 (2b)                   | = 168.0000 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 70.0000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 168.0000 (5)              |

#### 2. Ventilation rate

|                                                                           | main<br>heating | secondary<br>heating | other | total                       | m <sup>3</sup> per hour    |
|---------------------------------------------------------------------------|-----------------|----------------------|-------|-----------------------------|----------------------------|
| Number of chimneys                                                        | 0               | +                    | 0     | =                           | 0 * 40 = 0.0000 (6a)       |
| Number of open flues                                                      | 0               | +                    | 0     | =                           | 0 * 20 = 0.0000 (6b)       |
| Number of intermittent fans                                               |                 |                      |       |                             | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                   |                 |                      |       |                             | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                              |                 |                      |       |                             | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = |                 |                      |       |                             | Air changes per hour       |
| Pressure test                                                             |                 |                      |       |                             | 30.0000 / (5) = 0.1786 (8) |
| Measured/design AP50                                                      |                 |                      |       |                             | Yes                        |
| Infiltration rate                                                         |                 |                      |       |                             | 5.0000                     |
| Number of sides sheltered                                                 |                 |                      |       |                             | 0.4286 (18)                |
|                                                                           |                 |                      |       |                             | 1 (19)                     |
| Shelter factor                                                            |                 |                      |       | (20) = 1 - [0.075 x (19)] = | 0.9250 (20)                |
| Infiltration rate adjusted to include shelter factor                      |                 |                      |       | (21) = (18) x (20) =        | 0.3964 (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 |        |        |        |        |        |        |        |        |        |        |        |              |
|                 | 0.5054 | 0.4955 | 0.4856 | 0.4361 | 0.4262 | 0.3766 | 0.3766 | 0.3667 | 0.3964 | 0.4262 | 0.4460 | 0.4658 (22b) |
| Effective ac    | 0.6277 | 0.6228 | 0.6179 | 0.5951 | 0.5908 | 0.5709 | 0.5709 | 0.5672 | 0.5786 | 0.5908 | 0.5995 | 0.6085 (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   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| External Door                                               |                         |                            | 2.1200                    | 1.4000                        | 2.9680       |                                | (26a)           |
| Windows (Uw = 1.40)                                         |                         |                            | 20.6900                   | 1.3258                        | 27.4299      |                                | (27)            |
| Main Floor                                                  |                         |                            | 70.0000                   | 0.1400                        | 9.8000       | 110.0000                       | 7700.0000 (28a) |
| Main Wall                                                   | 59.9500                 | 22.8100                    | 37.1400                   | 0.2200                        | 8.1708       | 60.0000                        | 2228.4000 (29a) |
| wall to Stairs                                              | 13.1500                 |                            | 13.1500                   | 0.1864                        | 2.4509       | 60.0000                        | 789.0000 (29a)  |
| Flat roof                                                   | 4.1700                  |                            | 4.1700                    | 0.1400                        | 0.5838       | 9.0000                         | 37.5300 (30)    |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 147.2700                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 51.4034      |                                | (33)            |
| Party Wall 1                                                |                         |                            | 9.3300                    | 0.0000                        | 0.0000       | 180.0000                       | 1679.4000 (32)  |
| Party Ceilings 1                                            |                         |                            | 66.0000                   |                               |              | 40.0000                        | 2640.0000 (32b) |
| Internal Wall 1                                             |                         |                            | 66.5900                   |                               |              | 100.0000                       | 6659.0000 (32c) |

Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K  
Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Total fabric heat loss  
(28)...(30) + (32) + (32a)...(32e) = 21733.3300 (34)  
310.4761 (35)  
14.5781 (36)  
(33) + (36) = 65.9815 (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                     | 34.8018  | 34.5268  | 34.2573  | 32.9912 | 32.7543 | 31.6516 | 31.6516 | 31.4474 | 32.0764 | 32.7543 | 33.2335 | 33.7345 (38) |
| Heat transfer coeff       | 100.7833 | 100.5083 | 100.2387 | 98.9727 | 98.7358 | 97.6331 | 97.6331 | 97.4289 | 98.0578 | 98.7358 | 99.2150 | 99.7160 (39) |
| Average = Sum(39)m / 12 = |          |          |          |         |         |         |         |         |         |         |         | 98.9715 (39) |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.4398 | 1.4358 | 1.4320 | 1.4139 | 1.4105 | 1.3948 | 1.3948 | 1.3918 | 1.4008 | 1.4105 | 1.4174 | 1.4245 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.4139 (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  
Average daily hot water use (litres/day)  
2.2461 (42)  
87.5455 (43)

|                                        | Jan      | Feb      | Mar      | Apr      | May      | Jun     | Jul     | Aug     | Sep      | Oct      | Nov      | Dec                               |
|----------------------------------------|----------|----------|----------|----------|----------|---------|---------|---------|----------|----------|----------|-----------------------------------|
| Daily hot water use                    | 96.3000  | 92.7982  | 89.2964  | 85.7946  | 82.2927  | 78.7909 | 78.7909 | 82.2927 | 85.7946  | 89.2964  | 92.7982  | 96.3000 (44)                      |
| Energy conte                           | 142.8101 | 124.9027 | 128.8884 | 112.3680 | 107.8198 | 93.0403 | 86.2155 | 98.9335 | 100.1151 | 116.6745 | 127.3593 | 138.3040 (45)                     |
| Energy content (annual)                |          |          |          |          |          |         |         |         |          |          |          | Total = Sum(45)m = 1377.4311 (45) |
| Distribution loss (46)m = 0.15 x (45)m | 21.4215  | 18.7354  | 19.3333  | 16.8552  | 16.1730  | 13.9560 | 12.9323 | 14.8400 | 15.0173  | 17.5012  | 19.1039  | 20.7456 (46)                      |

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|                                                                 |          |          |          |          |          |          |          |                             |                   |            |          |          |          |      |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|-----------------------------|-------------------|------------|----------|----------|----------|------|
| Water storage loss:                                             |          |          |          |          |          |          |          |                             |                   |            |          |          | 210.0000 | (47) |
| Store volume                                                    |          |          |          |          |          |          |          |                             |                   |            |          |          | 1.8600   | (48) |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |                             |                   |            |          |          | 0.5400   | (49) |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |                             |                   |            |          |          | 1.0044   | (55) |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |                             |                   |            |          |          |          |      |
| Total storage loss                                              |          |          |          |          |          |          |          |                             |                   |            |          |          |          |      |
|                                                                 | 31.1364  | 28.1232  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364  | 31.1364                     | 30.1320           | 31.1364    | 30.1320  | 31.1364  | (56)     |      |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |                             |                   |            |          |          |          |      |
|                                                                 | 31.1364  | 28.1232  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364  | 31.1364                     | 30.1320           | 31.1364    | 30.1320  | 31.1364  | (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 |          |          |          |          |          |          |          |                             |                   |            |          |          |          |      |
|                                                                 | 197.2089 | 174.0371 | 183.2872 | 165.0120 | 162.2186 | 145.6843 | 140.6143 | 153.3323                    | 152.7591          | 171.0733   | 180.0033 | 192.7028 | (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   | 0.0000   | (63)     |      |
| Output from w/h                                                 |          |          |          |          |          |          |          |                             |                   |            |          |          |          |      |
|                                                                 | 197.2089 | 174.0371 | 183.2872 | 165.0120 | 162.2186 | 145.6843 | 140.6143 | 153.3323                    | 152.7591          | 171.0733   | 180.0033 | 192.7028 | (64)     |      |
|                                                                 |          |          |          |          |          |          |          | Total per year (kWh/year) = | Sum(64)m =        | 2017.9331  | 64)      |          |          |      |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |                             |                   |            |          |          |          |      |
|                                                                 | 91.0034  | 80.8377  | 86.3744  | 79.4776  | 79.3691  | 73.0511  | 72.1857  | 76.4144                     | 75.4035           | 82.3133    | 84.4622  | 89.5051  | (65)     |      |

| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 17.5892  | 15.6226  | 12.7051  | 9.6186   | 7.1900   | 6.0701   | 6.5590   | 8.5256   | 11.4430  | 14.5296  | 16.9581  | 18.0780 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 197.2971 | 199.3444 | 194.1852 | 183.2019 | 169.3374 | 156.3068 | 147.6015 | 145.5542 | 150.7134 | 161.6967 | 175.5612 | 188.5918 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 (71) |
| Water heating gains (Table 5)                                                       | 122.3164 | 120.2941 | 116.0946 | 110.3855 | 106.6789 | 101.4598 | 97.0238  | 102.7076 | 104.7270 | 110.6362 | 117.3086 | 120.3026 (72) |
| Total internal gains                                                                | 393.8945 | 391.9529 | 379.6768 | 359.8978 | 339.8982 | 320.5286 | 307.8761 | 313.4792 | 323.5753 | 343.5543 | 366.5197 | 383.6643 (73) |

| [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       |          |          |          | 9.3300     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 30.3197 (74) |          |          |               |
| East        |          |          |          | 5.1200     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 30.7319 (76) |          |          |               |
| West        |          |          |          | 6.2400     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 37.4549 (80) |          |          |               |
| Solar gains | 98.5061  | 191.3295 | 318.1279 | 478.5243   | 605.6733                       | 629.9957                          | 595.5822                           | 497.6254                     | 373.8636     | 227.2479 | 122.4237 | 81.3452 (83)  |
| Total gains | 492.4006 | 583.2825 | 697.8047 | 838.4222   | 945.5715                       | 950.5243                          | 903.4583                           | 811.1046                     | 697.4389     | 570.8022 | 488.9434 | 465.0134 (84) |

| 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                                                                         | 59.9012 | 60.0651 | 60.2266 | 60.9970 | 61.1433 | 61.8339 | 61.8339 | 61.9635 | 61.5661                   | 61.1433 | 60.8480 | 60.5423      |
| alpha                                                                       | 4.9934  | 5.0043  | 5.0151  | 5.0665  | 5.0762  | 5.1223  | 5.1223  | 5.1309  | 5.1044                    | 5.0762  | 5.0565  | 5.0362       |
| util living area                                                            | 0.9985  | 0.9961  | 0.9867  | 0.9443  | 0.8229  | 0.6289  | 0.4699  | 0.5404  | 0.8232                    | 0.9768  | 0.9966  | 0.9989 (86)  |
| Tweekday                                                                    | 18.3928 | 18.5765 | 18.8974 | 19.3137 | 19.5809 | 19.6785 | 19.6887 | 19.6898 | 19.6287                   | 19.2547 | 18.7578 | 18.3764      |
| Tweekend                                                                    | 20.3419 | 20.4223 | 20.5646 | 20.7524 | 20.8919 | 20.9515 | 20.9631 | 20.9606 | 20.9117                   | 20.7190 | 20.4974 | 20.3306      |
| 24 / 16                                                                     | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| 24 / 9                                                                      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| 16 / 9                                                                      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| MIT                                                                         | 19.9843 | 20.1064 | 20.3280 | 20.6133 | 20.8331 | 20.9255 | 20.9430 | 20.9392 | 20.8622                   | 20.5663 | 20.2153 | 19.9669 (87) |
| Th 2                                                                        | 19.7330 | 19.7360 | 19.7389 | 19.7527 | 19.7553 | 19.7674 | 19.7674 | 19.7696 | 19.7627                   | 19.7553 | 19.7501 | 19.7446 (88) |
| util rest of house                                                          | 0.9978  | 0.9944  | 0.9807  | 0.9196  | 0.7558  | 0.5209  | 0.3414  | 0.4024  | 0.7287                    | 0.9619  | 0.9948  | 0.9984 (89)  |
| Tweekday                                                                    | 18.3928 | 18.5765 | 18.8974 | 19.3137 | 19.5809 | 19.6785 | 19.6887 | 19.6898 | 19.6287                   | 19.2547 | 18.7578 | 18.3764      |
| Tweekend                                                                    | 18.3928 | 18.5765 | 18.8974 | 19.3137 | 19.5809 | 19.6785 | 19.6887 | 19.6898 | 19.6287                   | 19.2547 | 18.7578 | 18.3764      |
| MIT 2                                                                       | 18.3928 | 18.5765 | 18.8974 | 19.3137 | 19.5809 | 19.6785 | 19.6887 | 19.6898 | 19.6287                   | 19.2547 | 18.7578 | 18.3764 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.4714 (91)  |
| MIT                                                                         | 19.1430 | 19.2977 | 19.5718 | 19.9264 | 20.1712 | 20.2664 | 20.2800 | 20.2788 | 20.2102                   | 19.8730 | 19.4449 | 19.1262 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 19.1430 | 19.2977 | 19.5718 | 19.9264 | 20.1712 | 20.2664 | 20.2800 | 20.2788 | 20.2102                   | 19.8730 | 19.4449 | 19.1262 (93) |

|                  | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
|------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation      | 0.9974    | 0.9936    | 0.9797    | 0.9236    | 0.7803   | 0.5662   | 0.3956   | 0.4609   | 0.7668   | 0.9637   | 0.9942    | 0.9980 (94)    |
| Useful gains     | 491.1132  | 579.5768  | 683.6444  | 774.3848  | 737.8228 | 538.2251 | 357.3635 | 373.8637 | 534.8119 | 550.1031 | 486.1049  | 464.1001 (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 | 1495.9311 | 1447.0914 | 1310.3010 | 1091.3114 | 836.4148 | 553.2257 | 359.2934 | 377.9112 | 599.1557 | 915.5812 | 1224.7967 | 1488.3855 (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)   |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Energy Calculations Ltd  
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### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                      |          |          |          |          |         |        |        |        |        |          |              |                |
|----------------------|----------|----------|----------|----------|---------|--------|--------|--------|--------|----------|--------------|----------------|
| Space heating kWh    | 747.5845 | 582.9698 | 466.2325 | 228.1872 | 73.3525 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 271.9157 | 531.8581     | 762.0684 (98)  |
| Space heating        |          |          |          |          |         |        |        |        |        |          |              | 3664.1686 (98) |
| Space heating per m2 |          |          |          |          |         |        |        |        |        |          | (98) / (4) = | 52.3453 (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 %)                      |          |          |          |          |          |          |          |          |          |          |          | 302.4894 (206)  |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 100.0000 (208)  |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          | 1211.3378 (211) |
| Jan                                                                   | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                 |
| Space heating requirement                                             | 747.5845 | 582.9698 | 466.2325 | 228.1872 | 73.3525  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 271.9157 | 531.8581 | 762.0684 (98)   |
| Space heating efficiency (main heating system 1)                      | 302.4894 | 302.4894 | 302.4894 | 302.4894 | 302.4894 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 302.4894 | 302.4894 | 302.4894 (210)  |
| Space heating fuel (main heating system)                              | 247.1440 | 192.7240 | 154.1318 | 75.4364  | 24.2496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 89.8926  | 175.8270 | 251.9322 (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                                             | 197.2089 | 174.0371 | 183.2872 | 165.0120 | 162.2186 | 145.6843 | 140.6143 | 153.3323 | 152.7591 | 171.0733 | 180.0033 | 192.7028 (64)   |
| Efficiency of water heater (217)m                                     | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 (216)  |
| Fuel for water heating, kWh/month                                     | 116.3887 | 102.7131 | 108.1723 | 97.3867  | 95.7381  | 85.9798  | 82.9877  | 90.4936  | 90.1553  | 100.9639 | 106.2343 | 113.7292 (219)  |
| Water heating fuel used                                               |          |          |          |          |          |          |          |          |          |          |          | 1190.9426 (219) |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          | 1211.3378 (211) |
| Space heating fuel - secondary                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Electricity for pumps and fans:                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Total electricity for the above, kWh/year                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)                   |          |          |          |          |          |          |          |          |          |          |          | 310.6304 (232)  |
| Energy saving/generation technologies (Appendices M,N and Q)          |          |          |          |          |          |          |          |          |          |          |          |                 |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          | 2712.9107 (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               | 1211.3378       | 0.5190                     | 628.6843 (261)        |
| Space heating - secondary                   | 0.0000          | 0.5190                     | 0.0000 (263)          |
| Water heating (other fuel)                  | 1190.9426       | 0.5190                     | 618.0992 (264)        |
| Space and water heating                     |                 |                            | 1246.7835 (265)       |
| Pumps and fans                              | 0.0000          | 0.0000                     | 0.0000 (267)          |
| Energy for lighting                         | 310.6304        | 0.5190                     | 161.2172 (268)        |
| Energy saving/generation technologies       |                 |                            |                       |
| PV Unit                                     | -300.0000       | 0.5190                     | -155.7000 (269)       |
| Total CO2, kg/year                          |                 |                            | 1252.3006 (272)       |
| Dwelling Carbon Dioxide Emission Rate (DER) |                 |                            | 17.8900 (273)         |

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

|                                                                                 |     |             |
|---------------------------------------------------------------------------------|-----|-------------|
| DER                                                                             |     | 17.8900 ZC1 |
| Total Floor Area                                                                | TFA | 70.0000     |
| Assumed number of occupants                                                     | N   | 2.2461      |
| CO2 emission factor in Table 12 for electricity displaced from grid             | EF  | 0.5190      |
| CO2 emissions from appliances, equation (L14)                                   |     | 16.7020 ZC2 |
| CO2 emissions from cooking, equation (L16)                                      |     | 2.4701 ZC3  |
| Total CO2 emissions                                                             |     | 37.0621 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                                                               |     | 37.0621 ZC8 |

# FULL SAP CALCULATION PRINTOUT

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Energy Calculations Ltd  
SAP ♦ CODE ♦ SBEM ♦ DESIGN

### 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                                           | 70.0000 (1b)              | x 2.4000 (2b)                   | = 168.0000 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 70.0000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 168.0000 (5)              |

#### 2. Ventilation rate

|                                                                           | main<br>heating | secondary<br>heating | other | total | m <sup>3</sup> per hour                 |
|---------------------------------------------------------------------------|-----------------|----------------------|-------|-------|-----------------------------------------|
| Number of chimneys                                                        | 0               | +                    | 0     | =     | 0 * 40 = 0.0000 (6a)                    |
| Number of open flues                                                      | 0               | +                    | 0     | =     | 0 * 20 = 0.0000 (6b)                    |
| Number of intermittent fans                                               |                 |                      |       |       | 2 * 10 = 20.0000 (7a)                   |
| Number of passive vents                                                   |                 |                      |       |       | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                              |                 |                      |       |       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = |                 |                      |       |       | 20.0000 / (5) = 0.1190 (8)              |
| Pressure test                                                             |                 |                      |       |       | Yes                                     |
| Measured/design AP50                                                      |                 |                      |       |       | 5.0000                                  |
| Infiltration rate                                                         |                 |                      |       |       | 0.3690 (18)                             |
| Number of sides sheltered                                                 |                 |                      |       |       | 1 (19)                                  |
| Shelter factor                                                            |                 |                      |       |       | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                      |                 |                      |       |       | (21) = (18) x (20) = 0.3414 (21)        |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac    | 0.4352 | 0.4267 | 0.4182 | 0.3755 | 0.3670 | 0.3243 | 0.3243 | 0.3158 | 0.3414 | 0.3670 | 0.3840 | 0.4011 (22b) |
| Effective ac    | 0.5947 | 0.5910 | 0.5874 | 0.5705 | 0.5673 | 0.5526 | 0.5526 | 0.5499 | 0.5583 | 0.5673 | 0.5737 | 0.5804 (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                                                |             |                | 2.1200               | 1.2000           | 2.5440       |                   |               | (26a)         |         |         |         |         |      |
| TER Opening Type (Uw = 1.40)                                        |             |                | 15.3900              | 1.3258           | 20.4034      |                   |               | (27)          |         |         |         |         |      |
| Main Floor                                                          |             |                | 70.0000              | 0.1300           | 9.1000       |                   |               | (28a)         |         |         |         |         |      |
| Main Wall                                                           | 59.9500     | 17.5100        | 42.4400              | 0.1800           | 7.6392       |                   |               | (29a)         |         |         |         |         |      |
| wall to Stairs                                                      | 13.1500     |                | 13.1500              | 0.1800           | 2.3670       |                   |               | (29a)         |         |         |         |         |      |
| Flat roof                                                           | 4.1700      |                | 4.1700               | 0.1300           | 0.5421       |                   |               | (30)          |         |         |         |         |      |
| Total net area of external elements Aum(A, m2)                      |             |                | 147.2700             |                  |              |                   |               | (31)          |         |         |         |         |      |
| Fabric heat loss, W/K = Sum (A x U)                                 |             |                | (26)...(30) + (32) = |                  | 42.5957      |                   |               | (33)          |         |         |         |         |      |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                   |             |                |                      |                  |              |                   |               | 250.0000 (35) |         |         |         |         |      |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)          |             |                |                      |                  |              |                   |               | 11.3373 (36)  |         |         |         |         |      |
| Total fabric heat loss                                              |             |                |                      |                  |              | (33) + (36) =     | 53.9330       | (37)          |         |         |         |         |      |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |             |                |                      |                  |              |                   |               |               |         |         |         |         |      |
| (38)m                                                               | Jan         | Feb            | Mar                  | Apr              | May          | Jun               | Jul           | Aug           | Sep     | Oct     | Nov     | Dec     |      |
| Heat transfer coeff                                                 | 32.9712     | 32.7673        | 32.5675              | 31.6287          | 31.4530      | 30.6353           | 30.6353       | 30.4839       | 30.9503 | 31.4530 | 31.8083 | 32.1798 | (38) |
| Average = Sum(39)m / 12 =                                           | 86.9042     | 86.7003        | 86.5005              | 85.5617          | 85.3860      | 84.5683           | 84.5683       | 84.4169       | 84.8833 | 85.3860 | 85.7413 | 86.1128 | (39) |
|                                                                     |             |                |                      |                  |              |                   |               |               |         |         |         | 85.5608 | (39) |
| HLP                                                                 | Jan         | Feb            | Mar                  | Apr              | May          | Jun               | Jul           | Aug           | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)                                                       | 1.2415      | 1.2386         | 1.2357               | 1.2223           | 1.2198       | 1.2081            | 1.2081        | 1.2060        | 1.2126  | 1.2198  | 1.2249  | 1.2302  | (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                                           |          |          |          |          |          |         |         |         |          |          |          | 2.2461 (42)   |
| Average daily hot water use (litres/day)                    |          |          |          |          |          |         |         |         |          |          |          | 87.5455 (43)  |
| Daily hot water use                                         |          |          |          |          |          |         |         |         |          |          |          |               |
| Energy conte                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun     | Jul     | Aug     | Sep      | Oct      | Nov      | Dec           |
| Energy content (annual)                                     | 96.3000  | 92.7982  | 89.2964  | 85.7946  | 82.2927  | 78.7909 | 78.7909 | 82.2927 | 85.7946  | 89.2964  | 92.7982  | 96.3000 (44)  |
| Distribution loss (46)m = 0.15 x (45)m                      | 142.8101 | 124.9027 | 128.8884 | 112.3680 | 107.8198 | 93.0403 | 86.2155 | 98.9335 | 100.1151 | 116.6745 | 127.3593 | 138.3040 (45) |
| Water storage loss:                                         |          |          |          |          |          |         |         |         |          |          |          |               |
| Store volume                                                | 21.4215  | 18.7354  | 19.3333  | 16.8552  | 16.1730  | 13.9560 | 12.9323 | 14.8400 | 15.0173  | 17.5012  | 19.1039  | 20.7456 (46)  |
| a) If manufacturer declared loss factor is known (kWh/day): |          |          |          |          |          |         |         |         |          |          |          | 210.0000 (47) |
| Temperature factor from Table 2b                            |          |          |          |          |          |         |         |         |          |          |          | 1.7016 (48)   |
|                                                             |          |          |          |          |          |         |         |         |          |          |          | 0.5400 (49)   |

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|                                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          | 0.9188 (55)   |
| Total storage loss                                              | 28.4842  | 25.7277  | 28.4842  | 27.5653  | 28.4842  | 27.5653  | 28.4842  | 28.4842  | 27.5653  | 28.4842  | 27.5653  | 28.4842 (56)  |
| If cylinder contains dedicated solar storage                    | 28.4842  | 25.7277  | 28.4842  | 27.5653  | 28.4842  | 27.5653  | 28.4842  | 28.4842  | 27.5653  | 28.4842  | 27.5653  | 28.4842 (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 | 194.5567 | 171.6415 | 180.6349 | 162.4453 | 159.5664 | 143.1176 | 137.9621 | 150.6801 | 150.1924 | 168.4211 | 177.4367 | 190.0506 (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                                                 | 194.5567 | 171.6415 | 180.6349 | 162.4453 | 159.5664 | 143.1176 | 137.9621 | 150.6801 | 150.1924 | 168.4211 | 177.4367 | 190.0506 (64) |
| Heat gains from water heating, kWh/month                        | 88.8816  | 78.9212  | 84.2526  | 77.4242  | 77.2473  | 70.9978  | 70.0639  | 74.2927  | 73.3501  | 80.1915  | 82.4089  | 87.3833 (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                                                                               | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 17.5956  | 15.6283  | 12.7098  | 9.6221   | 7.1926   | 6.0723   | 6.5614   | 8.5287   | 11.4472  | 14.5349  | 16.9643  | 18.0846  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 197.2971 | 199.3444 | 194.1852 | 183.2019 | 169.3374 | 156.3068 | 147.6015 | 145.5542 | 150.7134 | 161.6967 | 175.5612 | 188.5918 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | (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)                                 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | (71) |
| Water heating gains (Table 5)                                                       | 119.4646 | 117.4423 | 113.2428 | 107.5337 | 103.8271 | 98.6080  | 94.1719  | 99.8557  | 101.8752 | 107.7843 | 114.4567 | 117.4507 | (72) |
| Total internal gains                                                                | 394.0491 | 392.1068 | 379.8296 | 360.0495 | 340.0490 | 320.6790 | 308.0267 | 313.6305 | 323.7277 | 343.7078 | 366.6741 | 383.8190 | (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       |          |          |          |          | 6.9400     | 10.6334                        |          | 0.6300                            | 0.7000                             | 0.7700                       |          | 22.5529 (74)  |  |
| East        |          |          |          |          | 3.8100     | 19.6403                        |          | 0.6300                            | 0.7000                             | 0.7700                       |          | 22.8688 (76)  |  |
| West        |          |          |          |          | 4.6400     | 19.6403                        |          | 0.6300                            | 0.7000                             | 0.7700                       |          | 27.8508 (80)  |  |
| -----       |          |          |          |          |            |                                |          |                                   |                                    |                              |          |               |  |
| Solar gains | 73.2725  | 142.3181 | 236.6355 | 355.9444 | 450.5226   | 468.6146                       | 443.0165 | 370.1525                          | 278.0939                           | 169.0356                     | 91.0633  | 60.5106 (83)  |  |
| Total gains | 467.3217 | 534.4249 | 616.4652 | 715.9940 | 790.5716   | 789.2936                       | 751.0432 | 683.7830                          | 601.8215                           | 512.7433                     | 457.7374 | 444.3296 (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                                                                         | 55.9364 | 56.0680 | 56.1975 | 56.8141 | 56.9310 | 57.4814 | 57.4814 | 57.5846 | 57.2682                   | 56.9310 | 56.6951 | 56.4505      |
| alpha                                                                       | 4.7291  | 4.7379  | 4.7465  | 4.7876  | 4.7954  | 4.8321  | 4.8321  | 4.8390  | 4.8179                    | 4.7954  | 4.7797  | 4.7634       |
| util living area                                                            | 0.9968  | 0.9934  | 0.9822  | 0.9401  | 0.8293  | 0.6466  | 0.4869  | 0.5514  | 0.8167                    | 0.9683  | 0.9936  | 0.9975 (86)  |
| MIT                                                                         | 19.6995 | 19.8580 | 20.1430 | 20.5204 | 20.8165 | 20.9590 | 20.9915 | 20.9850 | 20.8750                   | 20.4813 | 20.0245 | 19.6731 (87) |
| Th 2                                                                        | 19.8870 | 19.8893 | 19.8915 | 19.9022 | 19.9042 | 19.9135 | 19.9135 | 19.9152 | 19.9099                   | 19.9042 | 19.9002 | 19.8959 (88) |
| util rest of house                                                          | 0.9957  | 0.9912  | 0.9759  | 0.9187  | 0.7739  | 0.5526  | 0.3711  | 0.4296  | 0.7368                    | 0.9528  | 0.9910  | 0.9966 (89)  |
| MIT 2                                                                       | 18.1682 | 18.4005 | 18.8143 | 19.3522 | 19.7321 | 19.8878 | 19.9106 | 19.9094 | 19.8133                   | 19.3107 | 18.6519 | 18.1358 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.4714 (91)  |
| MIT                                                                         | 18.8901 | 19.0876 | 19.4407 | 19.9030 | 20.2433 | 20.3928 | 20.4202 | 20.4165 | 20.3138                   | 19.8625 | 19.2990 | 18.8605 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.8901 | 19.0876 | 19.4407 | 19.9030 | 20.2433 | 20.3928 | 20.4202 | 20.4165 | 20.3138                   | 19.8625 | 19.2990 | 18.8605 (93) |

#### 8. Space heating requirement

|                      |           |           |           |          |          |          |          |          |          |          |           |           |              |
|----------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|--------------|
| Utilisation          | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec       |              |
| Useful gains         | 0.9944    | 0.9890    | 0.9726    | 0.9188   | 0.7926   | 0.5956   | 0.4260   | 0.4873   | 0.7694   | 0.9521   | 0.9891    | 0.9955    | (94)         |
| Ext temp.            | 464.6830  | 528.5543  | 599.5962  | 657.8254 | 626.5902 | 470.1192 | 319.9173 | 333.2269 | 463.0147 | 488.1831 | 452.7382  | 442.3338  | (95)         |
| Heat loss rate W     | 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)         |
| Month fracti         | 1267.9403 | 1230.0678 | 1119.3754 | 941.4313 | 729.4820 | 489.8866 | 323.0641 | 339.0610 | 527.4508 | 790.8918 | 1045.9592 | 1262.4588 | (97)         |
| Space heating kWh    | 1.0000    | 1.0000    | 1.0000    | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000   | 1.0000    | 1.0000    | (97a)        |
| Space heating        | 597.6234  | 471.4171  | 386.7157  | 204.1963 | 76.5515  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 225.2152 | 427.1191  | 610.1730  | (98)         |
| Space heating per m2 |           |           |           |          |          |          |          |          |          |          |           |           | (98) / (4) = |

#### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Energy Calculations Ltd  
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### 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 %)                      |          |          |          |          |          |          |          |          |          |          |          | 93.5000 (206)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          | 3207.4988 (211) |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                             | 597.6234 | 471.4171 | 386.7157 | 204.1963 | 76.5515  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 225.2152 | 427.1191 | 610.1730 (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)                              | 639.1695 | 504.1894 | 413.5997 | 218.3917 | 81.8733  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 240.8719 | 456.8119 | 652.5914 (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                                             | 194.5567 | 171.6415 | 180.6349 | 162.4453 | 159.5664 | 143.1176 | 137.9621 | 150.6801 | 150.1924 | 168.4211 | 177.4367 | 190.0506 (64)   |
| Efficiency of water heater (217)m                                     | 87.6148  | 87.3730  | 86.7947  | 85.4251  | 82.9808  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 85.5897  | 87.0733  | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                     | 222.0593 | 196.4469 | 208.1175 | 190.1612 | 192.2931 | 179.3454 | 172.8848 | 188.8222 | 188.2111 | 196.7772 | 203.7785 | 216.6881 (219)  |
| Water heating fuel used                                               |          |          |          |          |          |          |          |          |          |          |          | 2355.5851 (219) |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          | 3207.4988 (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)                   |          |          |          |          |          |          |          |          |          |          |          | 310.7438 (232)  |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          | 5948.8277 (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                                                                     | 3207.4988          | 0.2160                        | 692.8197 (261)           |
| Space heating - secondary                                                                         | 0.0000             | 0.0000                        | 0.0000 (263)             |
| Water heating (other fuel)                                                                        | 2355.5851          | 0.2160                        | 508.8064 (264)           |
| Space and water heating                                                                           |                    |                               | 1201.6261 (265)          |
| Pumps and fans                                                                                    | 75.0000            | 0.5190                        | 38.9250 (267)            |
| Energy for lighting                                                                               | 310.7438           | 0.5190                        | 161.2761 (268)           |
| Total CO2, kg/m2/year                                                                             |                    |                               | 1401.8272 (272)          |
| Emissions per m2 for space and water heating                                                      |                    |                               | 17.1661 (272a)           |
| Fuel factor (electricity)                                                                         |                    |                               | 1.5500                   |
| Emissions per m2 for lighting                                                                     |                    |                               | 2.3039 (272b)            |
| Emissions per m2 for pumps and fans                                                               |                    |                               | 0.5561 (272c)            |
| Target Carbon Dioxide Emission Rate (TER) = (17.1661 * 1.55) + 2.3039 + 0.5561, rounded to 2 d.p. |                    |                               | 29.4700 (273)            |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Energy Calculations Ltd  
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### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF FABRIC ENERGY EFFICIENCY 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                                           | 70.0000 (1b)              | x 2.4000 (2b)                   | = 168.0000 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 70.0000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 168.0000 (5)              |

#### 2. Ventilation rate

|                                                                           | main<br>heating | secondary<br>heating | other | total | m <sup>3</sup> per hour                 |
|---------------------------------------------------------------------------|-----------------|----------------------|-------|-------|-----------------------------------------|
| Number of chimneys                                                        | 0               | +                    | 0     | =     | 0 * 40 = 0.0000 (6a)                    |
| Number of open flues                                                      | 0               | +                    | 0     | =     | 0 * 20 = 0.0000 (6b)                    |
| Number of intermittent fans                                               |                 |                      |       |       | 2 * 10 = 20.0000 (7a)                   |
| Number of passive vents                                                   |                 |                      |       |       | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                              |                 |                      |       |       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = |                 |                      |       |       | 20.0000 / (5) = 0.1190 (8)              |
| Pressure test                                                             |                 |                      |       |       | Yes                                     |
| Measured/design AP50                                                      |                 |                      |       |       | 5.0000                                  |
| Infiltration rate                                                         |                 |                      |       |       | 0.3690 (18)                             |
| Number of sides sheltered                                                 |                 |                      |       |       | 1 (19)                                  |
| Shelter factor                                                            |                 |                      |       |       | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                      |                 |                      |       |       | (21) = (18) x (20) = 0.3414 (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 | 0.4352 | 0.4267 | 0.4182 | 0.3755 | 0.3670 | 0.3243 | 0.3243 | 0.3158 | 0.3414 | 0.3670 | 0.3840 | 0.4011 (22b) |
| Effective ac    | 0.5947 | 0.5910 | 0.5874 | 0.5705 | 0.5673 | 0.5526 | 0.5526 | 0.5499 | 0.5583 | 0.5673 | 0.5737 | 0.5804 (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   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| External Door                                               |                         |                            | 2.1200                    | 1.4000                        | 2.9680       |                                | (26a)           |
| Windows (Uw = 1.40)                                         |                         |                            | 20.6900                   | 1.3258                        | 27.4299      |                                | (27)            |
| Main Floor                                                  |                         |                            | 70.0000                   | 0.1400                        | 9.8000       | 110.0000                       | 7700.0000 (28a) |
| Main Wall                                                   | 59.9500                 | 22.8100                    | 37.1400                   | 0.2200                        | 8.1708       | 60.0000                        | 2228.4000 (29a) |
| wall to Stairs                                              | 13.1500                 |                            | 13.1500                   | 0.1864                        | 2.4509       | 60.0000                        | 789.0000 (29a)  |
| Flat roof                                                   | 4.1700                  |                            | 4.1700                    | 0.1400                        | 0.5838       | 9.0000                         | 37.5300 (30)    |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 147.2700                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 51.4034      |                                | (33)            |
| Party Wall 1                                                |                         |                            | 9.3300                    | 0.0000                        | 0.0000       | 180.0000                       | 1679.4000 (32)  |
| Party Ceilings 1                                            |                         |                            | 66.0000                   |                               |              | 30.0000                        | 1980.0000 (32b) |
| Internal Wall 1                                             |                         |                            | 66.5900                   |                               |              | 100.0000                       | 6659.0000 (32c) |

Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K  
Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Total fabric heat loss  
(28)...(30) + (32) + (32a)...(32e) = 21073.3300 (34)  
301.0476 (35)  
14.5781 (36)  
(33) + (36) = 65.9815 (37)

|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |         |         |         |         |         |         |         |         |         |         |         |              |
| (38)m                                                               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Heat transfer coeff                                                 | 32.9712 | 32.7673 | 32.5675 | 31.6287 | 31.4530 | 30.6353 | 30.6353 | 30.4839 | 30.9503 | 31.4530 | 31.8083 | 32.1798 (38) |
| Average = Sum(39)m / 12 =                                           | 98.9527 | 98.7488 | 98.5489 | 97.6101 | 97.4345 | 96.6168 | 96.6168 | 96.4654 | 96.9318 | 97.4345 | 97.7898 | 98.1613 (39) |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 97.6093 (39) |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.4136  | 1.4107  | 1.4078  | 1.3944  | 1.3919  | 1.3802  | 1.3802  | 1.3781  | 1.3847  | 1.3919  | 1.3970  | 1.4023 (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                        |          |          |          |          |          |         |         |         |          |          |          |               |
| Average daily hot water use (litres/day) |          |          |          |          |          |         |         |         |          |          |          | 2.2461 (42)   |
|                                          |          |          |          |          |          |         |         |         |          |          |          | 87.5455 (43)  |
| Daily hot water use                      | Jan      | Feb      | Mar      | Apr      | May      | Jun     | Jul     | Aug     | Sep      | Oct      | Nov      | Dec           |
| Energy conte                             | 96.3000  | 92.7982  | 89.2964  | 85.7946  | 82.2927  | 78.7909 | 78.7909 | 82.2927 | 85.7946  | 89.2964  | 92.7982  | 96.3000 (44)  |
| Energy content (annual)                  | 142.8101 | 124.9027 | 128.8884 | 112.3680 | 107.8198 | 93.0403 | 86.2155 | 98.9335 | 100.1151 | 116.6745 | 127.3593 | 138.3040 (45) |
| Distribution loss (46)m = 0.15 x (45)m   |          |          |          |          |          |         |         |         |          |          |          |               |
|                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000 (46)   |

# FULL SAP CALCULATION PRINTOUT

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### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

|                                              |         |         |         |         |         |         |         |         |         |         |         |         |      |
|----------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Water storage loss:                          |         |         |         |         |         |         |         |         |         |         |         |         |      |
| Total storage loss                           | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | (56) |
| If cylinder contains dedicated solar storage | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | (57) |
| Primary loss                                 | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | (59) |
| Heat gains from water heating, kWh/month     | 30.3472 | 26.5418 | 27.3888 | 23.8782 | 22.9117 | 19.7711 | 18.3208 | 21.0234 | 21.2745 | 24.7933 | 27.0639 | 29.3896 | (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                                                                               | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 17.5892  | 15.6226  | 12.7051  | 9.6186   | 7.1900   | 6.0701   | 6.5590   | 8.5256   | 11.4430  | 14.5296  | 16.9581  | 18.0780  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 197.2971 | 199.3444 | 194.1852 | 183.2019 | 169.3374 | 156.3068 | 147.6015 | 145.5542 | 150.7134 | 161.6967 | 175.5612 | 188.5918 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | (71) |
| Water heating gains (Table 5)                                                       | 40.7892  | 39.4967  | 36.8129  | 33.1642  | 30.7953  | 27.4598  | 24.6247  | 28.2572  | 29.5479  | 33.3244  | 37.5887  | 39.5021  | (72) |
| Total internal gains                                                                | 312.3673 | 311.1556 | 300.3951 | 282.6765 | 264.0146 | 246.5285 | 235.4771 | 239.0289 | 248.3961 | 266.2425 | 286.7999 | 302.8639 | (73) |

#### 6. Solar gains

|       |            |                                |                              |                               |                              |              |
|-------|------------|--------------------------------|------------------------------|-------------------------------|------------------------------|--------------|
| [Jan] | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | Specific data<br>or Table 6b | Specific<br>FF<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |
| North | 9.3300     | 10.6334                        | 0.6300                       | 0.7000                        | 0.7700                       | 30.3197 (74) |
| East  | 5.1200     | 19.6403                        | 0.6300                       | 0.7000                        | 0.7700                       | 30.7319 (76) |
| West  | 6.2400     | 19.6403                        | 0.6300                       | 0.7000                        | 0.7700                       | 37.4545 (80) |

|             |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Solar gains | 98.5061  | 191.3295 | 318.1279 | 478.5243 | 605.6733 | 629.9957 | 595.5822 | 497.6254 | 373.8636 | 227.2479 | 122.4237 | 81.3492  | (83) |
| Total gains | 410.8734 | 502.4851 | 618.5230 | 761.2008 | 869.6879 | 876.5243 | 831.0593 | 736.6542 | 622.2598 | 493.4904 | 409.2235 | 384.2130 | (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                                                                         | 59.1566 | 59.2787 | 59.3989 | 59.9702 | 60.0783 | 60.5868 | 60.5868 | 60.6819 | 60.3899                   | 60.0783 | 59.8600 | 59.6335 |              |
| alpha                                                                       | 4.9438  | 4.9519  | 4.9599  | 4.9980  | 5.0052  | 5.0391  | 5.0391  | 5.0455  | 5.0260                    | 5.0052  | 4.9907  | 4.9756  |              |
| util living area                                                            | 0.9992  | 0.9977  | 0.9910  | 0.9574  | 0.8501  | 0.6647  | 0.5029  | 0.5829  | 0.8626                    | 0.9858  | 0.9983  | 0.9995  | (86)         |
| MIT                                                                         | 19.6223 | 19.7919 | 20.0940 | 20.4968 | 20.8143 | 20.9602 | 20.9920 | 20.9840 | 20.8529                   | 20.4137 | 19.9426 | 19.5942 | (87)         |
| Th 2                                                                        | 19.7529 | 19.7529 | 19.7573 | 19.7676 | 19.7695 | 19.7785 | 19.7785 | 19.7802 | 19.7751                   | 19.7695 | 19.7656 | 19.7616 | (88)         |
| util rest of house                                                          | 0.9989  | 0.9967  | 0.9869  | 0.9377  | 0.7888  | 0.5558  | 0.3680  | 0.4386  | 0.7788                    | 0.9764  | 0.9973  | 0.9992  | (89)         |
| MIT 2                                                                       | 18.5119 | 18.6830 | 18.9845 | 19.3816 | 19.6580 | 19.7638 | 19.7771 | 19.7768 | 19.7021                   | 19.3114 | 18.8421 | 18.4907 | (90)         |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         |         | 0.4714 (91)  |
| MIT                                                                         | 19.0354 | 19.2058 | 19.5076 | 19.9073 | 20.2031 | 20.3278 | 20.3498 | 20.3459 | 20.2446                   | 19.8311 | 19.3609 | 19.0109 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000  |              |
| adjusted MIT                                                                | 19.0354 | 19.2058 | 19.5076 | 19.9073 | 20.2031 | 20.3278 | 20.3498 | 20.3459 | 20.2446                   | 19.8311 | 19.3609 | 19.0109 | (93)         |

#### 8. Space heating requirement

|                      |           |           |           |           |          |          |          |          |          |          |           |           |       |
|----------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-------|
| Utilisation          | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec       |       |
| Useful gains         | 410.3101  | 500.5436  | 609.7901  | 715.8223  | 706.7294 | 531.9684 | 359.1591 | 373.9458 | 507.3131 | 482.1415 | 407.9605  | 383.8365  | (94)  |
| Ext temp.            | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000    | (96)  |
| Heat loss rate W     | 1458.1052 | 1412.6781 | 1281.8817 | 1074.4243 | 828.4978 | 553.4028 | 362.2947 | 380.6457 | 595.6068 | 899.4237 | 1198.9937 | 1453.8613 | (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    | 779.5596  | 612.9544  | 500.0362  | 258.1934  | 90.5957  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 310.4580 | 569.5439  | 796.0984  | (98)  |
| Space heating        |           |           |           |           |          |          |          |          |          |          |           | 3917.4396 | (98)  |
| Space heating per m2 |           |           |           |           |          |          |          |          |          |          |           | 55.9634   | (99)  |

#### 8c. Space cooling requirement

|                                                     |        |        |        |        |         |           |           |          |         |         |        |        |       |
|-----------------------------------------------------|--------|--------|--------|--------|---------|-----------|-----------|----------|---------|---------|--------|--------|-------|
| Calculated for June, July and August. See Table 10b | Jan    | Feb    | Mar    | Apr    | May     | Jun       | Jul       | Aug      | Sep     | Oct     | Nov    | Dec    |       |
| 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 |       |
| Heat loss rate W                                    | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 908.1982  | 714.9645  | 733.1371 | 0.0000  | 0.0000  | 0.0000 | 0.0000 | (100) |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.9053    | 0.9495    | 0.9204   | 0.0000  | 0.0000  | 0.0000 | 0.0000 | (101) |
| Useful loss                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 822.1725  | 678.8697  | 674.7485 | 0.0000  | 0.0000  | 0.0000 | 0.0000 | (102) |
| Total gains                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1107.9328 | 1053.1033 | 944.1016 | 0.0000  | 0.0000  | 0.0000 | 0.0000 | (103) |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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|                                          |        |        |        |        |        |          |          |          |                          |        |        |                |
|------------------------------------------|--------|--------|--------|--------|--------|----------|----------|----------|--------------------------|--------|--------|----------------|
| Month fraction                           | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000   | 1.0000   | 1.0000   | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (103a)  |
| Space cooling kWh                        | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 205.7474 | 278.4298 | 200.3987 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (104)   |
| Space cooling                            |        |        |        |        |        |          |          |          |                          |        |        | 684.5759 (104) |
| Cooled fraction                          |        |        |        |        |        |          |          |          | fC = cooled area / (4) = |        |        | 1.0000 (105)   |
| Intermittency factor (Table 10b)         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.2500   | 0.2500   | 0.2500   | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (106)   |
| Space cooling kWh                        | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 51.4368  | 69.6074  | 50.0997  | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (107)   |
| Space cooling                            |        |        |        |        |        |          |          |          |                          |        |        | 171.1440 (107) |
| Space cooling per m2                     |        |        |        |        |        |          |          |          |                          |        |        | 2.4449 (108)   |
| Energy for space heating                 |        |        |        |        |        |          |          |          |                          |        |        | 55.9634 (99)   |
| Energy for space cooling                 |        |        |        |        |        |          |          |          |                          |        |        | 2.4449 (108)   |
| Total                                    |        |        |        |        |        |          |          |          |                          |        |        | 58.4083 (109)  |
| Dwelling Fabric Energy Efficiency (DFEE) |        |        |        |        |        |          |          |          |                          |        |        | 58.4 (109)     |

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### CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 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                                           | 70.0000 (1b)              | x 2.4000 (2b)                   | = 168.0000 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 70.0000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 168.0000 (5)              |

#### 2. Ventilation rate

|                                                      | main<br>heating              | secondary<br>heating | other | total | m <sup>3</sup> per hour    |
|------------------------------------------------------|------------------------------|----------------------|-------|-------|----------------------------|
| Number of chimneys                                   | 0                            | +                    | 0     | =     | 0 * 40 = 0.0000 (6a)       |
| Number of open flues                                 | 0                            | +                    | 0     | =     | 0 * 20 = 0.0000 (6b)       |
| Number of intermittent fans                          |                              |                      |       |       | 2 * 10 = 20.0000 (7a)      |
| Number of passive vents                              |                              |                      |       |       | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                         |                              |                      |       |       | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(7a)+(7b)+(7c) = |                      |       |       | Air changes per hour       |
| Pressure test                                        |                              |                      |       |       | 20.0000 / (5) = 0.1190 (8) |
| Measured/design AP50                                 |                              |                      |       |       | Yes                        |
| Infiltration rate                                    |                              |                      |       |       | 5.0000                     |
| Number of sides sheltered                            |                              |                      |       |       | 0.3690 (18)                |
|                                                      |                              |                      |       |       | 1 (19)                     |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =  |                      |       |       | 0.9250 (20)                |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =         |                      |       |       | 0.3414 (21)                |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac    | 0.4352 | 0.4267 | 0.4182 | 0.3755 | 0.3670 | 0.3243 | 0.3243 | 0.3158 | 0.3414 | 0.3670 | 0.3840 | 0.4011 (22b) |
| Effective ac    | 0.5947 | 0.5910 | 0.5874 | 0.5705 | 0.5673 | 0.5526 | 0.5526 | 0.5499 | 0.5583 | 0.5673 | 0.5737 | 0.5804 (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                                                |                |                | 2.1200               | 1.2000           | 2.5440         |                   |                | (26a)          |                |                |                |                |      |
| TER Opening Type (Uw = 1.40)                                        |                |                | 15.3900              | 1.3258           | 20.4034        |                   |                | (27)           |                |                |                |                |      |
| Main Floor                                                          |                |                | 70.0000              | 0.1300           | 9.1000         |                   |                | (28a)          |                |                |                |                |      |
| Main Wall                                                           | 59.9500        | 17.5100        | 42.4400              | 0.1800           | 7.6392         |                   |                | (29a)          |                |                |                |                |      |
| wall to Stairs                                                      | 13.1500        |                | 13.1500              | 0.1800           | 2.3670         |                   |                | (29a)          |                |                |                |                |      |
| Flat roof                                                           | 4.1700         |                | 4.1700               | 0.1300           | 0.5421         |                   |                | (30)           |                |                |                |                |      |
| Total net area of external elements Aum(A, m2)                      |                |                | 147.2700             |                  |                |                   |                | (31)           |                |                |                |                |      |
| Fabric heat loss, W/K = Sum (A x U)                                 |                |                | (26)...(30) + (32) = |                  | 42.5957        |                   |                | (33)           |                |                |                |                |      |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                   |                |                |                      |                  |                |                   |                | 250.0000 (35)  |                |                |                |                |      |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)          |                |                |                      |                  |                |                   |                | 11.3373 (36)   |                |                |                |                |      |
| Total fabric heat loss                                              |                |                |                      |                  |                | (33) + (36) =     |                | 53.9330 (37)   |                |                |                |                |      |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |                |                |                      |                  |                |                   |                |                |                |                |                |                |      |
| (38)m                                                               | Jan<br>32.9712 | Feb<br>32.7673 | Mar<br>32.5675       | Apr<br>31.6287   | May<br>31.4530 | Jun<br>30.6353    | Jul<br>30.6353 | Aug<br>30.4839 | Sep<br>30.9503 | Oct<br>31.4530 | Nov<br>31.8083 | Dec<br>32.1798 | (38) |
| Heat transfer coeff                                                 | 86.9042        | 86.7003        | 86.5005              | 85.5617          | 85.3860        | 84.5683           | 84.5683        | 84.4169        | 84.8833        | 85.3860        | 85.7413        | 86.1128        | (39) |
| Average = Sum(39)m / 12 =                                           |                |                |                      |                  |                |                   |                |                |                |                |                | 85.5608        | (39) |
| HLP                                                                 | Jan<br>1.2415  | Feb<br>1.2386  | Mar<br>1.2357        | Apr<br>1.2223    | May<br>1.2198  | Jun<br>1.2081     | Jul<br>1.2081  | Aug<br>1.2060  | Sep<br>1.2126  | Oct<br>1.2198  | Nov<br>1.2249  | Dec<br>1.2302  | (40) |
| HLP (average)                                                       |                |                |                      |                  |                |                   |                |                |                |                |                | 1.2223         | (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                            |             |             |             |             |             |             |             |             |             |                    |             | 2.2461 (42)      |
| Average daily hot water use (litres/day)     |             |             |             |             |             |             |             |             |             |                    |             | 87.5455 (43)     |
| Daily hot water use                          | Jan 96.3000 | Feb 92.7982 | Mar 89.2964 | Apr 85.7946 | May 82.2927 | Jun 78.7909 | Jul 78.7909 | Aug 82.2927 | Sep 85.7946 | Oct 89.2964        | Nov 92.7982 | Dec 96.3000 (44) |
| Energy conte                                 | 142.8101    | 124.9027    | 128.8884    | 112.3680    | 107.8198    | 93.0403     | 86.2155     | 98.9335     | 100.1151    | 116.6745           | 127.3593    | 138.3040 (45)    |
| Energy content (annual)                      |             |             |             |             |             |             |             |             |             | Total = Sum(45)m = |             | 1377.4311 (45)   |
| Distribution loss (46)m = 0.15 x (45)m       | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000             | 0.0000      | 0.0000 (46)      |
| Water storage loss:                          |             |             |             |             |             |             |             |             |             |                    |             |                  |
| Total storage loss                           | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000      | 0.0000             | 0.0000      | 0.0000 (56)      |
| If cylinder contains dedicated solar storage |             |             |             |             |             |             |             |             |             |                    |             |                  |

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|                                          |         |         |         |         |         |         |         |         |         |         |         |              |
|------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Primary loss                             | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (57)  |
| Heat gains from water heating, kWh/month | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (59)  |
|                                          | 30.3472 | 26.5418 | 27.3888 | 23.8782 | 22.9117 | 19.7711 | 18.3208 | 21.0234 | 21.2745 | 24.7933 | 27.0639 | 29.3896 (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                                                                               | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | 112.3062 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 17.5956  | 15.6283  | 12.7098  | 9.6221   | 7.1926   | 6.0723   | 6.5614   | 8.5287   | 11.4472  | 14.5349  | 16.9643  | 18.0846  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 197.2971 | 199.3444 | 194.1852 | 183.2019 | 169.3374 | 156.3068 | 147.6015 | 145.5542 | 150.7134 | 161.6967 | 175.5612 | 188.5918 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | 34.2306  | (69) |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | (71) |
| Water heating gains (Table 5)                                                       | 40.7892  | 39.4967  | 36.8129  | 33.1642  | 30.7953  | 27.4598  | 24.6247  | 28.2572  | 29.5479  | 33.3244  | 37.5887  | 39.5021  | (72) |
| Total internal gains                                                                | 312.3737 | 311.1613 | 300.3997 | 282.6800 | 264.0172 | 246.5308 | 235.4795 | 239.0320 | 248.4003 | 266.2478 | 286.8060 | 302.8705 | (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       |          |          |          | 6.9400     | 10.6334                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       |          |          | 22.5529 (74) |
| East        |          |          |          | 3.8100     | 19.6403                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       |          |          | 22.8688 (76) |
| West        |          |          |          | 4.6400     | 19.6403                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       |          |          | 27.8508 (80) |
|             |          |          |          |            |                                |                                   |                                    |          |          |                              |          |          |              |
| Solar gains | 73.2725  | 142.3181 | 236.6355 | 355.9444   | 450.5226                       | 468.6146                          | 443.0165                           | 370.1525 | 278.0939 | 169.0356                     | 91.0633  | 60.5106  | (83)         |
| Total gains | 385.6463 | 453.4794 | 537.0352 | 638.6245   | 714.5398                       | 715.1453                          | 678.4960                           | 609.1845 | 526.4942 | 435.2834                     | 377.8694 | 363.3810 | (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                                                                         | 55.9364 | 56.0680 | 56.1975 | 56.8141 | 56.9310 | 57.4814 | 57.4814 | 57.5846 | 57.2682                   | 56.9310 | 56.6951 | 56.4505 |         |      |
| alpha                                                                       | 4.7291  | 4.7379  | 4.7465  | 4.7876  | 4.7954  | 4.8321  | 4.8321  | 4.8390  | 4.8179                    | 4.7954  | 4.7797  | 4.7634  |         |      |
| util living area                                                            | 0.9986  | 0.9967  | 0.9897  | 0.9596  | 0.8680  | 0.6972  | 0.5344  | 0.6093  | 0.8691                    | 0.9830  | 0.9972  | 0.9990  | (86)    |      |
| MIT                                                                         | 19.5930 | 19.7537 | 20.0452 | 20.4406 | 20.7697 | 20.9434 | 20.9874 | 20.9772 | 20.8300                   | 20.3904 | 19.9213 | 19.5670 | (87)    |      |
| Th 2                                                                        | 19.8870 | 19.8893 | 19.8915 | 19.9022 | 19.9042 | 19.9135 | 19.9135 | 19.9152 | 19.9099                   | 19.9042 | 19.9002 | 19.8959 | (88)    |      |
| util rest of house                                                          | 0.9981  | 0.9956  | 0.9859  | 0.9439  | 0.8192  | 0.6018  | 0.4096  | 0.4793  | 0.8000                    | 0.9740  | 0.9960  | 0.9986  | (89)    |      |
| MIT 2                                                                       | 18.6073 | 18.7695 | 19.0607 | 19.4538 | 19.7516 | 19.8884 | 19.9104 | 19.9089 | 19.8144                   | 19.4133 | 18.9456 | 18.5885 | (90)    |      |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.4714  | (91)    |      |
| MIT                                                                         | 19.0720 | 19.2335 | 19.5248 | 19.9190 | 20.2315 | 20.3857 | 20.4181 | 20.4125 | 20.2932                   | 19.8740 | 19.4056 | 19.0498 | (92)    |      |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000  |         |      |
| adjusted MIT                                                                | 19.0720 | 19.2335 | 19.5248 | 19.9190 | 20.2315 | 20.3857 | 20.4181 | 20.4125 | 20.2932                   | 19.8740 | 19.4056 | 19.0498 | (93)    |      |

#### 8. Space heating requirement

|                      |           |           |           |          |          |          |          |          |          |              |           |           |       |  |
|----------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|--------------|-----------|-----------|-------|--|
| Utilisation          | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct          | Nov       | Dec       |       |  |
| Useful gains         | 0.9976    | 0.9946    | 0.9842    | 0.9442   | 0.8353   | 0.6454   | 0.4689   | 0.5411   | 0.8275   | 0.9736       | 0.9952    | 0.9982    | (94)  |  |
| Ext temp.            | 384.7311  | 451.0448  | 528.5706  | 602.9674 | 596.8844 | 461.5682 | 318.1524 | 329.6459 | 435.6688 | 423.8069     | 376.0728  | 362.7314  | (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     | 1283.7493 | 1242.7168 | 1126.6543 | 942.8049 | 728.4741 | 489.2896 | 322.8941 | 338.7259 | 525.6999 | 791.8676     | 1055.0960 | 1278.7553 | (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    | 668.8696  | 532.0036  | 444.9743  | 244.6830 | 97.9027  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 273.8371     | 488.8967  | 681.5218  | (98)  |  |
| Space heating        |           |           |           |          |          |          |          |          |          |              |           | 3432.6888 | (98)  |  |
| Space heating per m2 |           |           |           |          |          |          |          |          |          | (98) / (4) = |           | 49.0384   | (99)  |  |

#### 8c. Space cooling requirement

|                                                     |        |        |        |        |         |          |          |          |         |         |        |          |        |  |
|-----------------------------------------------------|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|----------|--------|--|
| Calculated for June, July and August. See Table 10b | Jan    | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep     | Oct     | Nov    | Dec      |        |  |
| 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   |        |  |
| Heat loss rate W                                    | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 794.9425 | 625.8058 | 641.5686 | 0.0000  | 0.0000  | 0.0000 | 0.0000   | (100)  |  |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8827   | 0.9343   | 0.9043   | 0.0000  | 0.0000  | 0.0000 | 0.0000   | (101)  |  |
| Useful loss                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 701.7354 | 584.6697 | 580.1594 | 0.0000  | 0.0000  | 0.0000 | 0.0000   | (102)  |  |
| Total gains                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 919.3110 | 874.7857 | 795.1152 | 0.0000  | 0.0000  | 0.0000 | 0.0000   | (103)  |  |
| Month fracti                                        | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1.0000   | 1.0000   | 1.0000   | 0.0000  | 0.0000  | 0.0000 | 0.0000   | (103a) |  |
| Space cooling kWh                                   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 156.6544 | 215.8463 | 159.9271 | 0.0000  | 0.0000  | 0.0000 | 0.0000   | (104)  |  |
| Space cooling                                       |        |        |        |        |         |          |          |          |         |         |        | 532.4278 | (104)  |  |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Energy Calculations Ltd  
SAP ♦ CODE ♦ SBEM ♦ DESIGN

### CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

|                                        |        |        |        |        |        |         |         |         |        |        |                          |                |
|----------------------------------------|--------|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------------------------|----------------|
| Cooled fraction                        |        |        |        |        |        |         |         |         |        |        | FC = cooled area / (4) = | 1.0000 (105)   |
| Intermittency factor (Table 10b)       | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.2500  | 0.2500  | 0.2500  | 0.0000 | 0.0000 | 0.0000                   | 0.0000 (106)   |
| Space cooling kWh                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 39.1636 | 53.9616 | 39.9818 | 0.0000 | 0.0000 | 0.0000                   | 0.0000 (107)   |
| Space cooling                          |        |        |        |        |        |         |         |         |        |        |                          | 133.1070 (107) |
| Space cooling per m2                   |        |        |        |        |        |         |         |         |        |        |                          | 1.9015 (108)   |
| Energy for space heating               |        |        |        |        |        |         |         |         |        |        |                          | 49.0384 (99)   |
| Energy for space cooling               |        |        |        |        |        |         |         |         |        |        |                          | 1.9015 (108)   |
| Total                                  |        |        |        |        |        |         |         |         |        |        |                          | 50.9399 (109)  |
| Target Fabric Energy Efficiency (TFEE) |        |        |        |        |        |         |         |         |        |        |                          | 58.6 (109)     |

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Energy Calculations Ltd  
SAP ♦ CODE ♦ SBEM ♦ DESIGN

### CALCULATION OF HEAT DEMAND 09 Jan 2014

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

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 70.0000 (1b)              | x 2.4000 (2b)                   | = 168.0000 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 70.0000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 168.0000 (5)              |

#### 2. Ventilation rate

|                                                      | main<br>heating              | secondary<br>heating | other | total | m <sup>3</sup> per hour    |
|------------------------------------------------------|------------------------------|----------------------|-------|-------|----------------------------|
| Number of chimneys                                   | 0                            | +                    | 0     | =     | 0 * 40 = 0.0000 (6a)       |
| Number of open flues                                 | 0                            | +                    | 0     | =     | 0 * 20 = 0.0000 (6b)       |
| Number of intermittent fans                          |                              |                      |       |       | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                              |                              |                      |       |       | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                         |                              |                      |       |       | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(7a)+(7b)+(7c) = |                      |       |       | Air changes per hour       |
| Pressure test                                        |                              |                      |       |       | 30.0000 / (5) = 0.1786 (8) |
| Measured/design AP50                                 |                              |                      |       |       | Yes                        |
| Infiltration rate                                    |                              |                      |       |       | 5.0000                     |
| Number of sides sheltered                            |                              |                      |       |       | 0.4286 (18)                |
|                                                      |                              |                      |       |       | 1 (19)                     |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =  |                      |       |       | 0.9250 (20)                |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =         |                      |       |       | 0.3964 (21)                |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 4.4000 | 4.1000 | 4.1000 | 3.9000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000 | 4.0000 (22)  |
| Wind factor     | 1.1000 | 1.0250 | 1.0250 | 0.9750 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250 | 1.0000 (22a) |
| Adj infilt rate | 0.4361 | 0.4063 | 0.4063 | 0.3865 | 0.3865 | 0.3370 | 0.3370 | 0.3271 | 0.3370 | 0.3766 | 0.3667 | 0.3964 (22b) |
| Effective ac    | 0.5951 | 0.5826 | 0.5826 | 0.5747 | 0.5747 | 0.5568 | 0.5568 | 0.5535 | 0.5568 | 0.5709 | 0.5672 | 0.5786 (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   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| External Door                                               |                         |                            | 2.1200                    | 1.4000                        | 2.9680       |                                | (26a)           |
| Windows (Uw = 1.40)                                         |                         |                            | 20.6900                   | 1.3258                        | 27.4299      |                                | (27)            |
| Main Floor                                                  |                         |                            | 70.0000                   | 0.1400                        | 9.8000       | 110.0000                       | 7700.0000 (28a) |
| Main Wall                                                   | 59.9500                 | 22.8100                    | 37.1400                   | 0.2200                        | 8.1708       | 60.0000                        | 2228.4000 (29a) |
| wall to Stairs                                              | 13.1500                 |                            | 13.1500                   | 0.1864                        | 2.4509       | 60.0000                        | 789.0000 (29a)  |
| Flat roof                                                   | 4.1700                  |                            | 4.1700                    | 0.1400                        | 0.5838       | 9.0000                         | 37.5300 (30)    |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 147.2700                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 51.4034      |                                | (33)            |
| Party Wall 1                                                |                         |                            | 9.3300                    | 0.0000                        | 0.0000       | 180.0000                       | 1679.4000 (32)  |
| Party Ceilings 1                                            |                         |                            | 66.0000                   |                               |              | 40.0000                        | 2640.0000 (32b) |
| Internal Wall 1                                             |                         |                            | 66.5900                   |                               |              | 100.0000                       | 6659.0000 (32c) |

Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K  
Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Total fabric heat loss  
(28)...(30) + (32) + (32a)...(32e) = 21733.3300 (34)  
310.4761 (35)  
14.5781 (36)  
(33) + (36) = 65.9815 (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                                                               | 32.9912 | 32.2969 | 32.2969 | 31.8613 | 31.8613 | 30.8675 | 30.8675 | 30.6850 | 30.8675 | 31.6516 | 31.4474 | 32.0764 (38) |
| Heat transfer coeff                                                 | 98.9727 | 98.2784 | 98.2784 | 97.8427 | 97.8427 | 96.8490 | 96.8490 | 96.6665 | 96.8490 | 97.6331 | 97.4289 | 98.0578 (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 97.6290 (39) |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.4139  | 1.4040  | 1.4040  | 1.3978  | 1.3978  | 1.3836  | 1.3836  | 1.3810  | 1.3836  | 1.3948  | 1.3918  | 1.4008 (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                        |          |          |          |          |          |         |         |         |          |          |          | 2.2461 (42)                       |
| Average daily hot water use (litres/day) |          |          |          |          |          |         |         |         |          |          |          | 87.5455 (43)                      |
| Daily hot water use                      | Jan      | Feb      | Mar      | Apr      | May      | Jun     | Jul     | Aug     | Sep      | Oct      | Nov      | Dec                               |
| Energy conte                             | 96.3000  | 92.7982  | 89.2964  | 85.7946  | 82.2927  | 78.7909 | 78.7909 | 82.2927 | 85.7946  | 89.2964  | 92.7982  | 96.3000 (44)                      |
| Energy content (annual)                  | 142.8101 | 124.9027 | 128.8884 | 112.3680 | 107.8198 | 93.0403 | 86.2155 | 98.9335 | 100.1151 | 116.6745 | 127.3593 | 138.3040 (45)                     |
| Distribution loss (46)m = 0.15 x (45)m   |          |          |          |          |          |         |         |         |          |          |          | Total = Sum(45)m = 1377.4311 (45) |
|                                          | 21.4215  | 18.7354  | 19.3333  | 16.8552  | 16.1730  | 13.9560 | 12.9323 | 14.8400 | 15.0173  | 17.5012  | 19.1039  | 20.7456 (46)                      |

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|                                                                 |          |          |          |          |          |          |          |          |          |          |           |          |      |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------|------|
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |          | 210.0000  | (47)     |      |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          | 1.8600    | (48)     |      |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |          | 0.5400    | (49)     |      |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          | 1.0044    | (55)     |      |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |           |          |      |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |          |           |          |      |
|                                                                 | 31.1364  | 28.1232  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364   | (56)     |      |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |           |          |      |
|                                                                 | 31.1364  | 28.1232  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364   | (57)     |      |
| Primary loss                                                    | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624   | (59)     |      |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |           |          |      |
|                                                                 | 197.2089 | 174.0371 | 183.2872 | 165.0120 | 162.2186 | 145.6843 | 140.6143 | 153.3323 | 152.7591 | 171.0733 | 180.0033  | 192.7028 | (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                                                 |          |          |          |          |          |          |          |          |          |          |           |          |      |
|                                                                 | 197.2089 | 174.0371 | 183.2872 | 165.0120 | 162.2186 | 145.6843 | 140.6143 | 153.3323 | 152.7591 | 171.0733 | 180.0033  | 192.7028 | (64) |
| Total per year (kWh/year) = Sum(64)m =                          |          |          |          |          |          |          |          |          |          |          | 2017.9331 | (64)     |      |
| RHI water heating demand                                        |          |          |          |          |          |          |          |          |          |          | 2018      | (64)     |      |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |          |           |          |      |
|                                                                 | 91.0034  | 80.8377  | 86.3744  | 79.4776  | 79.3691  | 73.0511  | 72.1857  | 76.4144  | 75.4035  | 82.3133  | 84.4622   | 89.5051  | (65) |

| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 134.7675 | 134.7675 | 134.7675 | 134.7675 | 134.7675 | 134.7675 | 134.7675 | 134.7675 | 134.7675 | 134.7675 | 134.7675 | 134.7675 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 43.9729  | 39.0564  | 31.7628  | 24.0465  | 17.9750  | 15.1753  | 16.3974  | 21.3140  | 28.6076  | 36.3239  | 42.3953  | 45.1951 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 294.4732 | 297.5289 | 289.8286 | 273.4356 | 252.7424 | 233.2937 | 220.3007 | 217.2450 | 224.9453 | 241.3383 | 262.0316 | 281.4803 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 50.7229  | 50.7229  | 50.7229  | 50.7229  | 50.7229  | 50.7229  | 50.7229  | 50.7229  | 50.7229  | 50.7229  | 50.7229  | 50.7229 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 | -89.8450 (71) |
| Water heating gains (Table 5)                                                       | 122.3164 | 120.2941 | 116.0946 | 110.3855 | 106.6789 | 101.4598 | 97.0238  | 102.7076 | 104.7270 | 110.6362 | 117.3086 | 120.3026 (72) |
| Total internal gains                                                                | 556.4080 | 552.5248 | 533.3315 | 503.5130 | 473.0417 | 445.5742 | 429.3673 | 436.9120 | 453.9253 | 483.9438 | 517.3809 | 542.6233 (73) |

| [Jan]       |          |          |          |           | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |               |
|-------------|----------|----------|----------|-----------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|---------------|
| North       |          |          |          |           | 9.3300                 | 12.7500                                    | 0.6300                            | 0.7000                             | 0.7700                       | 36.3549 (74) |          |               |
| East        |          |          |          |           | 5.1200                 | 23.7835                                    | 0.6300                            | 0.7000                             | 0.7700                       | 37.2149 (76) |          |               |
| West        |          |          |          |           | 6.2400                 | 23.7835                                    | 0.6300                            | 0.7000                             | 0.7700                       | 45.3557 (80) |          |               |
| Solar gains | 118.9255 | 202.4007 | 334.9069 | 511.6568  | 630.3063               | 692.9542                                   | 648.8815                          | 553.3382                           | 419.7436                     | 258.3088     | 145.7252 | 98.6920 (83)  |
| Total gains | 675.3335 | 754.9255 | 868.2384 | 1015.1698 | 1103.3480              | 1138.5284                                  | 1078.2488                         | 990.2502                           | 873.6689                     | 742.2526     | 663.1060 | 641.3153 (84) |

| 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                                                                         | 60.9970 | 61.4279 | 61.4279 | 61.7014 | 61.7014 | 62.3346 | 62.3346 | 62.4522 | 62.3346                   | 61.8339 | 61.9635 | 61.5661      |
| alpha                                                                       | 5.0665  | 5.0952  | 5.0952  | 5.1134  | 5.1134  | 5.1556  | 5.1556  | 5.1635  | 5.1556                    | 5.1223  | 5.1309  | 5.1044       |
| util living area                                                            | 0.9925  | 0.9857  | 0.9592  | 0.8699  | 0.6881  | 0.4548  | 0.3049  | 0.3504  | 0.6528                    | 0.9172  | 0.9835  | 0.9940 (86)  |
| Tweekday                                                                    | 18.7207 | 18.8941 | 19.1984 | 19.5099 | 19.6574 | 19.6973 | 19.6988 | 19.7008 | 19.6865                   | 19.4891 | 19.0724 | 18.7059      |
| Tweekend                                                                    | 20.4808 | 20.5560 | 20.6956 | 20.8486 | 20.9379 | 20.9632 | 20.9657 | 20.9655 | 20.9501                   | 20.8307 | 20.6320 | 20.4706      |
| 24 / 16                                                                     | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| 24 / 9                                                                      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| 16 / 9                                                                      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| MIT                                                                         | 20.1987 | 20.3131 | 20.5302 | 20.7636 | 20.9041 | 20.9435 | 20.9471 | 20.9467 | 20.9220                   | 20.7387 | 20.4254 | 20.1830 (87) |
| Th 2                                                                        | 19.7527 | 19.7603 | 19.7603 | 19.7651 | 19.7651 | 19.7760 | 19.7760 | 19.7780 | 19.7760                   | 19.7674 | 19.7696 | 19.7627 (88) |
| util rest of house                                                          | 0.9894  | 0.9798  | 0.9425  | 0.8235  | 0.6038  | 0.3541  | 0.1954  | 0.2320  | 0.5398                    | 0.8740  | 0.9754  | 0.9915 (89)  |
| Tweekday                                                                    | 18.7207 | 18.8941 | 19.1984 | 19.5099 | 19.6574 | 19.6973 | 19.6988 | 19.7008 | 19.6865                   | 19.4891 | 19.0724 | 18.7059      |
| Tweekend                                                                    | 18.7207 | 18.8941 | 19.1984 | 19.5099 | 19.6574 | 19.6973 | 19.6988 | 19.7008 | 19.6865                   | 19.4891 | 19.0724 | 18.7059      |
| MIT 2                                                                       | 18.7207 | 18.8941 | 19.1984 | 19.5099 | 19.6574 | 19.6973 | 19.6988 | 19.7008 | 19.6865                   | 19.4891 | 19.0724 | 18.7059 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.4714 (91)  |
| MIT                                                                         | 19.4175 | 19.5631 | 19.8262 | 20.1009 | 20.2452 | 20.2848 | 20.2873 | 20.2882 | 20.2690                   | 20.0782 | 19.7103 | 19.4022 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 19.4175 | 19.5631 | 19.8262 | 20.1009 | 20.2452 | 20.2848 | 20.2873 | 20.2882 | 20.2690                   | 20.0782 | 19.7103 | 19.4022 (93) |

|                  | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
|------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation      | 0.9883    | 0.9786    | 0.9435    | 0.8374    | 0.6381   | 0.3964   | 0.2413   | 0.2816   | 0.5873   | 0.8867   | 0.9749    | 0.9905 (94)    |
| Useful gains     | 667.4444  | 738.7965  | 819.2078  | 850.1506  | 704.0044 | 451.3351 | 260.1283 | 278.9000 | 513.1024 | 658.1253 | 646.4744  | 635.2242 (95)  |
| Ext temp.        | 4.9000    | 5.5000    | 7.3000    | 9.7000    | 12.7000  | 15.6000  | 17.6000  | 17.4000  | 14.8000  | 11.4000  | 7.8000    | 4.9000 (96)    |
| Heat loss rate W |           |           |           |           |          |          |          |          |          |          |           |                |
|                  | 1436.8313 | 1382.0963 | 1231.0579 | 1017.6556 | 738.2383 | 453.7205 | 260.2579 | 279.1904 | 529.6629 | 847.2823 | 1160.4027 | 1422.0581 (97) |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Energy Calculations Ltd  
SAP ♦ CODE ♦ SBEM ♦ DESIGN

### CALCULATION OF HEAT DEMAND 09 Jan 2014

|                          |          |          |          |          |         |        |        |        |        |          |          |           |       |
|--------------------------|----------|----------|----------|----------|---------|--------|--------|--------|--------|----------|----------|-----------|-------|
| 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        |          |          |          |          |         |        |        |        |        |          |          |           |       |
|                          | 572.4238 | 432.2974 | 306.4165 | 120.6036 | 25.4700 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 140.7328 | 370.0284 | 585.4045  | (98)  |
| Space heating            |          |          |          |          |         |        |        |        |        |          |          | 2553.3769 | (98)  |
| RHI space heating demand |          |          |          |          |         |        |        |        |        |          |          | 2553      | (98)  |

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Energy Calculations Ltd  
SAP ♦ CODE ♦ SBEM ♦ DESIGN

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 70.0000 (1b)              | x 2.4000 (2b)                   | = 168.0000 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 70.0000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 168.0000 (5)              |

#### 2. Ventilation rate

|                                                      | main<br>heating              | secondary<br>heating | other | total | m <sup>3</sup> per hour    |
|------------------------------------------------------|------------------------------|----------------------|-------|-------|----------------------------|
| Number of chimneys                                   | 0                            | +                    | 0     | =     | 0 * 40 = 0.0000 (6a)       |
| Number of open flues                                 | 0                            | +                    | 0     | =     | 0 * 20 = 0.0000 (6b)       |
| Number of intermittent fans                          |                              |                      |       |       | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                              |                              |                      |       |       | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                         |                              |                      |       |       | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(7a)+(7b)+(7c) = |                      |       |       | Air changes per hour       |
| Pressure test                                        |                              |                      |       |       | 30.0000 / (5) = 0.1786 (8) |
| Measured/design AP50                                 |                              |                      |       |       | Yes                        |
| Infiltration rate                                    |                              |                      |       |       | 5.0000                     |
| Number of sides sheltered                            |                              |                      |       |       | 0.4286 (18)                |
|                                                      |                              |                      |       |       | 1 (19)                     |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =  |                      |       |       | 0.9250 (20)                |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =         |                      |       |       | 0.3964 (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 |        |        |        |        |        |        |        |        |        |        |        |              |
|                 | 0.5054 | 0.4955 | 0.4856 | 0.4361 | 0.4262 | 0.3766 | 0.3766 | 0.3667 | 0.3964 | 0.4262 | 0.4460 | 0.4658 (22b) |
| Effective ac    | 0.6277 | 0.6228 | 0.6179 | 0.5951 | 0.5908 | 0.5709 | 0.5709 | 0.5672 | 0.5786 | 0.5908 | 0.5995 | 0.6085 (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   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| External Door                                               |                         |                            | 2.1200                    | 1.4000                        | 2.9680       |                                | (26a)           |
| Windows (Uw = 1.40)                                         |                         |                            | 20.6900                   | 1.3258                        | 27.4299      |                                | (27)            |
| Main Floor                                                  |                         |                            | 70.0000                   | 0.1400                        | 9.8000       | 110.0000                       | 7700.0000 (28a) |
| Main Wall                                                   | 59.9500                 | 22.8100                    | 37.1400                   | 0.2200                        | 8.1708       | 60.0000                        | 2228.4000 (29a) |
| wall to Stairs                                              | 13.1500                 |                            | 13.1500                   | 0.1864                        | 2.4509       | 60.0000                        | 789.0000 (29a)  |
| Flat roof                                                   | 4.1700                  |                            | 4.1700                    | 0.1400                        | 0.5838       | 9.0000                         | 37.5300 (30)    |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 147.2700                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 51.4034      |                                | (33)            |
| Party Wall 1                                                |                         |                            | 9.3300                    | 0.0000                        | 0.0000       | 180.0000                       | 1679.4000 (32)  |
| Party Ceilings 1                                            |                         |                            | 66.0000                   |                               |              | 40.0000                        | 2640.0000 (32b) |
| Internal Wall 1                                             |                         |                            | 66.5900                   |                               |              | 100.0000                       | 6659.0000 (32c) |

Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K  
Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Total fabric heat loss  
(28)...(30) + (32) + (32a)...(32e) = 21733.3300 (34)  
310.4761 (35)  
14.5781 (36)  
(33) + (36) = 65.9815 (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                     | 34.8018  | 34.5268  | 34.2573  | 32.9912 | 32.7543 | 31.6516 | 31.6516 | 31.4474 | 32.0764 | 32.7543 | 33.2335 | 33.7345 (38) |
| Heat transfer coeff       | 100.7833 | 100.5083 | 100.2387 | 98.9727 | 98.7358 | 97.6331 | 97.6331 | 97.4289 | 98.0578 | 98.7358 | 99.2150 | 99.7160 (39) |
| Average = Sum(39)m / 12 = |          |          |          |         |         |         |         |         |         |         |         | 98.9715 (39) |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.4398 | 1.4358 | 1.4320 | 1.4139 | 1.4105 | 1.3948 | 1.3948 | 1.3918 | 1.4008 | 1.4105 | 1.4174 | 1.4245 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.4139 (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  
Average daily hot water use (litres/day)  
2.2461 (42)  
87.5455 (43)

|                                        | Jan      | Feb      | Mar      | Apr      | May      | Jun     | Jul     | Aug     | Sep      | Oct      | Nov      | Dec           |
|----------------------------------------|----------|----------|----------|----------|----------|---------|---------|---------|----------|----------|----------|---------------|
| Daily hot water use                    | 96.3000  | 92.7982  | 89.2964  | 85.7946  | 82.2927  | 78.7909 | 78.7909 | 82.2927 | 85.7946  | 89.2964  | 92.7982  | 96.3000 (44)  |
| Energy conte                           | 142.8101 | 124.9027 | 128.8884 | 112.3680 | 107.8198 | 93.0403 | 86.2155 | 98.9335 | 100.1151 | 116.6745 | 127.3593 | 138.3040 (45) |
| Energy content (annual)                |          |          |          |          |          |         |         |         |          |          |          |               |
| Distribution loss (46)m = 0.15 x (45)m | 21.4215  | 18.7354  | 19.3333  | 16.8552  | 16.1730  | 13.9560 | 12.9323 | 14.8400 | 15.0173  | 17.5012  | 19.1039  | 20.7456 (46)  |

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|                                                                 |                                          |          |          |          |          |          |          |          |          |          |          |                |               |
|-----------------------------------------------------------------|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|---------------|
| Water storage loss:                                             |                                          |          |          |          |          |          |          |          |          |          |          |                | 210.0000 (47) |
| Store volume                                                    |                                          |          |          |          |          |          |          |          |          |          |          |                |               |
| a) If manufacturer declared loss factor is known (kWh/day):     |                                          |          |          |          |          |          |          |          |          |          |          |                | 1.8600 (48)   |
| Temperature factor from Table 2b                                |                                          |          |          |          |          |          |          |          |          |          |          |                | 0.5400 (49)   |
| Enter (49) or (54) in (55)                                      |                                          |          |          |          |          |          |          |          |          |          |          |                | 1.0044 (55)   |
| Total storage loss                                              |                                          |          |          |          |          |          |          |          |          |          |          |                |               |
|                                                                 | 31.1364                                  | 28.1232  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364        | (56)          |
| If cylinder contains dedicated solar storage                    |                                          |          |          |          |          |          |          |          |          |          |          |                |               |
|                                                                 | 31.1364                                  | 28.1232  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364        | (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 |                                          |          |          |          |          |          |          |          |          |          |          |                |               |
|                                                                 | 197.2089                                 | 174.0371 | 183.2872 | 165.0120 | 162.2186 | 145.6843 | 140.6143 | 153.3323 | 152.7591 | 171.0733 | 180.0033 | 192.7028       | (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                                                 |                                          |          |          |          |          |          |          |          |          |          |          |                |               |
|                                                                 | 197.2089                                 | 174.0371 | 183.2872 | 165.0120 | 162.2186 | 145.6843 | 140.6143 | 153.3323 | 152.7591 | 171.0733 | 180.0033 | 192.7028       | (64)          |
|                                                                 | Total per year (kWh/year) = Sum(64)m =   |          |          |          |          |          |          |          |          |          |          | 2017.9331 (64) |               |
| Heat gains from water heating, kWh/month                        |                                          |          |          |          |          |          |          |          |          |          |          |                |               |
|                                                                 | 91.0034                                  | 80.8377  | 86.3744  | 79.4776  | 79.3691  | 73.0511  | 72.1857  | 76.4144  | 75.4035  | 82.3133  | 84.4622  | 89.5051        | (65)          |

|                  | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
|------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation      | 0.9913    | 0.9830    | 0.9580    | 0.8788    | 0.7166   | 0.5064   | 0.3496   | 0.4023   | 0.6817   | 0.9240   | 0.9826    | 0.9930 (94)    |
| Useful gains     | 649.1856  | 731.2351  | 815.7290  | 862.9676  | 773.0200 | 544.7169 | 358.3062 | 375.9526 | 564.2760 | 657.1762 | 628.6664  | 619.6052 (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 |           |           |           |           |          |          |          |          |          |          |           |                |
|                  | 1512.0573 | 1462.6000 | 1323.8371 | 1100.2550 | 839.7908 | 553.8415 | 359.3963 | 378.1299 | 601.9725 | 926.3781 | 1239.2714 | 1504.1021 (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)   |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Energy Calculations Ltd  
SAP ♦ CODE ♦ SBEM ♦ DESIGN

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh  
641.9766 491.4772 378.0324 170.8470 49.6775 0.0000 0.0000 0.0000 0.0000 200.2862 439.6356 658.0657 (98)  
Space heating  
3029.9981 (98)  
Space heating per m2 (98) / (4) = 43.2857 (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 %) 302.4894 (206)  
Efficiency of secondary/supplementary heating system, % 100.0000 (208)  
Space heating requirement 1001.6873 (211)

|                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |       |
|---------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| Space heating requirement                                     | 641.9766 | 491.4772 | 378.0324 | 170.8470 | 49.6775  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 200.2862 | 439.6356 | 658.0657  | (98)  |
| Space heating efficiency (main heating system 1)              | 302.4894 | 302.4894 | 302.4894 | 302.4894 | 302.4894 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 302.4894 | 302.4894 | 302.4894  | (210) |
| Space heating fuel (main heating system)                      | 212.2311 | 162.4775 | 124.9738 | 56.4803  | 16.4229  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 66.2126  | 145.3392 | 217.5500  | (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                                     | 197.2089 | 174.0371 | 183.2872 | 165.0120 | 162.2186 | 145.6843 | 140.6143 | 153.3323 | 152.7591 | 171.0733 | 180.0033 | 192.7028  | (64)  |
| Efficiency of water heater (217)m                             | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400  | (216) |
| Fuel for water heating, kWh/month                             | 116.3887 | 102.7131 | 108.1723 | 97.3867  | 95.7381  | 85.9798  | 82.9877  | 90.4936  | 90.1553  | 100.9639 | 106.2343 | 113.7292  | (219) |
| Water heating fuel used                                       |          |          |          |          |          |          |          |          |          |          |          | 1190.9426 | (219) |
| Annual totals kWh/year                                        |          |          |          |          |          |          |          |          |          |          |          |           |       |
| Space heating fuel - main system                              |          |          |          |          |          |          |          |          |          |          |          | 1001.6873 | (211) |
| Space heating fuel - secondary                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215) |
| Electricity for pumps and fans:                               |          |          |          |          |          |          |          |          |          |          |          |           |       |
| Total electricity for the above, kWh/year                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (231) |
| Electricity for lighting (calculated in Appendix L)           |          |          |          |          |          |          |          |          |          |          |          | 310.6304  | (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) |          |          |          |          |          |          |          |          |          |          |          |           |       |
| Total delivered energy for all uses                           |          |          |          |          |          |          |          |          |          |          |          | 2503.2602 | (238) |

#### 10a. Fuel costs - using Table 12 prices

|                                       | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |       |
|---------------------------------------|---------------|------------------|------------------|-------|
| Space heating - main system 1         | 1001.6873     | 13.1900          | 132.1226         | (240) |
| Space heating - secondary             | 0.0000        | 0.0000           | 0.0000           | (242) |
| Water heating (other fuel)            | 1190.9426     | 13.1900          | 157.0853         | (247) |
| Pumps and fans for heating            | 0.0000        | 0.0000           | 0.0000           | (249) |
| Energy for lighting                   | 310.6304      | 13.1900          | 40.9721          | (250) |
| Additional standing charges           |               |                  | 0.0000           | (251) |
| Energy saving/generation technologies |               |                  |                  |       |
| PV Unit                               | 0.0000        | 13.1900          | 0.0000           | (252) |
| Total energy cost                     |               |                  | 330.1800         | (255) |

#### 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)  
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 1.2059 (257)  
SAP value 83.1780  
SAP rating (Section 12) 83 (258)  
SAP band B

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

|                                       | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |       |
|---------------------------------------|-----------------|----------------------------|-----------------------|-------|
| Space heating - main system 1         | 1001.6873       | 0.5190                     | 519.8757              | (261) |
| Space heating - secondary             | 0.0000          | 0.5190                     | 0.0000                | (263) |
| Water heating (other fuel)            | 1190.9426       | 0.5190                     | 618.0992              | (264) |
| Space and water heating               |                 |                            | 1137.9749             | (265) |
| Pumps and fans                        | 0.0000          | 0.0000                     | 0.0000                | (267) |
| Energy for lighting                   | 310.6304        | 0.5190                     | 161.2172              | (268) |
| Energy saving/generation technologies |                 |                            |                       |       |
| PV Unit                               | -300.0000       | 0.5190                     | -155.7000             | (269) |
| Total kg/year                         |                 |                            | 1143.4920             | (272) |
| CO2 emissions per m2                  |                 |                            | 16.3400               | (273) |
| EI value                              |                 |                            | 86.6758               |       |
| EI rating                             |                 |                            | 87                    | (274) |
| EI band                               |                 |                            | B                     |       |

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### Calculation of stars for heating and DHW

|                                    |                                                         |           |
|------------------------------------|---------------------------------------------------------|-----------|
| Main heating energy efficiency     | $13.19 \times (1 + 0.29 \times 0.25) / 3.0249 = 4.677$  | stars = 4 |
| Main heating environmental impact  | $0.519 \times (1 + 0.29 \times 0.25) / 3.0249 = 0.1840$ | stars = 5 |
| Water heating energy efficiency    | $13.19 / 1.6944 = 7.784$                                | stars = 2 |
| Water heating environmental impact | $0.519 / 1.6944 = 0.3063$                               | stars = 4 |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Energy Calculations Ltd  
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### CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Ground floor                                           | 70.0000 (1b)              | x 2.4000 (2b)                     | = 168.0000 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 70.0000                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 168.0000 (5)                |

#### 2. Ventilation rate

|                                                                           | main<br>heating | secondary<br>heating | other                       | total           | m <sup>3</sup> per hour |
|---------------------------------------------------------------------------|-----------------|----------------------|-----------------------------|-----------------|-------------------------|
| Number of chimneys                                                        | 0               | +                    | 0                           | =               | 0 * 40 = 0.0000 (6a)    |
| Number of open flues                                                      | 0               | +                    | 0                           | =               | 0 * 20 = 0.0000 (6b)    |
| Number of intermittent fans                                               |                 |                      |                             |                 | 3 * 10 = 30.0000 (7a)   |
| Number of passive vents                                                   |                 |                      |                             |                 | 0 * 10 = 0.0000 (7b)    |
| Number of flueless gas fires                                              |                 |                      |                             |                 | 0 * 40 = 0.0000 (7c)    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = |                 |                      |                             | 30.0000 / (5) = | 0.1786 (8)              |
| Pressure test                                                             |                 |                      |                             |                 | Yes                     |
| Measured/design AP50                                                      |                 |                      |                             |                 | 5.0000                  |
| Infiltration rate                                                         |                 |                      |                             |                 | 0.4286 (18)             |
| Number of sides sheltered                                                 |                 |                      |                             |                 | 1 (19)                  |
| Shelter factor                                                            |                 |                      | (20) = 1 - [0.075 x (19)] = |                 | 0.9250 (20)             |
| Infiltration rate adjusted to include shelter factor                      |                 |                      | (21) = (18) x (20) =        |                 | 0.3964 (21)             |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 4.4000 | 4.1000 | 4.1000 | 3.9000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000 | 4.0000 (22)  |
| Wind factor     | 1.1000 | 1.0250 | 1.0250 | 0.9750 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250 | 1.0000 (22a) |
| Adj infilt rate | 0.4361 | 0.4063 | 0.4063 | 0.3865 | 0.3865 | 0.3370 | 0.3370 | 0.3271 | 0.3370 | 0.3766 | 0.3667 | 0.3964 (22b) |
| Effective ac    | 0.5951 | 0.5826 | 0.5826 | 0.5747 | 0.5747 | 0.5568 | 0.5568 | 0.5535 | 0.5568 | 0.5709 | 0.5672 | 0.5786 (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   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| External Door                                               |                         |                            | 2.1200                    | 1.4000                        | 2.9680       |                                | (26a)           |
| Windows (Uw = 1.40)                                         |                         |                            | 20.6900                   | 1.3258                        | 27.4299      |                                | (27)            |
| Main Floor                                                  |                         |                            | 70.0000                   | 0.1400                        | 9.8000       | 110.0000                       | 7700.0000 (28a) |
| Main Wall                                                   | 59.9500                 | 22.8100                    | 37.1400                   | 0.2200                        | 8.1708       | 60.0000                        | 2228.4000 (29a) |
| wall to Stairs                                              | 13.1500                 |                            | 13.1500                   | 0.1864                        | 2.4509       | 60.0000                        | 789.0000 (29a)  |
| Flat roof                                                   | 4.1700                  |                            | 4.1700                    | 0.1400                        | 0.5838       | 9.0000                         | 37.5300 (30)    |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 147.2700                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 51.4034      |                                | (33)            |
| Party Wall 1                                                |                         |                            | 9.3300                    | 0.0000                        | 0.0000       | 180.0000                       | 1679.4000 (32)  |
| Party Ceilings 1                                            |                         |                            | 66.0000                   |                               |              | 40.0000                        | 2640.0000 (32b) |
| Internal Wall 1                                             |                         |                            | 66.5900                   |                               |              | 100.0000                       | 6659.0000 (32c) |

Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K  
Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Total fabric heat loss  
(28)...(30) + (32) + (32a)...(32e) = 21733.3300 (34)  
310.4761 (35)  
14.5781 (36)  
(33) + (36) = 65.9815 (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                                                               | 32.9912 | 32.2969 | 32.2969 | 31.8613 | 31.8613 | 30.8675 | 30.8675 | 30.6850 | 30.8675 | 31.6516 | 31.4474 | 32.0764 (38) |
| Heat transfer coeff                                                 | 98.9727 | 98.2784 | 98.2784 | 97.8427 | 97.8427 | 96.8490 | 96.8490 | 96.6665 | 96.8490 | 97.6331 | 97.4289 | 98.0578 (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 97.6290 (39) |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.4139  | 1.4040  | 1.4040  | 1.3978  | 1.3978  | 1.3836  | 1.3836  | 1.3810  | 1.3836  | 1.3948  | 1.3918  | 1.4008 (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                        |          |          |          |          |          |         |         |         |          |          |          | 2.2461 (42)                       |
| Average daily hot water use (litres/day) |          |          |          |          |          |         |         |         |          |          |          | 87.5455 (43)                      |
| Daily hot water use                      | Jan      | Feb      | Mar      | Apr      | May      | Jun     | Jul     | Aug     | Sep      | Oct      | Nov      | Dec                               |
| Energy conte                             | 96.3000  | 92.7982  | 89.2964  | 85.7946  | 82.2927  | 78.7909 | 78.7909 | 82.2927 | 85.7946  | 89.2964  | 92.7982  | 96.3000 (44)                      |
| Energy content (annual)                  | 142.8101 | 124.9027 | 128.8884 | 112.3680 | 107.8198 | 93.0403 | 86.2155 | 98.9335 | 100.1151 | 116.6745 | 127.3593 | 138.3040 (45)                     |
| Distribution loss (46)m = 0.15 x (45)m   |          |          |          |          |          |         |         |         |          |          |          | Total = Sum(45)m = 1377.4311 (45) |
|                                          | 21.4215  | 18.7354  | 19.3333  | 16.8552  | 16.1730  | 13.9560 | 12.9323 | 14.8400 | 15.0173  | 17.5012  | 19.1039  | 20.7456 (46)                      |

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|                                                                 |          |          |          |          |          |          |          |          |          |          |          |           |      |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|------|
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |          |          | 210.0000  | (47) |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |          |           |      |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |          |          | 1.8600    | (48) |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          | 0.5400    | (49) |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          | 1.0044    | (55) |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |          |          |           |      |
|                                                                 | 31.1364  | 28.1232  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364   | (56) |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |          |           |      |
|                                                                 | 31.1364  | 28.1232  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364  | 31.1364  | 30.1320  | 31.1364  | 30.1320  | 31.1364   | (57) |
| Primary loss                                                    |          |          |          |          |          |          |          |          |          |          |          | 23.2624   | (59) |
|                                                                 | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624   | (58) |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |          |           |      |
|                                                                 | 197.2089 | 174.0371 | 183.2872 | 165.0120 | 162.2186 | 145.6843 | 140.6143 | 153.3323 | 152.7591 | 171.0733 | 180.0033 | 192.7028  | (62) |
| Solar input                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (63) |
|                                                                 | 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                                                 |          |          |          |          |          |          |          |          |          |          |          |           |      |
|                                                                 | 197.2089 | 174.0371 | 183.2872 | 165.0120 | 162.2186 | 145.6843 | 140.6143 | 153.3323 | 152.7591 | 171.0733 | 180.0033 | 192.7028  | (64) |
| Total per year (kWh/year) = Sum(64)m =                          |          |          |          |          |          |          |          |          |          |          |          | 2017.9331 | (64) |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |          |          |           |      |
|                                                                 | 91.0034  | 80.8377  | 86.3744  | 79.4776  | 79.3691  | 73.0511  | 72.1857  | 76.4144  | 75.4035  | 82.3133  | 84.4622  | 89.5051   | (65) |

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

|                      |          |          |          |          |         |        |        |        |        |          |          |                           |
|----------------------|----------|----------|----------|----------|---------|--------|--------|--------|--------|----------|----------|---------------------------|
| Space heating kWh    | 572.4238 | 432.2974 | 306.4165 | 120.6036 | 25.4700 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 140.7328 | 370.0284 | 585.4045 (98)             |
| Space heating        |          |          |          |          |         |        |        |        |        |          |          | 2553.3769 (98)            |
| Space heating per m2 |          |          |          |          |         |        |        |        |        |          |          | (98) / (4) = 36.4768 (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 %)                      |          |          |          |          |          |          |          |          |          |          |          | 302.9046 (206)  |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 100.0000 (208)  |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          | 842.9640 (211)  |
| Jan                                                                   | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                 |
| Space heating requirement                                             | 572.4238 | 432.2974 | 306.4165 | 120.6036 | 25.4700  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 140.7328 | 370.0284 | 585.4045 (98)   |
| Space heating efficiency (main heating system 1)                      | 302.9046 | 302.9046 | 302.9046 | 302.9046 | 302.9046 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 302.9046 | 302.9046 | 302.9046 (210)  |
| Space heating fuel (main heating system)                              | 188.9782 | 142.7173 | 101.1594 | 39.8157  | 8.4086   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 46.4611  | 122.1600 | 193.2636 (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                                             | 197.2089 | 174.0371 | 183.2872 | 165.0120 | 162.2186 | 145.6843 | 140.6143 | 153.3323 | 152.7591 | 171.0733 | 180.0033 | 192.7028 (64)   |
| Efficiency of water heater (217)m                                     | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 | 169.4400 (216)  |
| Fuel for water heating, kWh/month                                     | 116.3887 | 102.7131 | 108.1723 | 97.3867  | 95.7381  | 85.9798  | 82.9877  | 90.4936  | 90.1553  | 100.9639 | 106.2343 | 113.7292 (219)  |
| Water heating fuel used                                               |          |          |          |          |          |          |          |          |          |          |          | 1190.9426 (219) |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          | 842.9640 (211)  |
| Space heating fuel - secondary                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Electricity for pumps and fans:                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Total electricity for the above, kWh/year                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)                   |          |          |          |          |          |          |          |          |          |          |          | 310.6304 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)         |          |          |          |          |          |          |          |          |          |          |          |                 |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          | 2344.5369 (238) |

#### 10a. Fuel costs - using BEDF prices (480)

|                                       |               |                  |                  |
|---------------------------------------|---------------|------------------|------------------|
|                                       | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |
| Space heating - main system 1         | 842.9640      | 19.1200          | 161.1747 (240)   |
| Space heating - secondary             | 0.0000        | 0.0000           | 0.0000 (242)     |
| Water heating (other fuel)            | 1190.9426     | 19.1200          | 227.7082 (247)   |
| Pumps and fans for heating            | 0.0000        | 0.0000           | 0.0000 (249)     |
| Energy for lighting                   | 310.6304      | 19.1200          | 59.3925 (250)    |
| Additional standing charges           |               |                  | 0.0000 (251)     |
| Energy saving/generation technologies |               |                  |                  |
| PV Unit                               | 0.0000        | 19.1200          | 0.0000 (252)     |
| Total energy cost                     |               |                  | 448.2755 (255)   |

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

|                                       |                 |                            |                       |
|---------------------------------------|-----------------|----------------------------|-----------------------|
|                                       | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |
| Space heating - main system 1         | 842.9640        | 0.5190                     | 437.4983 (261)        |
| Space heating - secondary             | 0.0000          | 0.5190                     | 0.0000 (263)          |
| Water heating (other fuel)            | 1190.9426       | 0.5190                     | 618.0992 (264)        |
| Space and water heating               |                 |                            | 1055.5975 (265)       |
| Pumps and fans                        | 0.0000          | 0.0000                     | 0.0000 (267)          |
| Energy for lighting                   | 310.6304        | 0.5190                     | 161.2172 (268)        |
| Energy saving/generation technologies |                 |                            |                       |
| PV Unit                               | -300.0000       | 0.5190                     | -155.7000 (269)       |
| Total kg/year                         |                 |                            | 1061.1147 (272)       |

#### 13a. Primary energy - Individual heating systems including micro-CHP

|                               |                 |                                  |                         |
|-------------------------------|-----------------|----------------------------------|-------------------------|
|                               | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |
| Space heating - main system 1 | 842.9640        | 3.0700                           | 2587.8994 (261)         |
| Space heating - secondary     | 0.0000          | 3.0700                           | 0.0000 (263)            |
| Water heating (other fuel)    | 1190.9426       | 3.0700                           | 3656.1936 (264)         |
| Space and water heating       |                 |                                  | 6244.0931 (265)         |
| Pumps and fans                | 0.0000          | 0.0000                           | 0.0000 (267)            |
| Energy for lighting           | 310.6304        | 3.0700                           | 953.6352 (268)          |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Energy Calculations Ltd  
SAP • CODE • SBEM • DESIGN

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

|                                       |           |        |                 |
|---------------------------------------|-----------|--------|-----------------|
| Energy saving/generation technologies |           |        |                 |
| PV Unit                               | -300.0000 | 3.0700 | -921.0000 (269) |
| Primary energy kWh/year               |           |        | 6276.7283 (272) |
| Primary energy kWh/m2/year            |           |        | 89.6675 (273)   |

#### SAP 2012 EPC IMPROVEMENTS

|                                      |      |
|--------------------------------------|------|
| Current energy efficiency rating:    | B 83 |
| Current environmental impact rating: | B 87 |

(For testing purposes):

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

|                       |            |             |            |
|-----------------------|------------|-------------|------------|
| Recommended measures: | SAP change | Cost change | CO2 change |
| (none)                |            |             |            |

| Recommended measures | Typical annual savings | Energy efficiency | Environmental impact |
|----------------------|------------------------|-------------------|----------------------|
| (none)               |                        |                   |                      |
|                      | Total Savings £0       |                   | 0.00 kg/m²           |

|                                        |      |
|----------------------------------------|------|
| Potential energy efficiency rating:    | B 83 |
| Potential environmental impact rating: | B 87 |

Fuel prices for cost data on this page from database revision number 480 TEST (28 Jul 2021)  
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

|                          | Current    | Potential  | Saving     |
|--------------------------|------------|------------|------------|
| Electricity              | £448       | £448       | £0         |
| Space heating            | £161       | £161       | £0         |
| Water heating            | £228       | £228       | £0         |
| Lighting                 | £59        | £59        | £0         |
| Total cost of fuels      | £448       | £448       | £0         |
| Total cost of uses       | £448       | £448       | £0         |
| Delivered energy         | 33 kWh/m²  | 33 kWh/m²  | 0 kWh/m²   |
| Carbon dioxide emissions | 1.1 tonnes | 1.1 tonnes | 0.0 tonnes |
| CO2 emissions per m²     | 15 kg/m²   | 15 kg/m²   | 0 kg/m²    |
| Primary energy           | 90 kWh/m²  | 90 kWh/m²  | 0 kWh/m²   |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Energy Calculations Ltd  
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Energy Calculations Ltd  
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

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

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

#### Overheating Calculation Input Data

|                                           |                                               |
|-------------------------------------------|-----------------------------------------------|
| Dwelling type                             | EndTerrace Flat                               |
| Number of storeys                         | 1                                             |
| Cross ventilation possible                | Yes                                           |
| SAP Region                                | Thames Valley                                 |
| Front of dwelling faces                   | West                                          |
| Overshading                               | Average or unknown                            |
| Thermal mass parameter                    | 310.5 (calculated from construction elements) |
| Night ventilation                         | No                                            |
| Ventilation rate during hot weather (ach) | 6.00 (Windows fully open)                     |

#### Overheating Calculation

|                                          |             |
|------------------------------------------|-------------|
| Summer ventilation heat loss coefficient | 332.64 (P1) |
| Transmission heat loss coefficient       | 65.98 (37)  |
| Summer heat loss coefficient             | 398.62 (P2) |

| Overhangs   | Ratio | Z_overhangs | Overhang type |
|-------------|-------|-------------|---------------|
| Orientation |       |             |               |
| North       | 0.000 | 1.000       | None          |
| East        | 0.000 | 1.000       | None          |
| West        | 0.000 | 1.000       | None          |

| Solar shading | Z blinds | Solar access | Z overhangs | Z summer   |
|---------------|----------|--------------|-------------|------------|
| Orientation   |          |              |             |            |
| North         | 1.000    | 0.90         | 1.000       | 0.900 (P8) |
| East          | 1.000    | 0.90         | 1.000       | 0.900 (P8) |
| West          | 1.000    | 0.90         | 1.000       | 0.900 (P8) |

| [Jul]  | 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 | Shading | Gains<br>W |
|--------|------------|--------------------------------|-----------------------------------|------------------------------------|---------|------------|
| North  | 9.3300     | 81.1852                        | 0.6300                            | 0.7000                             | 0.9000  | 270.5715   |
| East   | 5.1200     | 117.5071                       | 0.6300                            | 0.7000                             | 0.9000  | 214.9105   |
| West   | 6.2400     | 117.5071                       | 0.6300                            | 0.7000                             | 0.9000  | 261.9221   |
| total: |            |                                |                                   |                                    |         | 747.4040   |

|                                                        | Jun             | Jul    | Aug    |      |
|--------------------------------------------------------|-----------------|--------|--------|------|
| Solar gains                                            | 799             | 747    | 639    | (P3) |
| Internal gains                                         | 446             | 429    | 437    |      |
| Total summer gains                                     | 1244            | 1177   | 1076   | (P5) |
| Summer gain/loss ratio                                 | 3.12            | 2.95   | 2.70   | (P6) |
| Summer external temperature                            | 16.00           | 17.90  | 17.80  |      |
| Thermal mass temperature increment (TMP = 310.5)       | 0.00            | 0.00   | 0.00   |      |
| Threshold temperature                                  | 19.12           | 20.85  | 20.50  | (P7) |
| Likelihood of high internal temperature                | Not significant | Slight | Slight |      |
| Assessment of likelihood of high internal temperature: | Slight          |        |        |      |

# BASIC COMPLIANCE REPORT

Energy Calculations Ltd  
SAP • CODE • SBEM • DESIGN

## Calculation Type: New Build (As Designed)

|                                    |                                                                                                    |                |             |
|------------------------------------|----------------------------------------------------------------------------------------------------|----------------|-------------|
| Property Reference                 | 015722                                                                                             | Issued on Date | 16/08/2021  |
| Assessment Reference               | 004                                                                                                | Prop Type Ref  |             |
| Property                           | Flat 1 , 18, Parkside Road, READING, RG30 2DB                                                      |                |             |
| SAP Rating                         | 83 B                                                                                               | DER            | 17.89       |
| Environmental                      | 87 B                                                                                               | TER            | 29.47       |
| CO <sub>2</sub> Emissions (t/year) | 1.06                                                                                               | % DER<TER      | 39.29       |
| General Requirements Compliance    | Pass                                                                                               | DFEE           | 58.41       |
|                                    |                                                                                                    | TFEE           | 58.58       |
|                                    |                                                                                                    | % DFEE<TFEE    | 0.29        |
| Assessor Details                   | Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcart@energycalculations.co.uk |                | Assessor ID |
|                                    |                                                                                                    |                | 7869-0001   |
| Client                             |                                                                                                    |                |             |

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

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

##### 1a TER and DER

|                                             |                    |                                   |      |
|---------------------------------------------|--------------------|-----------------------------------|------|
| Fuel for main heating                       | Electricity        |                                   |      |
| Fuel factor                                 | 1.55 (electricity) |                                   |      |
| Target Carbon Dioxide Emission Rate (TER)   | 29.47              | kgCO <sub>2</sub> /m <sup>2</sup> |      |
| Dwelling Carbon Dioxide Emission Rate (DER) | 17.89              | kgCO <sub>2</sub> /m <sup>2</sup> | Pass |
|                                             | -11.58 (-39.3%)    | kgCO <sub>2</sub> /m <sup>2</sup> |      |

##### 1b TFEE and DFEE

|                                          |              |                        |      |
|------------------------------------------|--------------|------------------------|------|
| Target Fabric Energy Efficiency (TFEE)   | 58.58        | kWh/m <sup>2</sup> /yr |      |
| Dwelling Fabric Energy Efficiency (DFEE) | 58.41        | kWh/m <sup>2</sup> /yr |      |
|                                          | -0.2 (-0.3%) | 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 | 0.21 (max. 0.30) | 0.22 (max. 0.70) | Pass |
| Party wall    | 0.00 (max. 0.20) | -                | Pass |
| Floor         | 0.14 (max. 0.25) | 0.14 (max. 0.70) | Pass |
| Roof          | 0.14 (max. 0.20) | 0.14 (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 | 5.00 (design value) |      |
| Maximum                        | 10.0                | Pass |

##### Limiting System Efficiencies

##### 4 Heating efficiency

|                          |                                                                             |  |
|--------------------------|-----------------------------------------------------------------------------|--|
| Main heating system      | Heat pump with radiators or underfloor - Electric<br>Panasonic WH-MDC05F3E5 |  |
| Secondary heating system | None                                                                        |  |

# BASIC COMPLIANCE REPORT

Energy Calculations Ltd  
SAP • CODE • SBEM • DESIGN

## Calculation Type: New Build (As Designed)

### 5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.86 kWh/day  
Permitted by DBSCG 2.30

Pass

Primary pipework insulated

Yes

Pass

### 6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

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 (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

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

Windows facing East

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

Windows facing West

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

Air change rate

6.00 ach

Blinds/curtains

None

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

### Party Walls

Type

U-value

Solid Wall

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

Pass

### Air permeability and pressure testing

#### 3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

### 10 Key features

Party wall U-value

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

Photovoltaic array

300.00 kWh/Year

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

# SUMMARY FOR INPUT DATA

Energy Calculations Ltd  
SAP • CODE • SBEM • DESIGN

## Calculation Type: New Build (As Designed)

|                                    |                                                                                                      |                |             |
|------------------------------------|------------------------------------------------------------------------------------------------------|----------------|-------------|
| Property Reference                 | 015722                                                                                               | Issued on Date | 16/08/2021  |
| Assessment Reference               | 004                                                                                                  | Prop Type Ref  |             |
| Property                           | Flat 1 , 18, Parkside Road, READING, RG30 2DB                                                        |                |             |
| SAP Rating                         | 83 B                                                                                                 | DER            | 17.89       |
| Environmental                      | 87 B                                                                                                 | TER            | 29.47       |
| CO <sub>2</sub> Emissions (t/year) | 1.06                                                                                                 | % DER<TER      | 39.29       |
| General Requirements Compliance    | Pass                                                                                                 | DFEE           | 58.41       |
|                                    |                                                                                                      | TFEE           | 58.58       |
|                                    |                                                                                                      | % DFEE<TFEE    | 0.29        |
| Assessor Details                   | Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk |                | Assessor ID |
|                                    |                                                                                                      |                | 7869-0001   |
| Client                             |                                                                                                      |                |             |

### SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

|                            |                            |                                                                                     |  |                     |                |                       |                |
|----------------------------|----------------------------|-------------------------------------------------------------------------------------|--|---------------------|----------------|-----------------------|----------------|
| Orientation                | West                       |                                                                                     |  |                     |                |                       |                |
| Property Tenure            | Unknown                    |                                                                                     |  |                     |                |                       |                |
| Transaction Type           | New dwelling               |                                                                                     |  |                     |                |                       |                |
| Terrain Type               | Urban                      |                                                                                     |  |                     |                |                       |                |
| 1.0 Property Type          | Flat, End-Terrace          |                                                                                     |  |                     |                |                       |                |
| 2.0 Number of Storeys      | 1                          |                                                                                     |  |                     |                |                       |                |
| 3.0 Date Built             | 2020                       |                                                                                     |  |                     |                |                       |                |
| 4.0 Sheltered Sides        | 1                          |                                                                                     |  |                     |                |                       |                |
| 5.0 Sunlight/Shade         | Average or unknown         |                                                                                     |  |                     |                |                       |                |
| 6.0 Measurements           |                            |                                                                                     |  |                     |                |                       |                |
| Ground Floor:              |                            | Heat Loss Perimeter                                                                 |  | Internal Floor Area |                | Average Storey Height |                |
|                            |                            | 30.46 m                                                                             |  | 70.00 m²            |                | 2.40 m                |                |
| 7.0 Living Area            | 33.00                      |                                                                                     |  | m²                  |                |                       |                |
| 8.0 Thermal Mass Parameter | Precise calculation        |                                                                                     |  | kJ/m²K              |                |                       |                |
| Thermal Mass               | 310.48                     |                                                                                     |  |                     |                |                       |                |
| 9.0 External Walls         |                            |                                                                                     |  |                     |                |                       |                |
| Description                | Type                       | Construction                                                                        |  | U-Value (W/m²K)     | Kappa (kJ/m²K) | Gross Area (m²)       | Nett Area (m²) |
| Main Wall                  | Cavity Wall                | Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure |  | 0.22                | 60.00          | 59.95                 | 37.14          |
| wall to Stairs             | Cavity Wall                | Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure |  | 0.22                | 60.00          | 13.15                 | 13.15          |
| 9.1 Party Walls            |                            |                                                                                     |  |                     |                |                       |                |
| Description                | Type                       | Construction                                                                        |  | U-Value (W/m²K)     | Kappa (kJ/m²K) | Area (m²)             |                |
| Party Wall 1               | Solid Wall                 | Dense plaster both sides, dense blocks, cavity or cavity fill                       |  | 0.00                | 180.00         | 9.33                  |                |
| 9.2 Internal Walls         |                            |                                                                                     |  |                     |                |                       |                |
| Description                | Construction               |                                                                                     |  |                     | Kappa (kJ/m²K) | Area (m²)             |                |
| Internal Wall 1            | Dense block, dense plaster |                                                                                     |  |                     | 100.00         | 66.59                 |                |
| 10.0 External Roofs        |                            |                                                                                     |  |                     |                |                       |                |
| Description                | Type                       | Construction                                                                        |  | U-Value (W/m²K)     | Kappa (kJ/m²K) | Gross Area (m²)       | Nett Area (m²) |
| Flat roof                  | External Flat Roof         | Plasterboard, insulated flat roof                                                   |  | 0.14                | 9.00           | 4.17                  | 4.17           |
| 10.1 Party Ceilings        |                            |                                                                                     |  |                     |                |                       |                |

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

| Description      | Construction                                    | Kappa<br>(kJ/m²K) | Area<br>(m²) |
|------------------|-------------------------------------------------|-------------------|--------------|
| Party Ceilings 1 | Precast concrete planks floor, screed, carpeted | 30.00             | 66.00        |

| 11.0 Heat Loss Floors |                      |                                        |                    |                   |              |
|-----------------------|----------------------|----------------------------------------|--------------------|-------------------|--------------|
| Description           | Type                 | Construction                           | U-Value<br>(W/m²K) | Kappa<br>(kJ/m²K) | Area<br>(m²) |
| Main Floor            | Ground Floor - Solid | Slab on ground, screed over insulation | 0.14               | 110.00            | 70.00        |

| 12.0 Opening Types |              |                  |                        |             |              |         |            |              |                    |  |
|--------------------|--------------|------------------|------------------------|-------------|--------------|---------|------------|--------------|--------------------|--|
| Description        | Data Source  | Type             | Glazing                | Glazing Gap | Argon Filled | G-value | Frame Type | Frame Factor | U Value<br>(W/m²K) |  |
| External Door      | Manufacturer | Half Glazed Door | Double Low-E Soft 0.05 |             |              | 0.63    |            | 0.70         | 1.40               |  |
| Windows            | Manufacturer | Window           | Double Low-E Soft 0.05 |             |              | 0.63    |            | 0.70         | 1.40               |  |
| Door to Stairs     | SAP table    | Door to Corridor |                        |             |              |         |            |              | 1.40               |  |

| 13.0 Openings |                  |               |             |              |                |               |           |            |       |           |                |  |
|---------------|------------------|---------------|-------------|--------------|----------------|---------------|-----------|------------|-------|-----------|----------------|--|
| Name          | Opening Type     | Location      | Orientation | Curtain Type | Overhang Ratio | Wide Overhang | Width (m) | Height (m) | Count | Area (m²) | Curtain Closed |  |
| Door          | Half Glazed Door | [1] Main Wall | North       |              |                |               |           |            |       | 2.12      |                |  |
| Windows       | Window           | [1] Main Wall | West        | None         | 0.00           |               |           |            |       | 6.24      |                |  |
| Windows       | Window           | [1] Main Wall | East        | None         | 0.00           |               |           |            |       | 5.12      |                |  |
| Windows       | Window           | [1] Main Wall | North       | None         | 0.00           |               |           |            |       | 9.33      |                |  |

|                       |                   |
|-----------------------|-------------------|
| 14.0 Conservatory     | None              |
| 15.0 Draught Proofing | 100 %             |
| 16.0 Draught Lobby    | No                |
| 17.0 Thermal Bridging | Calculate Bridges |

| 17.1 List of Bridges |                                                                  |        |        |          |  |
|----------------------|------------------------------------------------------------------|--------|--------|----------|--|
| Source Type          | Bridge Type                                                      | Length | Psi    | Imported |  |
| Table K1 - Approved  | E2 Other lintels (including other steel lintels)                 | 11.80  | 0.300  | No       |  |
| Table K1 - Approved  | E3 Sill                                                          | 11.80  | 0.040  | No       |  |
| Table K1 - Approved  | E4 Jamb                                                          | 32.20  | 0.050  | No       |  |
| Table K1 - Approved  | E5 Ground floor (normal)                                         | 30.46  | 0.160  | No       |  |
| Table K1 - Approved  | E7 Party floor between dwellings (in blocks of flats)            | 30.46  | 0.070  | No       |  |
| Table K1 - Default   | E14 Flat roof                                                    | 8.50   | 0.080  | No       |  |
| Table K1 - Approved  | E16 Corner (normal)                                              | 7.40   | 0.090  | No       |  |
| Table K1 - Approved  | E17 Corner (inverted – internal area greater than external area) | 2.37   | -0.090 | No       |  |
| Table K1 - Default   | P1 Party wall - Ground floor                                     | 5.11   | 0.160  | No       |  |

|         |       |       |
|---------|-------|-------|
| Y-value | 0.099 | W/m²K |
|---------|-------|-------|

|                           |      |                   |
|---------------------------|------|-------------------|
| 18.0 Pressure Testing     | Yes  |                   |
| Designed AP <sub>50</sub> | 5.00 | m³/(h.m²) @ 50 Pa |
| Property Tested ?         |      |                   |
| As Built AP <sub>50</sub> |      | m³/(h.m²) @ 50 Pa |

| 19.0 Mechanical Ventilation           |                    |
|---------------------------------------|--------------------|
| <b>Summer Overheating</b>             |                    |
| Windows open in hot weather           | Windows fully open |
| Cross ventilation possible            | Yes                |
| Night Ventilation                     | No                 |
| Air change rate                       | 6.00               |
| <b>Mechanical Ventilation</b>         |                    |
| Mechanical Ventilation System Present | No                 |

# SUMMARY FOR INPUT DATA

Energy Calculations Ltd  
SAP ♦ CODE ♦ SBEM ♦ DESIGN

## Calculation Type: New Build (As Designed)

### 20.0 Fans, Open Fireplaces, Flues

|                              | MHS | SHS | Other | Total |
|------------------------------|-----|-----|-------|-------|
| Number of Chimneys           | 0   |     | 0     | 0     |
| Number of open flues         | 0   |     | 0     | 0     |
| Number of intermittent fans  |     |     |       | 3     |
| Number of passive vents      |     |     |       | 0     |
| Number of flueless gas fires |     |     |       | 0     |

### 21.0 Fixed Cooling System

No

### 22.0 Lighting

#### Internal

|                                 |        |   |
|---------------------------------|--------|---|
| Total number of light fittings  | 9      |   |
| Total number of L.E.L. fittings | 9      |   |
| Percentage of L.E.L. fittings   | 100.00 | % |

#### External

|                         |     |
|-------------------------|-----|
| External lights fitted  | Yes |
| Light and motion sensor | Yes |

### 23.0 Electricity Tariff

Standard

### 24.0 Main Heating 1

|                    |                                       |   |
|--------------------|---------------------------------------|---|
| Percentage of Heat | 100                                   | % |
| Database Ref. No.  | 102968                                |   |
| Fuel Type          | Electricity                           |   |
| Main Heating       | PET                                   |   |
| SAP Code           | 224                                   |   |
| In Winter          | 0.0                                   |   |
| In Summer          | 0.0                                   |   |
| Controls           | CHD Time and temperature zone control |   |
| PCDF Controls      | 0                                     |   |
| Sap Code           | 2207                                  |   |
| Is MHS Pumped      | Pump in heated space                  |   |
| Heat Emitter       | Underfloor                            |   |
| Underfloor Heating | Yes - Pipes in thin screed            |   |
| Flow Temperature   | <= 35°C                               |   |

### 25.0 Main Heating 2

None

|                   |      |
|-------------------|------|
| Community Heating | None |
|-------------------|------|

### 28.0 Water Heating

|                                                  |                         |
|--------------------------------------------------|-------------------------|
|                                                  | HWP From main heating 1 |
| Water Heating                                    | Main Heating 1          |
| Flue Gas Heat Recovery System                    | No                      |
| Waste Water Heat Recovery Instantaneous System 1 | No                      |
| Waste Water Heat Recovery Instantaneous System 2 | No                      |
| Waste Water Heat Recovery Storage System         | No                      |
| Solar Panel                                      | No                      |
| Water use <= 125 litres/person/day               | Yes                     |

# SUMMARY FOR INPUT DATA

Energy Calculations Ltd  
SAP ♦ CODE ♦ SBEM ♦ DESIGN

## Calculation Type: New Build (As Designed)

|                                                          |                                                               |          |
|----------------------------------------------------------|---------------------------------------------------------------|----------|
| SAP Code                                                 | <input type="text" value="901"/>                              |          |
| Immersion Only Heating Hot Water                         | <input type="text" value="Yes"/>                              |          |
| <hr/>                                                    |                                                               |          |
| <b>29.0 Hot Water Cylinder</b>                           | <input type="text" value="Hot Water Cylinder"/>               |          |
| Cylinder Stat                                            | <input type="text" value="Yes"/>                              |          |
| Cylinder In Heated Space                                 | <input type="text" value="Yes"/>                              |          |
| Independent Time Control                                 | <input type="text" value="Yes"/>                              |          |
| Insulation Type                                          | <input type="text" value="Measured Loss"/>                    |          |
| Cylinder Volume                                          | <input type="text" value="210.00"/>                           | L        |
| Loss                                                     | <input type="text" value="1.86"/>                             | kWh/day  |
| Pipes insulation                                         | <input type="text" value="Fully insulated primary pipework"/> |          |
| <hr/>                                                    |                                                               |          |
| <b>31.0 Thermal Store</b>                                | <input type="text" value="None"/>                             |          |
| <hr/>                                                    |                                                               |          |
| <b>32.0 Photovoltaic Unit</b>                            | <input type="text" value="More Dwellings, One Block"/>        |          |
| Apportioned                                              | <input type="text" value="300.00"/>                           | kWh/Year |
| <hr/>                                                    |                                                               |          |
| <b>Recommendations</b>                                   |                                                               |          |
| <b>Lower cost measures</b>                               |                                                               |          |
| None                                                     |                                                               |          |
| <b>Further measures to achieve even higher standards</b> |                                                               |          |
| None                                                     |                                                               |          |

# BLOCK COMPLIANCE

Energy Calculations Ltd  
SAP • CODE • SBEM • DESIGN

## Calculation Type: New Build (As Designed)

|                  |                                                                                                      |                |            |
|------------------|------------------------------------------------------------------------------------------------------|----------------|------------|
| Block Reference  | 000516                                                                                               | Issued on Date | 16/08/2021 |
| Block Name       | Parkside Road                                                                                        |                |            |
| Assessor Details | Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk | Assessor ID    | 7869-0001  |
| Client           |                                                                                                      |                |            |

### Block Compliance Report - DER

| Block Reference: 000516                               |            | Block Name: Parkside Road    |                                          |                                          |           |
|-------------------------------------------------------|------------|------------------------------|------------------------------------------|------------------------------------------|-----------|
| Property-Assessment Reference                         | Multiplier | Floor Area (m <sup>2</sup> ) | DER (kgCO <sub>2</sub> /m <sup>2</sup> ) | TER (kgCO <sub>2</sub> /m <sup>2</sup> ) | % DER/TER |
| 015722-004                                            | 1          | 70                           | 17.89                                    | 29.47                                    | 39.29 %   |
| 015723-004                                            | 1          | 50                           | 21.33                                    | 31.34                                    | 31.93 %   |
| 015724-004                                            | 1          | 42.9                         | 22.37                                    | 33.10                                    | 32.41 %   |
| 015725-004                                            | 1          | 65                           | 16.86                                    | 25.77                                    | 34.58 %   |
| 015726-004                                            | 1          | 77.6                         | 15.49                                    | 25.88                                    | 40.14 %   |
| 015727-004                                            | 1          | 73                           | 16.64                                    | 24.80                                    | 32.90 %   |
| 015728-004                                            | 1          | 77                           | 15.36                                    | 26.08                                    | 41.11 %   |
| 015729-004                                            | 1          | 70.3                         | 17.18                                    | 27.75                                    | 38.08 %   |
| 015730-004                                            | 1          | 63.68                        | 16.67                                    | 26.03                                    | 35.95 %   |
| 015731-004                                            | 1          | 50.64                        | 18.50                                    | 26.84                                    | 31.08 %   |
| 015732-004                                            | 1          | 77                           | 16.15                                    | 28.08                                    | 42.48 %   |
| Totals:                                               | 11         | 717.12                       | 194.44                                   | 305.12                                   |           |
| Average DER = 17.32 kgCO <sub>2</sub> /m <sup>2</sup> |            | % DER/TER                    | PASS                                     |                                          |           |
| Average TER = 27.44 kgCO <sub>2</sub> /m <sup>2</sup> |            | 36.88 %                      |                                          |                                          |           |

### Block Compliance Report - DFEE

| Block Reference: 000516                     |            | Block Name: Parkside Road    |                               |                               |             |
|---------------------------------------------|------------|------------------------------|-------------------------------|-------------------------------|-------------|
| Property-Assessment Reference               | Multiplier | Floor Area (m <sup>2</sup> ) | DFEE (kWh/m <sup>2</sup> /yr) | TFEE (kWh/m <sup>2</sup> /yr) | % DFEE/TFEE |
| 015722-004                                  | 1          | 70                           | 58.41                         | 58.58                         | 0.29 %      |
| 015723-004                                  | 1          | 50                           | 54.32                         | 54.44                         | 0.22 %      |
| 015724-004                                  | 1          | 42.9                         | 55.45                         | 55.97                         | 0.94 %      |
| 015725-004                                  | 1          | 65                           | 43.28                         | 43.82                         | 1.21 %      |
| 015726-004                                  | 1          | 77.6                         | 45.82                         | 48.35                         | 5.22 %      |
| 015727-004                                  | 1          | 73                           | 38.64                         | 40.24                         | 3.99 %      |
| 015728-004                                  | 1          | 77                           | 47.54                         | 49.93                         | 4.79 %      |
| 015729-004                                  | 1          | 70.3                         | 46.03                         | 51.12                         | 9.95 %      |
| 015730-004                                  | 1          | 63.68                        | 41.89                         | 44.39                         | 5.61 %      |
| 015731-004                                  | 1          | 50.64                        | 36.75                         | 39.96                         | 8.04 %      |
| 015732-004                                  | 1          | 77                           | 52.10                         | 56.40                         | 7.62 %      |
| Totals:                                     | 11         | 717.12                       | 520.23                        | 543.19                        |             |
| Average DFEE = 47.15 kWh/m <sup>2</sup> /yr |            | % DFEE/TFEE                  | PASS                          |                               |             |
| Average TFEE = 49.35 kWh/m <sup>2</sup> /yr |            | 4.46 %                       |                               |                               |             |