



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 32

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
toby@abacusenergyuk.com

Report Issue Date: 08/02/2024

EXCELLENCE
IN ENERGY
ASSESSMENT

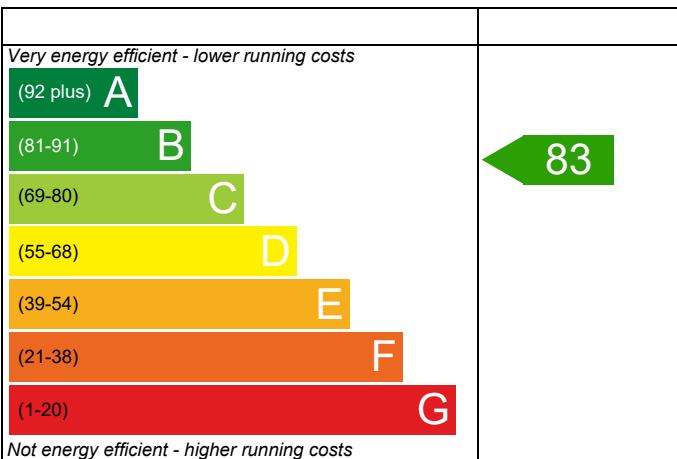
Plot 32

Dwelling type: Flat, Detached
 Date of assessment: 08/02/2024
 Produced by: Abacus Energy (UK) Ltd
 Total floor area: 61.36 m²
 DRRN: 2738-2402-0340

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 (CO₂) emissions.

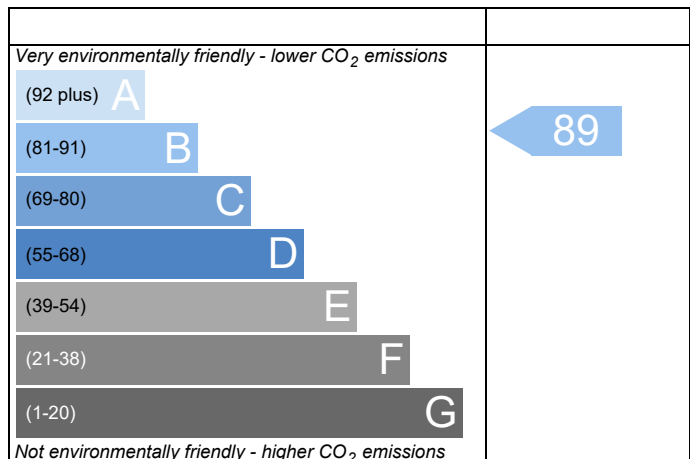
Energy Efficiency Rating



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 (CO₂) 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 (CO₂) emissions. The higher the rating the less impact it has on the environment.

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.



BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

| | | | |
|----------------------|------------------|----------------|------------|
| Property Reference | SAP 0931 Plot 32 | Issued on Date | 08/02/2024 |
| Assessment Reference | Rev B | Prop Type Ref | Block Ev1 |
| Property | Plot 32 | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 83 B | DER | 16.21 | TER | 20.36 |
| Environmental | 89 B | % DER<TER | 20.40 | | |
| CO ₂ Emissions (t/year) | 0.76 | DFEE | 47.85 | TFEE | 55.48 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 13.75 | | |

| | | | |
|------------------|---|-------------|-----------|
| Assessor Details | Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com | Assessor ID | E477-0001 |
| Client | Foreman Homes, FORE | | |

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 | Mains gas | | |
| Fuel factor | 1.00 (mains gas) | | |
| Target Carbon Dioxide Emission Rate (TER) | 20.36 | kgCO ₂ /m ² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.21 | kgCO ₂ /m ² | Pass |
| | -4.15 (-20.4%) | kgCO ₂ /m ² | |

1b TFEE and DFEE

| | | | |
|--|---------------|------------------------|------|
| Target Fabric Energy Efficiency (TFEE) | 55.48 | kWh/m ² /yr | |
| Dwelling Fabric Energy Efficiency (DFEE) | 47.85 | kWh/m ² /yr | |
| | -7.7 (-13.9%) | kWh/m ² /yr | Pass |

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

| Element | Average | Highest | |
|---------------|------------------|------------------|------|
| External wall | 0.23 (max. 0.30) | 0.27 (max. 0.70) | Pass |
| Party wall | 0.00 (max. 0.20) | - | Pass |
| Floor | 0.12 (max. 0.25) | 0.12 (max. 0.70) | Pass |
| Openings | 1.18 (max. 2.00) | 1.20 (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) | m ³ /(h.m ²) @ 50 Pa | |
| Maximum | 10.0 | m ³ /(h.m ²) @ 50 Pa | Pass |

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoFIT sustain 830 VUW 306/6-3 (H-GB)
Combi boiler
Efficiency: 89.3% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing South East

5.25 m², No overhang

Windows facing North West

4.31 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00 W/m²K

Floor U-value

0.12 W/m²K

Door U-value

1.10 W/m²K

Photovoltaic array

418.00 kWh/Year

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RECOMMENDATIONS

| | Typical cost | Typical savings per year | Energy efficiency | Environmental impact | Result |
|---------------------|--------------|--------------------------|-------------------|----------------------|-------------------|
| Low energy lights | | | 0 | 0 | Already installed |
| Solar water heating | | | 0 | 0 | Not applicable |
| Photovoltaic | | | 0 | 0 | Not applicable |
| Wind turbine | | | 0 | 0 | Not applicable |
| Totals | £0 | £0 | B 83 | B 89 | |

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

| | | | |
|----------------------|------------------|----------------|------------|
| Property Reference | SAP 0931 Plot 32 | Issued on Date | 08/02/2024 |
| Assessment Reference | Rev B | Prop Type Ref | Block Ev1 |
| Property | Plot 32 | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 83 B | DER | 16.21 | TER | 20.36 |
| Environmental | 89 B | % DER<TER | 20.40 | | |
| CO ₂ Emissions (t/year) | 0.76 | DFEE | 47.85 | TFEE | 55.48 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 13.75 | | |

| | | | |
|------------------|---|-------------|-----------|
| Assessor Details | Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com | Assessor ID | E477-0001 |
|------------------|---|-------------|-----------|

| | |
|--------|---------------------|
| Client | Foreman Homes, FORE |
|--------|---------------------|

| | Junction detail | Source Type | Psi (W/mK) | Length (m) | Result | Reference |
|---------------|---|------------------------|------------|------------|--------|-------------------------|
| External wall | E2 Other lintels (including other steel lintels) | Independently assessed | 0.043 | 9.06 | 0.39 | Catnic Thermally Broken |
| External wall | E3 Sill | Independently assessed | 0.021 | 8.05 | 0.17 | Knauf P5 |
| External wall | E4 Jamb | Independently assessed | 0.016 | 18.30 | 0.29 | Knauf P6 |
| External wall | E5 Ground floor (normal) | Table K1 - Approved | 0.160 | 31.53 | 5.04 | |
| External wall | E7 Party floor between dwellings (in blocks of flats) | Table K1 - Approved | 0.070 | 31.53 | 2.21 | Knauf P15 |
| External wall | E16 Corner (normal) | Independently assessed | 0.061 | 9.42 | 0.57 | Knauf P23 |

Total: **8.68** W/mK:
 Y-Value: **0.061** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

| | | | | | |
|--|---|-----------------------|-----------------------|--------------------|-----------|
| Property Reference | SAP 0931 Plot 32 | | Issued on Date | 08/02/2024 | |
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| Property | Plot 32 | | | | |
| SAP Rating | 83 B | DER | 16.21 | TER | 20.36 |
| Environmental | 89 B | % DER<TER | 20.40 | | |
| CO₂ Emissions (t/year) | 0.76 | DFEE | 47.85 | TFEE | 55.48 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 13.75 | | |
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| Client | Foreman Homes, FORE | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 61 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.36 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.21 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.8 kWh/m²/yrOK

2 Fabric U-values

| Element | Average | Highest | |
|-------------------|------------------|------------------|----|
| External wall | 0.23 (max. 0.30) | 0.27 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.12 (max. 0.25) | 0.12 (max. 0.70) | OK |
| Roof (no roof) | | | |
| Openings | 1.18 (max. 2.00) | 1.20 (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: Boiler system with radiators or underfloor - Mains gas

Data from database

Vaillant ecoFIT sustain 830 VUW 306/6-3 (H-GB)

Combi boiler

Efficiency: 89.3% SEDBUK2009

Minimum: 88.0%

OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:

Average

Windows facing South East:

5.25 m², No overhang

Windows facing North West:

4.31 m², No overhang

Air change rate:

4.00 ach

Blinds/curtains:

None

10 Key features

| | |
|--------------------|-------------------------|
| Party wall U-value | 0.00 W/m ² K |
| Floor U-value | 0.12 W/m ² K |
| Door U-value | 1.10 W/m ² K |
| Photovoltaic array | 418.00 kWh/Year |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m2) | Storey height (m) | Volume (m3) |
|--|--------------|-------------------|--|
| Ground floor | 61.3600 (1b) | 2.5300 (2b) | 155.2408 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 61.3600 | | 155.2408 (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 155.2408 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour |
|---|--------------|-------------------|-------|-----------------------------|--------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 2 * 10 = | 20.0000 (7a) |
| Number of passive vents | | | | 1 * 10 = | 10.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Air changes per hour | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 30.0000 / (5) = | 0.1932 (8) |
| Pressure test | | | | | Yes |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.4432 (18) |
| Number of sides sheltered | | | | | 2 (19) |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3768 (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 | 0.4804 | 0.4710 | 0.4615 | 0.4144 | 0.4050 | 0.3579 | 0.3579 | 0.3485 | 0.3768 | 0.4050 | 0.4239 | 0.4427 (22b) |
| Effective ac | 0.6154 | 0.6109 | 0.6065 | 0.5859 | 0.5820 | 0.5641 | 0.5641 | 0.5607 | 0.5710 | 0.5820 | 0.5898 | 0.5980 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K |
|--|----------|-------------|------------|----------------------|-----------|--------------------------------------|-----------------|
| Front Door | | | 2.1200 | 1.1000 | 2.3320 | | (26) |
| Windows (Uw = 1.20) | | | 9.5600 | 1.1450 | 10.9466 | | (27) |
| Ground Floor | | | 61.3600 | 0.1200 | 7.3632 | 90.0000 | 5522.4000 (28a) |
| Brick and Block | 45.8100 | | 45.8100 | 0.2200 | 10.0782 | 42.2200 | 1934.0982 (29a) |
| 10.4N Brick and Block | 16.9800 | 9.5600 | 7.4200 | 0.2700 | 2.0034 | 113.5000 | 842.1700 (29a) |
| Wall to Corridor | 16.9800 | 2.1200 | 14.8600 | 0.2300 | 3.4174 | 113.5000 | 1686.6100 (29a) |
| Total net area of external elements Aum(A, m2) | | | 141.1300 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 36.1408 | | (33) |
| Party Ceilings 1 | | | 61.3600 | | | 70.0000 | 4295.2000 (32b) |
| Ground Floor Stud | | | 125.8400 | | | 9.0000 | 1132.5600 (32c) |
| Heat capacity Cm = Sum(A x k) | | | | | | (28)...(30) + (32) + (32a)...(32e) = | 15413.0382 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 251.1903 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6780 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 44.8188 (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 | 31.5255 | 31.2960 | 31.0710 | 30.0143 | 29.8166 | 28.8962 | 28.8962 | 28.7258 | 29.2507 | 29.8166 | 30.2165 | 30.6347 (38) |
| Average = Sum(39)m / 12 = | 76.3442 | 76.1147 | 75.8897 | 74.8330 | 74.6353 | 73.7150 | 73.7150 | 73.5445 | 74.0695 | 74.6353 | 75.0353 | 75.4534 (39) |
| | | | | | | | | | | | | 74.8321 (39) |

| HLP | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP (average) | 1.2442 | 1.2405 | 1.2368 | 1.2196 | 1.2164 | 1.2014 | 1.2014 | 1.1986 | 1.2071 | 1.2164 | 1.2229 | 1.2297 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.0198 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 82.1706 (43) |
| Daily hot water use | 90.3877 | 87.1008 | 83.8140 | 80.5272 | 77.2404 | 73.9535 | 73.9535 | 77.2404 | 80.5272 | 83.8140 | 87.1008 | 90.3877 (44) |
| Energy conte | 134.0423 | 117.2342 | 120.9752 | 105.4691 | 101.2001 | 87.3280 | 80.9223 | 92.8595 | 93.9685 | 109.5112 | 119.5401 | 129.8128 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1292.8634 (45) |
| Distribution loss (46)m = 0.15 x (45)m | 20.1063 | 17.5851 | 18.1463 | 15.8204 | 15.1800 | 13.0992 | 12.1383 | 13.9289 | 14.0953 | 16.4267 | 17.9310 | 19.4719 (46) |
| Water storage loss: | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

| | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|----------|----------|------|
| 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 | 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 | 0.0000 | (57) |
| Combi loss | 1.3933 | 1.1743 | 1.1660 | 0.9767 | 0.8989 | 0.7427 | 0.6882 | 0.8248 | 0.8702 | 1.0555 | 1.1974 | 1.3493 | 1.3493 | (61) |
| Total heat required for water heating calculated for each month | 135.4356 | 118.4085 | 122.1413 | 106.4458 | 102.0991 | 88.0707 | 81.6105 | 93.6843 | 94.8387 | 110.5668 | 120.7375 | 131.1621 | 131.1621 | (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 | 0.0000 | (63) |
| Output from w/h | 135.4356 | 118.4085 | 122.1413 | 106.4458 | 102.0991 | 88.0707 | 81.6105 | 93.6843 | 94.8387 | 110.5668 | 120.7375 | 131.1621 | 131.1621 | (64) |
| Heat gains from water heating, kWh/month | 44.9174 | 39.2740 | 40.5158 | 35.3127 | 33.8738 | 29.2222 | 27.0787 | 31.0820 | 31.4621 | 36.6764 | 40.0464 | 43.5001 | 43.5001 | (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 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 16.4910 | 14.6471 | 11.9118 | 9.0180 | 6.7411 | 5.6911 | 6.1494 | 7.9933 | 10.7286 | 13.6224 | 15.8993 | 16.9493 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 176.3634 | 178.1935 | 173.5817 | 163.7637 | 151.3703 | 139.7223 | 131.9406 | 130.1105 | 134.7223 | 144.5403 | 156.9337 | 168.5818 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | (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) | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | (71) |
| Water heating gains (Table 5) | 60.3728 | 58.4434 | 54.4567 | 49.0454 | 45.5293 | 40.5864 | 36.3961 | 41.7769 | 43.6973 | 49.2962 | 55.6200 | 58.4679 | (72) |
| Total internal gains | 309.5244 | 307.5812 | 296.2474 | 278.1244 | 259.9379 | 242.2970 | 230.7834 | 236.1779 | 245.4455 | 263.7561 | 284.7503 | 300.2962 | (73) |

6. Solar gains

| | | | | | | | | | | | | | |
|-------------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|----------|----------|----------|----------|------|
| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b g | Specific data or Table 6c FF | Access factor Table 6d | Gains W | | | | | | | |
| Southeast | 5.2500 | 36.7938 | 0.6300 | 0.7000 | 0.7700 | 59.0345 (77) | | | | | | | |
| Northwest | 4.3100 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 14.8618 (81) | | | | | | | |
| Solar gains | 73.8963 | 130.8093 | 192.0912 | 259.9883 | 311.2691 | 317.8422 | 302.7616 | 263.1548 | 215.3918 | 148.1075 | 89.4098 | 62.6582 | (83) |
| Total gains | 383.4207 | 438.3905 | 488.3386 | 538.1127 | 571.2070 | 560.1392 | 533.5450 | 499.3327 | 460.8372 | 411.8636 | 374.1600 | 362.9543 | (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 | 56.0802 | 56.2493 | 56.4161 | 57.2127 | 57.3643 | 58.0805 | 58.0805 | 58.2151 | 57.8025 | 57.3643 | 57.0585 | 56.7423 | |
| alpha | 4.7387 | 4.7500 | 4.7611 | 4.8142 | 4.8243 | 4.8720 | 4.8720 | 4.8810 | 4.8535 | 4.8243 | 4.8039 | 4.7828 | |
| util living area | 0.9976 | 0.9951 | 0.9883 | 0.9652 | 0.8981 | 0.7516 | 0.5856 | 0.6412 | 0.8691 | 0.9774 | 0.9953 | 0.9982 | (86) |
| MIT | 19.6621 | 19.8160 | 20.0726 | 20.4186 | 20.7271 | 20.9233 | 20.9820 | 20.9726 | 20.8331 | 20.4370 | 19.9908 | 19.6392 | (87) |
| Th 2 | 19.8848 | 19.8878 | 19.8907 | 19.9044 | 19.9069 | 19.9189 | 19.9189 | 19.9211 | 19.9143 | 19.9069 | 19.9017 | 19.8963 | (88) |
| util rest of house | 0.9968 | 0.9934 | 0.9839 | 0.9512 | 0.8559 | 0.6579 | 0.4529 | 0.5083 | 0.7999 | 0.9657 | 0.9934 | 0.9976 | (89) |
| MIT 2 | 18.6740 | 18.8297 | 19.0864 | 19.4351 | 19.7207 | 19.8833 | 19.9144 | 19.9133 | 19.8207 | 19.4596 | 19.0155 | 18.6604 | (90) |
| Living area fraction | fLA = Living area / (4) = | | | | | | | | | | | | 0.3360 (91) |
| MIT | 19.0061 | 19.1612 | 19.4178 | 19.7656 | 20.0589 | 20.2328 | 20.2732 | 20.2693 | 20.1609 | 19.7881 | 19.3433 | 18.9893 | (92) |
| Temperature adjustment | | | | | | | | | | | | | 0.0000 |
| adjusted MIT | 19.0061 | 19.1612 | 19.4178 | 19.7656 | 20.0589 | 20.2328 | 20.2732 | 20.2693 | 20.1609 | 19.7881 | 19.3433 | 18.9893 | (93) |

8. Space heating requirement

| | | | | | | | | | | | | | |
|----------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------------------------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| | 0.9959 | 0.9919 | 0.9815 | 0.9490 | 0.8627 | 0.6874 | 0.4981 | 0.5535 | 0.8181 | 0.9640 | 0.9920 | 0.9969 | (94) |
| Useful gains | 381.8645 | 434.8487 | 479.2965 | 510.6786 | 492.7655 | 385.0316 | 265.7787 | 276.3994 | 377.0239 | 397.0424 | 371.1798 | 361.8148 | (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 | 1122.7229 | 1085.4838 | 980.3305 | 813.1062 | 623.8676 | 415.2196 | 270.7677 | 284.5649 | 448.9283 | 685.7533 | 918.6760 | 1115.9043 | (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 | 551.1986 | 437.2268 | 372.7693 | 217.7479 | 97.5399 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 214.8008 | 394.1973 | 561.0426 | (98) |
| Space heating | | | | | | | | | | | | | 2846.5232 (98) |
| Space heating per m2 | | | | | | | | | | | | | (98) / (4) = 46.3905 (99) |

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 90.2000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 3155.7907 (211) |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Space heating requirement | 551.1986 | 437.2268 | 372.7693 | 217.7479 | 97.5399 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 214.8008 | 394.1973 | 561.0426 | (98) |
| Space heating efficiency (main heating system 1) | 90.2000 | 90.2000 | 90.2000 | 90.2000 | 90.2000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 90.2000 | 90.2000 | 90.2000 | (210) |
| Space heating fuel (main heating system) | 611.0850 | 484.7303 | 413.2697 | 241.4056 | 108.1374 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 238.1384 | 437.0258 | 621.9984 | (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 | 135.4356 | 118.4085 | 122.1413 | 106.4458 | 102.0991 | 88.0707 | 81.6105 | 93.6843 | 94.8387 | 110.5668 | 120.7375 | 131.1621 | (64) |
| Efficiency of water heater (217)m | 87.0455 | 86.8015 | 86.2875 | 85.0683 | 82.4526 | 76.2000 | 76.2000 | 76.2000 | 76.2000 | 84.8994 | 86.4748 | 76.2000 | (216) |
| Fuel for water heating, kWh/month | 155.5917 | 136.4131 | 141.5515 | 125.1299 | 123.8275 | 115.5784 | 107.1004 | 122.9453 | 124.4603 | 130.2327 | 139.6216 | 150.4749 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 1572.9272 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 3155.7907 (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) | | | | | | | | | | | | | 291.2356 (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | |
| Total delivered energy for all uses | | | | | | | | | | | | | 5094.9535 (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 | 3155.7907 | 0.2160 | 681.6508 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 1572.9272 | 0.2160 | 339.7523 (264) |
| Space and water heating | | | 1021.4031 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 291.2356 | 0.5190 | 151.1513 (268) |
| Energy saving/generation technologies | | | |
| PV Unit | -418.0000 | 0.5190 | -216.9420 (269) |
| Total CO2, kg/year | | | 994.5374 (272) |
| Dwelling Carbon Dioxide Emission Rate (DER) | | | 16.2100 (273) |

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

| | | | |
|---|--|-----|-------------|
| DER | | | 16.2100 ZC1 |
| Total Floor Area | | TFA | 61.3600 |
| Assumed number of occupants | | N | 2.0198 |
| CO2 emission factor in Table 12 for electricity displaced from grid | | EF | 0.5190 |
| CO2 emissions from appliances, equation (L14) | | | 17.0321 ZC2 |
| CO2 emissions from cooking, equation (L16) | | | 2.7294 ZC3 |
| Total CO2 emissions | | | 35.9715 ZC4 |
| Residual CO2 emissions offset from biofuel CHP | | | 0.0000 ZC5 |
| Additional allowable electricity generation, kWh/m ² /year | | | 0.0000 ZC6 |
| Resulting CO2 emissions offset from additional allowable electricity generation | | | 0.0000 ZC7 |
| Net CO2 emissions | | | 35.9715 ZC8 |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 61.3600 (1b) | 2.5300 (2b) | 155.2408 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 61.3600 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 155.2408 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour |
|---|--------------|-------------------|-----------------------------|-----------------|-------------------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 2 * 10 = | 20.0000 (7a) |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Air changes per hour | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 20.0000 / (5) = | 0.1288 (8) |
| Pressure test | | | | Yes | |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.3788 (18) |
| Number of sides sheltered | | | | | 2 (19) |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.3220 (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 infiltr rate | | | | | | | | | | | | |
| Effective ac | 0.4106 | 0.4025 | 0.3945 | 0.3542 | 0.3462 | 0.3059 | 0.3059 | 0.2979 | 0.3220 | 0.3462 | 0.3623 | 0.3784 (22b) |
| Effective ac | 0.5843 | 0.5810 | 0.5778 | 0.5627 | 0.5599 | 0.5468 | 0.5468 | 0.5444 | 0.5518 | 0.5599 | 0.5656 | 0.5716 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K | | | | | |
|---|----------------------|-------------------------|------------------------|----------------------------|----------------------|-----------------------------|---------------|---------|---------|---------|---------|--------------|
| TER Opaque door | | | 2.1200 | 1.0000 | 2.1200 | | (26) | | | | | |
| TER Opening Type (Uw = 1.40) | | | 9.5600 | 1.3258 | 12.6742 | | (27) | | | | | |
| Ground Floor | | | 61.3600 | 0.1300 | 7.9768 | | (28a) | | | | | |
| Brick and Block | 45.8100 | | 45.8100 | 0.1800 | 8.2458 | | (29a) | | | | | |
| 10.4N Brick and Block | 16.9800 | 9.5600 | 7.4200 | 0.1800 | 1.3356 | | (29a) | | | | | |
| Wall to Corridor | 16.9800 | 2.1200 | 14.8600 | 0.1800 | 2.6748 | | (29a) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 141.1300 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 35.0272 | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 250.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 9.8702 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 44.8974 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | 29.9323 | 29.7647 | 29.6003 | 28.8284 | 28.6840 | 28.0117 | 28.0117 | 27.8872 | 28.2707 | 28.6840 | 28.9762 | 29.2816 (38) |
| Heat transfer coeff | 74.8298 | 74.6621 | 74.4978 | 73.7259 | 73.5815 | 72.9092 | 72.9092 | 72.7847 | 73.1681 | 73.5815 | 73.8736 | 74.1791 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 73.7252 (39) |
| HLP | 1.2195 | 1.2168 | 1.2141 | 1.2015 | 1.1992 | 1.1882 | 1.1882 | 1.1862 | 1.1924 | 1.1992 | 1.2039 | 1.2089 (40) |
| HLP (average) | | | | | | | | | | | | 1.2015 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.0198 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 82.1706 (43) |
| Daily hot water use | 90.3877 | 87.1008 | 83.8140 | 80.5272 | 77.2404 | 73.9535 | 73.9535 | 77.2404 | 80.5272 | 83.8140 | 87.1008 | 90.3877 (44) |
| Energy conte | 134.0423 | 117.2342 | 120.9752 | 105.4691 | 101.2001 | 87.3280 | 80.9223 | 92.8595 | 93.9685 | 109.5112 | 119.5401 | 129.8128 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1292.8634 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |
| Water storage loss: | 20.1063 | 17.5851 | 18.1463 | 15.8204 | 15.1800 | 13.0992 | 12.1383 | 13.9289 | 14.0953 | 16.4267 | 17.9310 | 19.4719 (46) |
| 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 | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| Combi 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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (57) |
| | 46.0606 | 40.0902 | 42.7107 | 39.7120 | 39.3608 | 36.4702 | 37.6859 | 39.3608 | 39.7120 | 42.7107 | 42.9538 | 46.0606 | 46.0606 | (61) | | | | | | | | | | |
| Total heat required for water heating calculated for each month | 180.1028 | 157.3245 | 163.6859 | 145.1812 | 140.5610 | 123.7983 | 118.6082 | 132.2203 | 133.6805 | 152.2219 | 162.4939 | 175.8733 | (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 | 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 | 180.1028 | 157.3245 | 163.6859 | 145.1812 | 140.5610 | 123.7983 | 118.6082 | 132.2203 | 133.6805 | 152.2219 | 162.4939 | 175.8733 | (64) | | | | | | | | | | | |
| Heat gains from water heating, kWh/month | 56.0842 | 49.0029 | 50.9019 | 44.9965 | 43.4893 | 38.1541 | 36.3281 | 40.7160 | 41.1725 | 47.0902 | 50.4855 | 54.6779 | (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) |
| (66)m | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 16.4910 | 14.6471 | 11.9118 | 9.0180 | 6.7411 | 5.6911 | 6.1494 | 7.9933 | 10.7286 | 13.6224 | 15.8993 | 16.9493 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 176.3634 | 178.1935 | 173.5817 | 163.7637 | 151.3703 | 139.7223 | 131.9406 | 130.1105 | 134.7223 | 144.5403 | 156.9337 | 168.5818 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | (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) | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | (71) |
| Water heating gains (Table 5) | 75.3820 | 72.9210 | 68.4166 | 62.4951 | 58.4533 | 52.9918 | 48.8281 | 54.7258 | 57.1841 | 63.2932 | 70.1188 | 73.4918 | (72) |
| Total internal gains | 324.5336 | 322.0589 | 310.2073 | 291.5741 | 272.8619 | 254.7024 | 243.2154 | 249.1268 | 258.9322 | 277.7531 | 299.2491 | 315.3201 | (73) |

6. Solar gains

| | | | | | | | | | | | | | |
|-------------|----------|------------|---------------|---------------|----------|--------------|----------|----------|----------|----------|----------|----------|------|
| [Jan] | Area | Solar flux | g | FF | Access | Gains | | | | | | | |
| | m2 | Table 6a | Specific data | Specific data | factor | W | | | | | | | |
| | | W/m2 | or Table 6b | or Table 6c | Table 6d | | | | | | | | |
| Southeast | 5.2500 | 36.7938 | 0.6300 | 0.7000 | 0.7700 | 59.0345 (77) | | | | | | | |
| Northwest | 4.3100 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 14.8618 (81) | | | | | | | |
| Solar gains | 73.8963 | 130.8093 | 192.0912 | 259.9883 | 311.2691 | 317.8422 | 302.7616 | 263.1548 | 215.3918 | 148.1075 | 89.4098 | 62.6582 | (83) |
| Total gains | 398.4299 | 452.8682 | 502.2985 | 551.5624 | 584.1311 | 572.5446 | 545.9771 | 512.2816 | 474.3240 | 425.8606 | 388.6588 | 377.9782 | (84) |

7. Mean internal temperature (heating season)

| | | | | | | | | | | | | | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------------------|
| Temperature during heating periods in the living area from Table 9, T _{hl} (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 | 56.9441 | 57.0719 | 57.1978 | 57.7967 | 57.9101 | 58.4441 | 58.4441 | 58.5441 | 58.2373 | 57.9101 | 57.6811 | 57.4436 | |
| alpha | 4.7963 | 4.8048 | 4.8132 | 4.8531 | 4.8607 | 4.8963 | 4.8963 | 4.9029 | 4.8825 | 4.8607 | 4.8454 | 4.8296 | |
| util living area | 0.9972 | 0.9943 | 0.9864 | 0.9606 | 0.8878 | 0.7360 | 0.5688 | 0.6229 | 0.8548 | 0.9735 | 0.9944 | 0.9978 | (86) |
| MIT | 19.7117 | 19.8632 | 20.1153 | 20.4507 | 20.7486 | 20.9312 | 20.9844 | 20.9761 | 20.8490 | 20.4680 | 20.0294 | 19.6840 | (87) |
| Th 2 | 19.9044 | 19.9066 | 19.9087 | 19.9188 | 19.9207 | 19.9294 | 19.9294 | 19.9311 | 19.9261 | 19.9207 | 19.9169 | 19.9129 | (88) |
| util rest of house | 0.9962 | 0.9923 | 0.9815 | 0.9453 | 0.8435 | 0.6423 | 0.4399 | 0.4930 | 0.7829 | 0.9602 | 0.9921 | 0.9971 | (89) |
| MIT 2 | 18.1982 | 18.4204 | 18.7877 | 19.2725 | 19.6715 | 19.8831 | 19.9237 | 19.9212 | 19.8038 | 19.3054 | 18.6709 | 18.1636 | (90) |
| Living area fraction | | | | | | | | | | | | | fLA = Living area / (4) = 0.3360 (91) |
| MIT | 18.7068 | 18.9052 | 19.2338 | 19.6685 | 20.0334 | 20.2353 | 20.2802 | 20.2757 | 20.1550 | 19.6961 | 19.1274 | 18.6745 | (92) |
| Temperature adjustment | | | | | | | | | | | | | 0.0000 |
| adjusted MIT | 18.7068 | 18.9052 | 19.2338 | 19.6685 | 20.0334 | 20.2353 | 20.2802 | 20.2757 | 20.1550 | 19.6961 | 19.1274 | 18.6745 | (93) |

8. Space heating requirement

| | | | | | | | | | | | | | |
|----------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------------------------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Useful gains | 0.9947 | 0.9897 | 0.9774 | 0.9409 | 0.8489 | 0.6711 | 0.4836 | 0.5370 | 0.8005 | 0.9565 | 0.9897 | 0.9958 | (94) |
| Ext temp. | 396.3020 | 448.2260 | 490.9399 | 518.9455 | 495.8423 | 384.2498 | 264.0426 | 275.0853 | 379.6929 | 407.3486 | 384.6477 | 376.3926 | (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 | 1078.0573 | 1045.6582 | 948.6423 | 793.9148 | 613.1861 | 410.8645 | 268.3183 | 282.0927 | 443.0367 | 669.3020 | 888.5098 | 1073.7050 | (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 | 507.2260 | 401.4744 | 340.5306 | 197.9779 | 87.3038 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 194.8933 | 362.7807 | 518.8004 | (98) |
| Space heating per m2 | | | | | | | | | | | | | (98) / (4) = 2610.9871 (98) |
| | | | | | | | | | | | | | 42.5519 (99) |

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 93.4000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 2795.4894 (211) |
| Space heating requirement | 507.2260 | 401.4744 | 340.5306 | 197.9779 | 87.3038 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 194.8933 | 362.7807 | 518.8004 | (98) |
| Space heating efficiency (main heating system 1) | 93.4000 | 93.4000 | 93.4000 | 93.4000 | 93.4000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 93.4000 | 93.4000 | 93.4000 | (210) |
| Space heating fuel (main heating system) | 543.0685 | 429.8441 | 364.5938 | 211.9678 | 93.4730 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 208.6652 | 388.4162 | 555.4608 | (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 | 180.1028 | 157.3245 | 163.6859 | 145.1812 | 140.5610 | 123.7983 | 118.6082 | 132.2203 | 133.6805 | 152.2219 | 162.4939 | 175.8733 | (64) |
| Efficiency of water heater (217)m | 87.5157 | 87.3083 | 86.8536 | 85.8326 | 83.8911 | 80.3000 | 80.3000 | 80.3000 | 80.3000 | 85.6744 | 87.0143 | 87.6102 | (216) |
| Fuel for water heating, kWh/month | 205.7950 | 180.1942 | 188.4619 | 169.1446 | 167.5518 | 154.1697 | 147.7063 | 164.6579 | 166.4764 | 177.6750 | 186.7439 | 200.7454 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 2109.3221 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2795.4894 (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) | | | | | | | | | | | | | 291.2356 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 5271.0471 (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 | 2795.4894 | 0.2160 | 603.8257 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 2109.3221 | 0.2160 | 455.6136 (264) |
| Space and water heating | | | 1059.4393 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 291.2356 | 0.5190 | 151.1513 (268) |
| Total CO2, kg/m2/year | | | 1249.5156 (272) |
| Emissions per m2 for space and water heating | | | 17.2660 (272a) |
| Fuel factor (mains gas) | | | 1.0000 |
| Emissions per m2 for lighting | | | 2.4634 (272b) |
| Emissions per m2 for pumps and fans | | | 0.6344 (272c) |
| Target Carbon Dioxide Emission Rate (TER) = (17.2660 * 1.00) + 2.4634 + 0.6344, rounded to 2 d.p. | | | 20.3600 (273) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m2) | Storey height (m) | Volume (m3) |
|--|--------------|---------------------------------|----------------------|
| Ground floor | 61.3600 (1b) | 2.5300 (2b) | 155.2408 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 61.3600 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 155.2408 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour |
|---|--------------|-------------------|-----------------------------|-----------------|--------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 2 * 10 = | 20.0000 (7a) |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Air changes per hour | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 20.0000 / (5) = | 0.1288 (8) |
| Pressure test | | | | Yes | |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.3788 (18) |
| Number of sides sheltered | | | | | 2 (19) |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.3220 (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 | 0.4106 | 0.4025 | 0.3945 | 0.3542 | 0.3462 | 0.3059 | 0.3059 | 0.2979 | 0.3220 | 0.3462 | 0.3623 | 0.3784 (22b) |
| Effective ac | 0.5843 | 0.5810 | 0.5778 | 0.5627 | 0.5599 | 0.5468 | 0.5468 | 0.5444 | 0.5518 | 0.5599 | 0.5656 | 0.5716 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K |
|--|----------|-------------|------------|----------------------|-----------|--------------------------------------|-----------------|
| Front Door | | | 2.1200 | 1.1000 | 2.3320 | | (26) |
| Windows (Uw = 1.20) | | | 9.5600 | 1.1450 | 10.9466 | | (27) |
| Ground Floor | | | 61.3600 | 0.1200 | 7.3632 | 90.0000 | 5522.4000 (28a) |
| Brick and Block | 45.8100 | | 45.8100 | 0.2200 | 10.0782 | 42.2200 | 1934.0982 (29a) |
| 10.4N Brick and Block | 16.9800 | 9.5600 | 7.4200 | 0.2700 | 2.0034 | 113.5000 | 842.1700 (29a) |
| Wall to Corridor | 16.9800 | 2.1200 | 14.8600 | 0.2300 | 3.4174 | 113.5000 | 1686.6100 (29a) |
| Total net area of external elements Aum(A, m2) | | | 141.1300 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 36.1408 | | (33) |
| Party Ceilings 1 | | | 61.3600 | | | 30.0000 | 1840.8000 (32b) |
| Ground Floor Stud | | | 125.8400 | | | 9.0000 | 1132.5600 (32c) |
| Heat capacity Cm = Sum(A x k) | | | | | | (28)...(30) + (32) + (32a)...(32e) = | 12958.6382 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 211.1903 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6780 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 44.8188 (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 | 29.9323 | 29.7647 | 29.6003 | 28.8284 | 28.6840 | 28.0117 | 28.0117 | 27.8872 | 28.2707 | 28.6840 | 28.9762 | 29.2816 (38) |
| Heat transfer coeff | 74.7511 | 74.5834 | 74.4191 | 73.6472 | 73.5028 | 72.8305 | 72.8305 | 72.7060 | 73.0895 | 73.5028 | 73.7949 | 74.1004 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 73.6465 (39) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP | 1.2182 | 1.2155 | 1.2128 | 1.2002 | 1.1979 | 1.1869 | 1.1869 | 1.1849 | 1.1912 | 1.1979 | 1.2027 | 1.2076 (40) |
| HLP (average) | | | | | | | | | | | | 1.2002 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.0198 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 82.1706 (43) |
| Daily hot water use | 90.3877 | 87.1008 | 83.8140 | 80.5272 | 77.2404 | 73.9535 | 73.9535 | 77.2404 | 80.5272 | 83.8140 | 87.1008 | 90.3877 (44) |
| Energy conte | 134.0423 | 117.2342 | 120.9752 | 105.4691 | 101.2001 | 87.3280 | 80.9223 | 92.8595 | 93.9685 | 109.5112 | 119.5401 | 129.8128 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1292.8634 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |
| Water 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 (46) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| 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 | 28.4840 | 24.9123 | 25.7072 | 22.4122 | 21.5050 | 18.5572 | 17.1960 | 19.7326 | 19.9683 | 23.2711 | 25.4023 | 27.5852 | (65) |

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| 5. Internal gains (see Table 5 and 5a) | | | | | | | | | | | | | |
| Metabolic gains (Table 5), Watts | | | | | | | | | | | | | |
| (66)m | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | 100.9907 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 16.4910 | 14.6471 | 11.9118 | 9.0180 | 6.7411 | 5.6911 | 6.1494 | 7.9933 | 10.7286 | 13.6224 | 15.8993 | 16.9493 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 176.3634 | 178.1935 | 173.5817 | 163.7637 | 151.3703 | 139.7223 | 131.9406 | 130.1105 | 134.7223 | 144.5403 | 156.9337 | 168.5818 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | 33.0991 | (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) | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | (71) |
| Water heating gains (Table 5) | 38.2849 | 37.0718 | 34.5527 | 31.1280 | 28.9046 | 25.7739 | 23.1129 | 26.5224 | 27.7338 | 31.2784 | 35.2809 | 37.0769 | (72) |
| Total internal gains | 284.4365 | 283.2097 | 273.3435 | 257.2070 | 240.3132 | 224.4845 | 214.5002 | 217.9234 | 226.4819 | 242.7383 | 261.4112 | 275.9052 | (73) |

| | | | | | | | | | | | | | |
|----------------|----------|----------|----------|------------|----------|---------------|----------|---------------|----------|----------|----------|----------|------|
| 6. Solar gains | | | | | | | | | | | | | |
| [Jan] | | | Area | Solar flux | | g | | FF | | Access | | Gains | |
| | | | m2 | Table 6a | | Specific data | | Specific data | | factor | | W | |
| | | | | W/m2 | | or Table 6b | | or Table 6c | | Table 6d | | | |
| Southeast | | | 5.2500 | 36.7938 | | 0.6300 | | 0.7000 | | 0.7700 | | 59.0345 | (77) |
| Northwest | | | 4.3100 | 11.2829 | | 0.6300 | | 0.7000 | | 0.7700 | | 14.8618 | (81) |
| Solar gains | 73.8963 | 130.8093 | 192.0912 | 259.9883 | 311.2691 | 317.8422 | 302.7616 | 263.1548 | 215.3918 | 148.1075 | 89.4098 | 62.6582 | (83) |
| Total gains | 358.3328 | 414.0190 | 465.4347 | 517.1954 | 551.5824 | 542.3267 | 517.2618 | 481.0782 | 441.8736 | 390.8458 | 350.8209 | 338.5634 | (84) |

| | | | | | | | | | | | | | |
|---|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| 7. Mean internal temperature (heating season) | | | | | | | | | | | | | |
| Temperature during heating periods in the living area from Table 9, Thl (C) | | | | | | | | | | | | | |
| Utilisation factor for gains for living area, nil,m (see Table 9a) | | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (85) |
| tau | 48.1548 | 48.2630 | 48.3696 | 48.8766 | 48.9726 | 49.4246 | 49.4246 | 49.5093 | 49.2495 | 48.9726 | 48.7787 | 48.5776 | |
| alpha | 4.2103 | 4.2175 | 4.2246 | 4.2584 | 4.2648 | 4.2950 | 4.2950 | 4.3006 | 4.2833 | 4.2648 | 4.2519 | 4.2385 | |
| util living area | 0.9963 | 0.9926 | 0.9835 | 0.9561 | 0.8857 | 0.7452 | 0.5868 | 0.6433 | 0.8601 | 0.9712 | 0.9931 | 0.9971 | (86) |
| MIT | 19.4666 | 19.6405 | 19.9299 | 20.3152 | 20.6631 | 20.8927 | 20.9707 | 20.9567 | 20.7851 | 20.3352 | 19.8310 | 19.4357 | (87) |
| Th 2 | 19.9054 | 19.9076 | 19.9098 | 19.9198 | 19.9217 | 19.9305 | 19.9305 | 19.9321 | 19.9271 | 19.9217 | 19.9179 | 19.9139 | (88) |
| util rest of house | 0.9952 | 0.9904 | 0.9783 | 0.9413 | 0.8451 | 0.6575 | 0.4591 | 0.5165 | 0.7955 | 0.9586 | 0.9907 | 0.9962 | (89) |
| MIT 2 | 18.5121 | 18.6868 | 18.9753 | 19.3590 | 19.6830 | 19.8757 | 19.9217 | 19.9176 | 19.7984 | 19.3853 | 18.8852 | 18.4879 | (90) |
| Living area fraction | fLA = Living area / (4) = | | | | | | | | | | | | |
| MIT | 18.8329 | 19.0073 | 19.2961 | 19.6803 | 20.0124 | 20.2175 | 20.2742 | 20.2668 | 20.1300 | 19.7045 | 19.2031 | 18.8064 | (92) |
| Temperature adjustment | 0.0000 | | | | | | | | | | | | |
| adjusted MIT | 18.8329 | 19.0073 | 19.2961 | 19.6803 | 20.0124 | 20.2175 | 20.2742 | 20.2668 | 20.1300 | 19.7045 | 19.2031 | 18.8064 | (93) |

| | | | | | | | | | | | | | |
|------------------------------|----------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| 8. Space heating requirement | | | | | | | | | | | | | |
| Utilisation | 0.9937 | 0.9880 | 0.9746 | 0.9372 | 0.8490 | 0.6831 | 0.5021 | 0.5588 | 0.8097 | 0.9554 | 0.9885 | 0.9950 | (94) |
| Useful gains | 356.0746 | 409.0663 | 453.5915 | 484.7249 | 468.3172 | 370.4876 | 259.7372 | 268.8310 | 357.7718 | 373.4134 | 346.7839 | 336.8712 | (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 | 1086.3483 | 1052.1694 | 952.2739 | 793.9420 | 610.9815 | 409.1219 | 267.5934 | 281.1409 | 440.7273 | 669.2075 | 893.1454 | 1082.3410 | (97) |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | (97a) |
| Space heating kWh | 543.3236 | 432.1653 | 371.0197 | 222.6363 | 106.1422 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 220.0708 | 393.3803 | 554.6295 | (98) |
| Space heating | 2843.3678 (98) | | | | | | | | | | | | |
| Space heating per m2 | 46.3391 (99) / (4) = | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|--------|--------|
| 8c. Space cooling requirement | | | | | | | | | | | | | |
| Calculated for June, July and August. See Table 10b | | | | | | | | | | | | | |
| 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 | (100) |
| Heat loss rate W | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (101) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.8254 | 0.8916 | 0.8646 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (102) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 565.0615 | 480.4999 | 477.7453 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (103) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 709.5812 | 678.8250 | 637.8190 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (103a) |
| 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 | | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | |
|--|--------|--------|--------|--------|--------|----------|----------|----------|--------|--------|--------|---------------------------------------|
| Space cooling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 104.0542 | 147.5539 | 119.0948 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (104) |
| Cooled fraction | | | | | | | | | | | | 370.7029 (104) |
| Intermittency factor (Table 10b) | | | | | | | | | | | | FC = cooled area / (4) = 1.0000 (105) |
| Space cooling kWh | 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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 26.0136 | 36.8885 | 29.7737 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (107) |
| Space cooling per m2 | | | | | | | | | | | | 92.6757 (107) |
| Energy for space heating | | | | | | | | | | | | 1.5104 (108) |
| Energy for space cooling | | | | | | | | | | | | 46.3391 (99) |
| Total | | | | | | | | | | | | 1.5104 (108) |
| Dwelling Fabric Energy Efficiency (DFEE) | | | | | | | | | | | | 47.8495 (109) |
| | | | | | | | | | | | | 47.8 (109) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 61.3600 (1b) | 2.5300 (2b) | 155.2408 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 61.3600 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 155.2408 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour |
|---|--------------|-------------------|-------|-----------------------------|-------------------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 2 * 10 = | 20.0000 (7a) |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Air changes per hour | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 20.0000 / (5) = | 0.1288 (8) |
| Pressure test | | | | | Yes |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.3788 (18) |
| Number of sides sheltered | | | | | 2 (19) |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3220 (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 | 0.4106 | 0.4025 | 0.3945 | 0.3542 | 0.3462 | 0.3059 | 0.3059 | 0.2979 | 0.3220 | 0.3462 | 0.3623 | 0.3784 (22b) |
| | 0.5843 | 0.5810 | 0.5778 | 0.5627 | 0.5599 | 0.5468 | 0.5468 | 0.5444 | 0.5518 | 0.5599 | 0.5656 | 0.5716 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K | | | | | |
|---|----------------------|-------------------------|------------------------|----------------------------|----------------------|-----------------------------|---------------|--------------|---------|---------|---------|--------------|
| TER Opaque door | | | 2.1200 | 1.0000 | 2.1200 | | (26) | | | | | |
| TER Opening Type (Uw = 1.40) | | | 9.5600 | 1.3258 | 12.6742 | | (27) | | | | | |
| Ground Floor | | | 61.3600 | 0.1300 | 7.9768 | | (28a) | | | | | |
| Brick and Block | 45.8100 | | 45.8100 | 0.1800 | 8.2458 | | (29a) | | | | | |
| 10.4N Brick and Block | 16.9800 | 9.5600 | 7.4200 | 0.1800 | 1.3356 | | (29a) | | | | | |
| Wall to Corridor | 16.9800 | 2.1200 | 14.8600 | 0.1800 | 2.6748 | | (29a) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 141.1300 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 35.0272 | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 250.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 9.8702 (36) | | | | | |
| Total fabric heat loss | | | | | | | (33) + (36) = | 44.8974 (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 | 29.9323 | 29.7647 | 29.6003 | 28.8284 | 28.6840 | 28.0117 | 28.0117 | 27.8872 | 28.2707 | 28.6840 | 28.9762 | 29.2816 (38) |
| Heat transfer coeff | 74.8298 | 74.6621 | 74.4978 | 73.7259 | 73.5815 | 72.9092 | 72.9092 | 72.7847 | 73.1681 | 73.5815 | 73.8736 | 74.1791 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 73.7252 (39) |
| HLP | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| HLP (average) | 1.2195 | 1.2168 | 1.2141 | 1.2015 | 1.1992 | 1.1882 | 1.1882 | 1.1862 | 1.1924 | 1.1992 | 1.2039 | 1.2089 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|--------------------|----------------|
| Assumed occupancy | | | | | | | | | | | | 2.0198 (42) | |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 82.1706 (43) | |
| Daily hot water use | 90.3877 | 87.1008 | 83.8140 | 80.5272 | 77.2404 | 73.9535 | 73.9535 | 77.2404 | 80.5272 | 83.8140 | 87.1008 | 90.3877 (44) | |
| Energy conte | 134.0423 | 117.2342 | 120.9752 | 105.4691 | 101.2001 | 87.3280 | 80.9223 | 92.8595 | 93.9685 | 109.5112 | 119.5401 | 129.8128 (45) | |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = | 1292.8634 (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 (46) | |
| If cylinder contains dedicated solar storage | | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | |
|--|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------|---------|-------|
| Intermittency factor (Table 10b) | 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 | 23.5454 | 34.9255 | 27.6953 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (107) |
| Space cooling | | | | | | | | | | | 86.1662 | (107) |
| Space cooling per m2 | | | | | | | | | | | 1.4043 | (108) |
| Energy for space heating | | | | | | | | | | | 46.8372 | (99) |
| Energy for space cooling | | | | | | | | | | | 1.4043 | (108) |
| Total | | | | | | | | | | | 48.2415 | (109) |
| Target Fabric Energy Efficiency (TFEE) | | | | | | | | | | | 55.5 | (109) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 61.3600 (1b) | 2.5300 (2b) | 155.2408 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 61.3600 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 155.2408 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour |
|---|--------------|-------------------|-----------------------------|-----------------|-------------------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 2 * 10 = | 20.0000 (7a) |
| Number of passive vents | | | | 1 * 10 = | 10.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Air changes per hour | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 30.0000 / (5) = | 0.1932 (8) |
| Pressure test | | | | Yes | |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.4432 (18) |
| Number of sides sheltered | | | | | 2 (19) |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.3768 (21) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed | 5.1000 | 4.7000 | 4.6000 | 4.3000 | 4.3000 | 4.0000 | 4.0000 | 3.9000 | 4.0000 | 4.5000 | 4.4000 | 4.7000 (22) |
| Wind factor | 1.2750 | 1.1750 | 1.1500 | 1.0750 | 1.0750 | 1.0000 | 1.0000 | 0.9750 | 1.0000 | 1.1250 | 1.1000 | 1.1750 (22a) |
| Adj infilt rate | 0.4804 | 0.4427 | 0.4333 | 0.4050 | 0.4050 | 0.3768 | 0.3768 | 0.3673 | 0.3768 | 0.4239 | 0.4144 | 0.4427 (22b) |
| Effective ac | 0.6154 | 0.5980 | 0.5939 | 0.5820 | 0.5820 | 0.5710 | 0.5710 | 0.5675 | 0.5710 | 0.5898 | 0.5859 | 0.5980 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K |
|--|----------------------|-------------------------|------------------------|----------------------------|-----------|--------------------------------------|-----------------|
| Front Door | | | 2.1200 | 1.1000 | 2.3320 | | (26) |
| Windows (Uw = 1.20) | | | 9.5600 | 1.1450 | 10.9466 | | (27) |
| Ground Floor | | | 61.3600 | 0.1200 | 7.3632 | 90.0000 | 5522.4000 (28a) |
| Brick and Block | 45.8100 | | 45.8100 | 0.2200 | 10.0782 | 42.2200 | 1934.0982 (29a) |
| 10.4N Brick and Block | 16.9800 | 9.5600 | 7.4200 | 0.2700 | 2.0034 | 113.5000 | 842.1700 (29a) |
| Wall to Corridor | 16.9800 | 2.1200 | 14.8600 | 0.2300 | 3.4174 | 113.5000 | 1686.6100 (29a) |
| Total net area of external elements Aum(A, m ²) | | | 141.1300 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 36.1408 | | (33) |
| Party Ceilings 1 | | | 61.3600 | | | 70.0000 | 4295.2000 (32b) |
| Ground Floor Stud | | | 125.8400 | | | 9.0000 | 1132.5600 (32c) |
| Heat capacity Cm = Sum(A x k) | | | | | | (28)...(30) + (32) + (32a)...(32e) = | 15413.0382 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 251.1903 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6780 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 44.8188 (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 | 31.5255 | 30.6347 | 30.4233 | 29.8166 | 29.8166 | 29.2507 | 29.2507 | 29.0712 | 29.2507 | 30.2165 | 30.0143 | 30.6347 (38) |
| Average = Sum(39)m / 12 = | 76.3442 | 75.4534 | 75.2421 | 74.6353 | 74.6353 | 74.0695 | 74.0695 | 73.8899 | 74.0695 | 75.0353 | 74.8330 | 75.4534 (39) |
| | | | | | | | | | | | | 74.8109 (39) |

| HLP | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP (average) | 1.2442 | 1.2297 | 1.2262 | 1.2164 | 1.2164 | 1.2071 | 1.2071 | 1.2042 | 1.2071 | 1.2229 | 1.2196 | 1.2297 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.0198 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 82.1706 (43) |
| Daily hot water use | 90.3877 | 87.1008 | 83.8140 | 80.5272 | 77.2404 | 73.9535 | 73.9535 | 77.2404 | 80.5272 | 83.8140 | 87.1008 | 90.3877 (44) |
| Energy conte | 134.0423 | 117.2342 | 120.9752 | 105.4691 | 101.2001 | 87.3280 | 80.9223 | 92.8595 | 93.9685 | 109.5112 | 119.5401 | 129.8128 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1292.8634 (45) |
| Distribution loss (46)m = 0.15 x (45)m | 20.1063 | 17.5851 | 18.1463 | 15.8204 | 15.1800 | 13.0992 | 12.1383 | 13.9289 | 14.0953 | 16.4267 | 17.9310 | 19.4719 (46) |
| Water storage loss: | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

| | | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|----------|----------|----------|------|
| 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 | 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 | 0.0000 | 0.0000 | (57) |
| Combi loss | 1.3933 | 1.1743 | 1.1660 | 0.9767 | 0.8989 | 0.7427 | 0.6882 | 0.8248 | 0.8702 | 1.0555 | 1.1974 | 1.3493 | 1.3493 | 1.3493 | (61) |
| Total heat required for water heating calculated for each month | 135.4356 | 118.4085 | 122.1413 | 106.4458 | 102.0991 | 88.0707 | 81.6105 | 93.6843 | 94.8387 | 110.5668 | 120.7375 | 131.1621 | 131.1621 | 131.1621 | (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 | 0.0000 | 0.0000 | (63) |
| Output from w/h | 135.4356 | 118.4085 | 122.1413 | 106.4458 | 102.0991 | 88.0707 | 81.6105 | 93.6843 | 94.8387 | 110.5668 | 120.7375 | 131.1621 | 131.1621 | 131.1621 | (64) |
| RHI water heating demand | | | | | | | | | | | | | | | (64) |
| Heat gains from water heating, kWh/month | 44.9174 | 39.2740 | 40.5158 | 35.3127 | 33.8738 | 29.2222 | 27.0787 | 31.0820 | 31.4621 | 36.6764 | 40.0464 | 43.5001 | 43.5001 | 43.5001 | (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 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 41.2274 | 36.6178 | 29.7796 | 22.5451 | 16.8527 | 14.2278 | 15.3736 | 19.9832 | 26.8214 | 34.0559 | 39.7483 | 42.3733 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 263.2289 | 265.9604 | 259.0772 | 244.4235 | 225.9259 | 208.5407 | 196.9263 | 194.1948 | 201.0781 | 215.7318 | 234.2294 | 251.6146 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | (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) | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | (71) |
| Water heating gains (Table 5) | 60.3728 | 58.4434 | 54.4567 | 49.0454 | 45.5293 | 40.5864 | 36.3961 | 41.7769 | 43.6973 | 49.2962 | 55.6200 | 58.4679 | (72) |
| Total internal gains | 457.3642 | 453.5566 | 435.8485 | 408.5489 | 380.8428 | 355.8899 | 341.2310 | 348.4899 | 364.1318 | 391.6189 | 422.1328 | 444.9907 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b g | Specific data or Table 6c FF | Access factor Table 6d | Gains W | | | | | | | |
|-------------|----------|--------------------------|-----------------------------|------------------------------|------------------------|--------------|----------|----------|----------|----------|----------|----------|------|
| Southeast | 5.2500 | 46.3896 | 0.6300 | 0.7000 | 0.7700 | 74.4306 (77) | | | | | | | |
| Northwest | 4.3100 | 15.0428 | 0.6300 | 0.7000 | 0.7700 | 19.8143 (81) | | | | | | | |
| Solar gains | 94.2449 | 142.9882 | 210.0015 | 291.3003 | 334.4992 | 370.1396 | 343.9563 | 304.4315 | 250.3348 | 171.5449 | 113.0708 | 76.2575 | (83) |
| Total gains | 551.6091 | 596.5448 | 645.8499 | 699.8493 | 715.3420 | 726.0295 | 685.1874 | 652.9214 | 614.4667 | 563.1639 | 535.2036 | 521.2482 | (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Thl (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | | | | | | | | | | | | | 21.0000 (85) |
| tau | 56.0802 | 56.7423 | 56.9017 | 57.3643 | 57.3643 | 57.8025 | 57.8025 | 57.9429 | 57.8025 | 57.0585 | 57.2127 | 56.7423 | |
| alpha | 4.7387 | 4.7828 | 4.7934 | 4.8243 | 4.8243 | 4.8535 | 4.8535 | 4.8629 | 4.8535 | 4.8039 | 4.8142 | 4.7828 | |
| util living area | 0.9858 | 0.9790 | 0.9575 | 0.8982 | 0.7695 | 0.5545 | 0.3972 | 0.4152 | 0.6744 | 0.9001 | 0.9706 | 0.9883 | (86) |
| MIT | 20.0298 | 20.1426 | 20.3797 | 20.6652 | 20.8848 | 20.9816 | 20.9971 | 20.9965 | 20.9547 | 20.7239 | 20.3624 | 20.0164 | (87) |
| Th 2 | 19.8848 | 19.8963 | 19.8991 | 19.9069 | 19.9069 | 19.9143 | 19.9143 | 19.9166 | 19.9143 | 19.9017 | 19.9044 | 19.8963 | (88) |
| util rest of house | 0.9811 | 0.9721 | 0.9432 | 0.8650 | 0.7007 | 0.4547 | 0.2822 | 0.2956 | 0.5724 | 0.8577 | 0.9590 | 0.9843 | (89) |
| MIT 2 | 19.0383 | 19.1579 | 19.3895 | 19.6600 | 19.8405 | 19.9079 | 19.9138 | 19.9161 | 19.8958 | 19.7138 | 19.3809 | 19.0347 | (90) |
| Living area fraction | 19.3715 | 19.4888 | 19.7222 | 19.9978 | 20.1914 | 20.2687 | 20.2779 | 20.2792 | 20.2516 | 20.0533 | 19.7107 | 19.3646 | (92) |
| Temperature adjustment | 19.3715 | 19.4888 | 19.7222 | 19.9978 | 20.1914 | 20.2687 | 20.2779 | 20.2792 | 20.2516 | 20.0533 | 19.7107 | 19.3646 | (93) |
| adjusted MIT | 19.3715 | 19.4888 | 19.7222 | 19.9978 | 20.1914 | 20.2687 | 20.2779 | 20.2792 | 20.2516 | 20.0533 | 19.7107 | 19.3646 | (93) |

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|--|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| Utilisation | 0.9783 | 0.9689 | 0.9405 | 0.8681 | 0.7200 | 0.4882 | 0.3210 | 0.3360 | 0.6059 | 0.8645 | 0.9565 | 0.9817 | (94) |
| Useful gains | 539.6324 | 578.0047 | 607.3999 | 607.5581 | 515.0756 | 354.4406 | 219.9578 | 219.3907 | 372.3219 | 486.8694 | 511.9234 | 511.7352 | (95) |
| Ext temp. | 5.4000 | 5.7000 | 7.3000 | 9.6000 | 12.6000 | 15.4000 | 17.3000 | 17.3000 | 15.0000 | 11.8000 | 8.4000 | 5.5000 | (96) |
| Heat loss rate W | 1066.6401 | 1040.4131 | 934.6753 | 776.0422 | 566.5902 | 360.6233 | 220.5690 | 220.1298 | 388.9859 | 619.2873 | 846.4169 | 1046.1325 | (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 | 392.0937 | 310.7384 | 243.4929 | 121.3086 | 38.3269 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 98.5189 | 240.8353 | 397.5916 | (98) |
| Space heating RHI space heating demand | | | | | | | | | | | | 1842.9064 | (98) |
| | | | | | | | | | | | | 1843 | (98) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m2) | Storey height (m) | Volume (m3) |
|---|--------------|----------------------------------|----------------------|
| Ground floor | 61.3600 (1b) | 2.5300 (2b) | 155.2408 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 61.3600 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) | 155.2408 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour |
|---|--------------|-------------------|-----------------------------|-----------------|--------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 2 * 10 = | 20.0000 (7a) |
| Number of passive vents | | | | 1 * 10 = | 10.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Air changes per hour | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 30.0000 / (5) = | 0.1932 (8) |
| Pressure test | | | | Yes | |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.4432 (18) |
| Number of sides sheltered | | | | | 2 (19) |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.3768 (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 | 0.4804 | 0.4710 | 0.4615 | 0.4144 | 0.4050 | 0.3579 | 0.3579 | 0.3485 | 0.3768 | 0.4050 | 0.4239 | 0.4427 (22b) |
| Effective ac | 0.6154 | 0.6109 | 0.6065 | 0.5859 | 0.5820 | 0.5641 | 0.5641 | 0.5607 | 0.5710 | 0.5820 | 0.5898 | 0.5980 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K |
|--|----------|-------------|------------|----------------------|-----------|--------------------------------------|-----------------|
| Front Door | | | 2.1200 | 1.1000 | 2.3320 | | (26) |
| Windows (Uw = 1.20) | | | 9.5600 | 1.1450 | 10.9466 | | (27) |
| Ground Floor | | | 61.3600 | 0.1200 | 7.3632 | 90.0000 | 5522.4000 (28a) |
| Brick and Block | 45.8100 | | 45.8100 | 0.2200 | 10.0782 | 42.2200 | 1934.0982 (29a) |
| 10.4N Brick and Block | 16.9800 | 9.5600 | 7.4200 | 0.2700 | 2.0034 | 113.5000 | 842.1700 (29a) |
| Wall to Corridor | 16.9800 | 2.1200 | 14.8600 | 0.2300 | 3.4174 | 113.5000 | 1686.6100 (29a) |
| Total net area of external elements Aum(A, m2) | | | 141.1300 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 36.1408 | | (33) |
| Party Ceilings 1 | | | 61.3600 | | | 70.0000 | 4295.2000 (32b) |
| Ground Floor Stud | | | 125.8400 | | | 9.0000 | 1132.5600 (32c) |
| Heat capacity Cm = Sum(A x k) | | | | | | (28)...(30) + (32) + (32a)...(32e) = | 15413.0382 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 251.1903 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6780 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 44.8188 (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 | 31.5255 | 31.2960 | 31.0710 | 30.0143 | 29.8166 | 28.8962 | 28.8962 | 28.7258 | 29.2507 | 29.8166 | 30.2165 | 30.6347 (38) |
| Average = Sum(39)m / 12 = | 76.3442 | 76.1147 | 75.8897 | 74.8330 | 74.6353 | 73.7150 | 73.7150 | 73.5445 | 74.0695 | 74.6353 | 75.0353 | 75.4534 (39) |
| | | | | | | | | | | | | 74.8321 (39) |

| HLP | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP (average) | 1.2442 | 1.2405 | 1.2368 | 1.2196 | 1.2164 | 1.2014 | 1.2014 | 1.1986 | 1.2071 | 1.2164 | 1.2229 | 1.2297 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.0198 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 82.1706 (43) |
| Daily hot water use | 90.3877 | 87.1008 | 83.8140 | 80.5272 | 77.2404 | 73.9535 | 73.9535 | 77.2404 | 80.5272 | 83.8140 | 87.1008 | 90.3877 (44) |
| Energy conte | 134.0423 | 117.2342 | 120.9752 | 105.4691 | 101.2001 | 87.3280 | 80.9223 | 92.8595 | 93.9685 | 109.5112 | 119.5401 | 129.8128 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1292.8634 (45) |
| Distribution loss (46)m = 0.15 x (45)m | 20.1063 | 17.5851 | 18.1463 | 15.8204 | 15.1800 | 13.0992 | 12.1383 | 13.9289 | 14.0953 | 16.4267 | 17.9310 | 19.4719 (46) |
| Water storage loss: | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|----------|------|
| 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) |
| Combi loss | 1.3933 | 1.1743 | 1.1660 | 0.9767 | 0.8989 | 0.7427 | 0.6882 | 0.8248 | 0.8702 | 1.0555 | 1.1974 | 1.3493 | (61) |
| Total heat required for water heating calculated for each month | 135.4356 | 118.4085 | 122.1413 | 106.4458 | 102.0991 | 88.0707 | 81.6105 | 93.6843 | 94.8387 | 110.5668 | 120.7375 | 131.1621 | (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 | 135.4356 | 118.4085 | 122.1413 | 106.4458 | 102.0991 | 88.0707 | 81.6105 | 93.6843 | 94.8387 | 110.5668 | 120.7375 | 131.1621 | (64) |
| Heat gains from water heating, kWh/month | 44.9174 | 39.2740 | 40.5158 | 35.3127 | 33.8738 | 29.2222 | 27.0787 | 31.0820 | 31.4621 | 36.6764 | 40.0464 | 43.5001 | (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 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 41.2274 | 36.6178 | 29.7796 | 22.5451 | 16.8527 | 14.2278 | 15.3736 | 19.9832 | 26.8214 | 34.0559 | 39.7483 | 42.3733 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 263.2289 | 265.9604 | 259.0772 | 244.4235 | 225.9259 | 208.5407 | 196.9263 | 194.1948 | 201.0781 | 215.7318 | 234.2294 | 251.6146 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | (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) | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | (71) |
| Water heating gains (Table 5) | 60.3728 | 58.4434 | 54.4567 | 49.0454 | 45.5293 | 40.5864 | 36.3961 | 41.7769 | 43.6973 | 49.2962 | 55.6200 | 58.4679 | (72) |
| Total internal gains | 457.3642 | 453.5566 | 435.8485 | 408.5489 | 380.8428 | 355.8899 | 341.2310 | 348.4899 | 364.1318 | 391.6189 | 422.1328 | 444.9907 | (73) |

6. Solar gains

| | | | | | | | | | | | | | |
|-------------|----------------|------------------|---------------|---------------|----------|--------------|----------|----------|----------|----------|----------|----------|------|
| [Jan] | Area | Solar flux | g | FF | Access | Gains | | | | | | | |
| | m ² | Table 6a | Specific data | Specific data | factor | W | | | | | | | |
| | | W/m ² | or Table 6b | or Table 6c | Table 6d | | | | | | | | |
| Southeast | 5.2500 | 36.7938 | 0.6300 | 0.7000 | 0.7700 | 59.0345 (77) | | | | | | | |
| Northwest | 4.3100 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 14.8618 (81) | | | | | | | |
| Solar gains | 73.8963 | 130.8093 | 192.0912 | 259.9883 | 311.2691 | 317.8422 | 302.7616 | 263.1548 | 215.3918 | 148.1075 | 89.4098 | 62.6582 | (83) |
| Total gains | 531.2605 | 584.3659 | 627.9396 | 668.5373 | 692.1120 | 673.7321 | 643.9927 | 611.6447 | 579.5236 | 539.7264 | 511.5425 | 507.6488 | (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 | 56.0802 | 56.2493 | 56.4161 | 57.2127 | 57.3643 | 58.0805 | 58.0805 | 58.2151 | 57.8025 | 57.3643 | 57.0585 | 56.7423 | |
| alpha | 4.7387 | 4.7500 | 4.7611 | 4.8142 | 4.8243 | 4.8720 | 4.8720 | 4.8810 | 4.8535 | 4.8243 | 4.8039 | 4.7828 | |
| util living area | 0.9907 | 0.9843 | 0.9691 | 0.9267 | 0.8295 | 0.6580 | 0.4946 | 0.5389 | 0.7732 | 0.9400 | 0.9831 | 0.9924 | (86) |
| MIT | 19.8777 | 20.0244 | 20.2616 | 20.5694 | 20.8192 | 20.9571 | 20.9912 | 20.9869 | 20.9050 | 20.5949 | 20.1872 | 19.8519 | (87) |
| Th 2 | 19.8848 | 19.8878 | 19.8907 | 19.9044 | 19.9069 | 19.9189 | 19.9189 | 19.9211 | 19.9143 | 19.9069 | 19.9017 | 19.8963 | (88) |
| util rest of house | 0.9878 | 0.9792 | 0.9588 | 0.9018 | 0.7741 | 0.5638 | 0.3778 | 0.4197 | 0.6883 | 0.9143 | 0.9767 | 0.9900 | (89) |
| MIT 2 | 18.8877 | 19.0348 | 19.2690 | 19.5722 | 19.7913 | 19.9004 | 19.9169 | 19.9177 | 19.8663 | 19.6038 | 19.2081 | 18.8715 | (90) |
| Living area fraction | fLA = Living area / (4) = | | | | | | | | | | | | 0.3360 (91) |
| MIT | 19.2204 | 19.3674 | 19.6025 | 19.9073 | 20.1367 | 20.2555 | 20.2779 | 20.2770 | 20.2154 | 19.9369 | 19.5371 | 19.2010 | (92) |
| Temperature adjustment | | | | | | | | | | | | | 0.0000 |
| adjusted MIT | 19.2204 | 19.3674 | 19.6025 | 19.9073 | 20.1367 | 20.2555 | 20.2779 | 20.2770 | 20.2154 | 19.9369 | 19.5371 | 19.2010 | (93) |

8. Space heating requirement

| | | | | | | | | | | | | | |
|----------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------------------------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| | 0.9854 | 0.9762 | 0.9555 | 0.9019 | 0.7869 | 0.5946 | 0.4174 | 0.4601 | 0.7140 | 0.9151 | 0.9740 | 0.9880 | (94) |
| Useful gains | 523.5277 | 570.4787 | 600.0256 | 602.9386 | 544.6565 | 400.5914 | 268.7831 | 281.4220 | 413.7837 | 493.9052 | 498.2677 | 501.5424 | (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 | 1139.0872 | 1101.1796 | 994.3485 | 823.7097 | 629.6777 | 416.8957 | 271.1165 | 285.1334 | 452.9624 | 696.8606 | 933.2216 | 1131.8768 | (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 | 457.9763 | 356.6310 | 293.3763 | 158.9552 | 63.2558 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 150.9988 | 313.1668 | 468.9688 | (98) |
| Space heating | | | | | | | | | | | | | 2263.3289 (98) |
| Space heating per m ² | | | | | | | | | | | | | (98) / (4) = 36.8861 (99) |

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

| | | | | | | | | | | | | | | |
|---|----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | 0.0000 | (201) | | | | | | | | | | | |
| Fraction of space heat from main system(s) | | 1.0000 | (202) | | | | | | | | | | | |
| Efficiency of main space heating system 1 (in %) | | 90.2000 | (206) | | | | | | | | | | | |
| Efficiency of secondary/supplementary heating system, % | | 0.0000 | (208) | | | | | | | | | | | |
| Space heating requirement | | 2509.2338 | (211) | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| Space heating requirement | 457.9763 | 356.6310 | 293.3763 | 158.9552 | 63.2558 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 150.9988 | 313.1668 | 468.9688 | (98) | |
| Space heating efficiency (main heating system 1) | 90.2000 | 90.2000 | 90.2000 | 90.2000 | 90.2000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 90.2000 | 90.2000 | 90.2000 | (210) | |
| Space heating fuel (main heating system) | 507.7342 | 395.3781 | 325.2509 | 176.2253 | 70.1284 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 167.4045 | 347.1916 | 519.9210 | (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 | 135.4356 | 118.4085 | 122.1413 | 106.4458 | 102.0991 | 88.0707 | 81.6105 | 93.6843 | 94.8387 | 110.5668 | 120.7375 | 131.1621 | (64) | |
| Efficiency of water heater (217)m | 86.5699 | 86.2501 | 85.5782 | 84.0095 | 81.0100 | 76.2000 | 76.2000 | 76.2000 | 76.2000 | 83.6996 | 85.8129 | 86.7179 | (217) | |
| Fuel for water heating, kWh/month | 156.4465 | 137.2851 | 142.7247 | 126.7069 | 126.0327 | 115.5784 | 107.1004 | 122.9453 | 124.4603 | 132.0995 | 140.6984 | 151.2516 | (219) | |
| Water heating fuel used | | | | | | | | | | | | | 1583.3297 | (219) |
| Annual totals kWh/year | | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2509.2338 | (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) | | | | | | | | | | | | | 291.2356 | (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | | |
| Total delivered energy for all uses | | | | | | | | | | | | | 4458.7992 | (238) |

10a. Fuel costs - using Table 12 prices

| | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year | |
|---------------------------------------|---------------|------------------|------------------|-------|
| Space heating - main system 1 | 2509.2338 | 3.4800 | 87.3213 | (240) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (242) |
| Water heating (other fuel) | 1583.3297 | 3.4800 | 55.0999 | (247) |
| Pumps and fans for heating | 75.0000 | 13.1900 | 9.8925 | (249) |
| Energy for lighting | 291.2356 | 13.1900 | 38.4140 | (250) |
| Additional standing charges | | | 120.0000 | (251) |
| Energy saving/generation technologies | | | | |
| PV Unit | 0.0000 | 13.1900 | 0.0000 | (252) |
| Total energy cost | | | 310.7277 | (255) |

11a. SAP rating - Individual heating systems

| | | | |
|----------------------------------|---|---------|-------|
| Energy cost deflator (Table 12): | | 0.4200 | (256) |
| Energy cost factor (ECF) | $[(255) \times (256)] / [(4) + 45.0] =$ | 1.2270 | (257) |
| SAP value | | 82.8831 | |
| 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 | 2509.2338 | 0.2160 | 541.9945 | (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (263) |
| Water heating (other fuel) | 1583.3297 | 0.2160 | 341.9992 | (264) |
| Space and water heating | | | 883.9937 | (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 | (267) |
| Energy for lighting | 291.2356 | 0.5190 | 151.1513 | (268) |
| Energy saving/generation technologies | | | | |
| PV Unit | -418.0000 | 0.5190 | -216.9420 | (269) |
| Total kg/year | | | 857.1280 | (272) |
| CO2 emissions per m2 | | | 13.9700 | (273) |
| EI value | | | 89.2013 | |
| EI rating | | | 89 | (274) |
| EI band | | | B | |

Calculation of stars for heating and DHW

| | |
|------------------------------------|---|
| Main heating energy efficiency | $3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4 |
| Main heating environmental impact | $0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4 |
| Water heating energy efficiency | $3.48 / 0.8204 = 4.242$, stars = 4 |
| Water heating environmental impact | $0.216 / 0.8204 = 0.2633$, stars = 4 |

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Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 61.3600 (1b) | 2.5300 (2b) | 155.2408 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 61.3600 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 155.2408 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour |
|---|--------------|-------------------|-----------------------------|-----------------|-------------------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 2 * 10 = | 20.0000 (7a) |
| Number of passive vents | | | | 1 * 10 = | 10.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Air changes per hour | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 30.0000 / (5) = | 0.1932 (8) |
| Pressure test | | | | Yes | |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.4432 (18) |
| Number of sides sheltered | | | | | 2 (19) |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.3768 (21) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed | 5.1000 | 4.7000 | 4.6000 | 4.3000 | 4.3000 | 4.0000 | 4.0000 | 3.9000 | 4.0000 | 4.5000 | 4.4000 | 4.7000 (22) |
| Wind factor | 1.2750 | 1.1750 | 1.1500 | 1.0750 | 1.0750 | 1.0000 | 1.0000 | 0.9750 | 1.0000 | 1.1250 | 1.1000 | 1.1750 (22a) |
| Adj infilt rate | | | | | | | | | | | | |
| Effective ac | 0.4804 | 0.4427 | 0.4333 | 0.4050 | 0.4050 | 0.3768 | 0.3768 | 0.3673 | 0.3768 | 0.4239 | 0.4144 | 0.4427 (22b) |
| Effective ac | 0.6154 | 0.5980 | 0.5939 | 0.5820 | 0.5820 | 0.5710 | 0.5710 | 0.5675 | 0.5710 | 0.5898 | 0.5859 | 0.5980 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K |
|--|----------------------|-------------------------|------------------------|----------------------------|-----------|--------------------------------------|-----------------|
| Front Door | | | 2.1200 | 1.1000 | 2.3320 | | (26) |
| Windows (Uw = 1.20) | | | 9.5600 | 1.1450 | 10.9466 | | (27) |
| Ground Floor | | | 61.3600 | 0.1200 | 7.3632 | 90.0000 | 5522.4000 (28a) |
| Brick and Block | 45.8100 | | 45.8100 | 0.2200 | 10.0782 | 42.2200 | 1934.0982 (29a) |
| 10.4N Brick and Block | 16.9800 | 9.5600 | 7.4200 | 0.2700 | 2.0034 | 113.5000 | 842.1700 (29a) |
| Wall to Corridor | 16.9800 | 2.1200 | 14.8600 | 0.2300 | 3.4174 | 113.5000 | 1686.6100 (29a) |
| Total net area of external elements Aum(A, m ²) | | | 141.1300 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 36.1408 | | (33) |
| Party Ceilings 1 | | | 61.3600 | | | 70.0000 | 4295.2000 (32b) |
| Ground Floor Stud | | | 125.8400 | | | 9.0000 | 1132.5600 (32c) |
| Heat capacity Cm = Sum(A x k) | | | | | | (28)...(30) + (32) + (32a)...(32e) = | 15413.0382 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 251.1903 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6780 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 44.8188 (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 | 31.5255 | 30.6347 | 30.4233 | 29.8166 | 29.8166 | 29.2507 | 29.2507 | 29.0712 | 29.2507 | 30.2165 | 30.0143 | 30.6347 (38) |
| Average = Sum(39)m / 12 = | 76.3442 | 75.4534 | 75.2421 | 74.6353 | 74.6353 | 74.0695 | 74.0695 | 73.8899 | 74.0695 | 75.0353 | 74.8330 | 75.4534 (39) |
| | | | | | | | | | | | | 74.8109 (39) |

| HLP | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP (average) | 1.2442 | 1.2297 | 1.2262 | 1.2164 | 1.2164 | 1.2071 | 1.2071 | 1.2042 | 1.2071 | 1.2229 | 1.2196 | 1.2297 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.0198 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 82.1706 (43) |
| Daily hot water use | 90.3877 | 87.1008 | 83.8140 | 80.5272 | 77.2404 | 73.9535 | 73.9535 | 77.2404 | 80.5272 | 83.8140 | 87.1008 | 90.3877 (44) |
| Energy conte | 134.0423 | 117.2342 | 120.9752 | 105.4691 | 101.2001 | 87.3280 | 80.9223 | 92.8595 | 93.9685 | 109.5112 | 119.5401 | 129.8128 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1292.8634 (45) |
| Distribution loss (46)m = 0.15 x (45)m | 20.1063 | 17.5851 | 18.1463 | 15.8204 | 15.1800 | 13.0992 | 12.1383 | 13.9289 | 14.0953 | 16.4267 | 17.9310 | 19.4719 (46) |
| Water storage loss: | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

| | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|----------|----------|------|
| 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 | 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 | 0.0000 | (57) |
| Combi loss | 1.3933 | 1.1743 | 1.1660 | 0.9767 | 0.8989 | 0.7427 | 0.6882 | 0.8248 | 0.8702 | 1.0555 | 1.1974 | 1.3493 | 1.3493 | (61) |
| Total heat required for water heating calculated for each month | 135.4356 | 118.4085 | 122.1413 | 106.4458 | 102.0991 | 88.0707 | 81.6105 | 93.6843 | 94.8387 | 110.5668 | 120.7375 | 131.1621 | 131.1621 | (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 | 0.0000 | (63) |
| Output from w/h | 135.4356 | 118.4085 | 122.1413 | 106.4458 | 102.0991 | 88.0707 | 81.6105 | 93.6843 | 94.8387 | 110.5668 | 120.7375 | 131.1621 | 131.1621 | (64) |
| Heat gains from water heating, kWh/month | 44.9174 | 39.2740 | 40.5158 | 35.3127 | 33.8738 | 29.2222 | 27.0787 | 31.0820 | 31.4621 | 36.6764 | 40.0464 | 43.5001 | 43.5001 | (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 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | 121.1889 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 41.2274 | 36.6178 | 29.7796 | 22.5451 | 16.8527 | 14.2278 | 15.3736 | 19.9832 | 26.8214 | 34.0559 | 39.7483 | 42.3733 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 263.2289 | 265.9604 | 259.0772 | 244.4235 | 225.9259 | 208.5407 | 196.9263 | 194.1948 | 201.0781 | 215.7318 | 234.2294 | 251.6146 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | 49.1387 | (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) | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | -80.7926 | (71) |
| Water heating gains (Table 5) | 60.3728 | 58.4434 | 54.4567 | 49.0454 | 45.5293 | 40.5864 | 36.3961 | 41.7769 | 43.6973 | 49.2962 | 55.6200 | 58.4679 | (72) |
| Total internal gains | 457.3642 | 453.5566 | 435.8485 | 408.5489 | 380.8428 | 355.8899 | 341.2310 | 348.4899 | 364.1318 | 391.6189 | 422.1328 | 444.9907 | (73) |

6. Solar gains

| | | | | | | | | | | | | | |
|-------------|----------|------------|---------------|---------------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| [Jan] | Area | Solar flux | Specific data | Specific data | FF | Access | Gains | | | | | | |
| | m2 | Table 6a | g | Specific data | | factor | W | | | | | | |
| | | W/m2 | or Table 6b | or Table 6c | | Table 6d | | | | | | | |
| Southeast | 5.2500 | 46.3896 | 0.6300 | 0.7000 | 0.7700 | 74.4306 | (77) | | | | | | |
| Northwest | 4.3100 | 15.0428 | 0.6300 | 0.7000 | 0.7700 | 19.8143 | (81) | | | | | | |
| Solar gains | 94.2449 | 142.9882 | 210.0015 | 291.3003 | 334.4992 | 370.1396 | 343.9563 | 304.4315 | 250.3348 | 171.5449 | 113.0708 | 76.2575 | (83) |
| Total gains | 551.6091 | 596.5448 | 645.8499 | 699.8493 | 715.3420 | 726.0295 | 685.1874 | 652.9214 | 614.4667 | 563.1639 | 535.2036 | 521.2482 | (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 | 56.0802 | 56.7423 | 56.9017 | 57.3643 | 57.3643 | 57.8025 | 57.8025 | 57.9429 | 57.8025 | 57.0585 | 57.2127 | 56.7423 | | |
| alpha | 4.7387 | 4.7828 | 4.7934 | 4.8243 | 4.8243 | 4.8535 | 4.8535 | 4.8629 | 4.8535 | 4.8039 | 4.8142 | 4.7828 | | |
| util living area | 0.9858 | 0.9790 | 0.9575 | 0.8982 | 0.7695 | 0.5545 | 0.3972 | 0.4152 | 0.6744 | 0.9001 | 0.9706 | 0.9883 | (86) | |
| MIT | 20.0298 | 20.1426 | 20.3797 | 20.6652 | 20.8848 | 20.9816 | 20.9971 | 20.9965 | 20.9547 | 20.7239 | 20.3624 | 20.0164 | (87) | |
| Th 2 | 19.8848 | 19.8963 | 19.8991 | 19.9069 | 19.9069 | 19.9143 | 19.9143 | 19.9166 | 19.9143 | 19.9017 | 19.9044 | 19.8963 | (88) | |
| util rest of house | 0.9811 | 0.9721 | 0.9432 | 0.8650 | 0.7007 | 0.4547 | 0.2822 | 0.2956 | 0.5724 | 0.8577 | 0.9590 | 0.9843 | (89) | |
| MIT 2 | 19.0383 | 19.1579 | 19.3895 | 19.6600 | 19.8405 | 19.9079 | 19.9138 | 19.9161 | 19.8958 | 19.7138 | 19.3809 | 19.0347 | (90) | |
| Living area fraction | | | | | | | | | fLA = Living area / (4) = | | | 0.3360 | (91) | |
| MIT | 19.3715 | 19.4888 | 19.7222 | 19.9978 | 20.1914 | 20.2687 | 20.2779 | 20.2792 | 20.2516 | 20.0533 | 19.7107 | 19.3646 | (92) | |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | | |
| adjusted MIT | 19.3715 | 19.4888 | 19.7222 | 19.9978 | 20.1914 | 20.2687 | 20.2779 | 20.2792 | 20.2516 | 20.0533 | 19.7107 | 19.3646 | (93) | |

8. Space heating requirement

| | | | | | | | | | | | | | | |
|----------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|---------|------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| | 0.9783 | 0.9689 | 0.9405 | 0.8681 | 0.7200 | 0.4882 | 0.3210 | 0.3360 | 0.6059 | 0.8645 | 0.9565 | 0.9817 | (94) | |
| Useful gains | 539.6324 | 578.0047 | 607.3999 | 607.5581 | 515.0756 | 354.4406 | 219.9578 | 219.3907 | 372.3219 | 486.8694 | 511.9234 | 511.7352 | (95) | |
| Ext temp. | 5.4000 | 5.7000 | 7.3000 | 9.6000 | 12.6000 | 15.4000 | 17.3000 | 17.3000 | 15.0000 | 11.8000 | 8.4000 | 5.5000 | (96) | |
| Heat loss rate W | 1066.6401 | 1040.4131 | 934.6753 | 776.0422 | 566.5902 | 360.6233 | 220.5690 | 220.1298 | 388.9859 | 619.2873 | 846.4169 | 1046.1325 | (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 | 392.0937 | 310.7384 | 243.4929 | 121.3086 | 38.3269 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 98.5189 | 240.8353 | 397.5916 | (98) | |
| Space heating | | | | | | | | | | | | 1842.9064 | (98) | |
| Space heating per m2 | | | | | | | | | | | | (98) / (4) = | 30.0343 | (99) |

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 90.2000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 2043.1335 (211) |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Space heating requirement | 392.0937 | 310.7384 | 243.4929 | 121.3086 | 38.3269 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 98.5189 | 240.8353 | 397.5916 | (98) |
| Space heating efficiency (main heating system 1) | 90.2000 | 90.2000 | 90.2000 | 90.2000 | 90.2000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 90.2000 | 90.2000 | 90.2000 | (210) |
| Space heating fuel (main heating system) | 434.6937 | 344.4994 | 269.9478 | 134.4885 | 42.4910 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 109.2227 | 267.0015 | 440.7890 | (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 | 135.4356 | 118.4085 | 122.1413 | 106.4458 | 102.0991 | 88.0707 | 81.6105 | 93.6843 | 94.8387 | 110.5668 | 120.7375 | 131.1621 | (64) |
| Efficiency of water heater (217)m | 86.1370 | 85.8481 | 84.9841 | 83.0671 | 79.5708 | 76.2000 | 76.2000 | 76.2000 | 76.2000 | 82.2125 | 84.9860 | 76.2000 | (216) |
| Fuel for water heating, kWh/month | 157.2328 | 137.9280 | 143.7224 | 128.1444 | 128.3123 | 115.5784 | 107.1004 | 122.9453 | 124.4603 | 134.4890 | 142.0674 | 152.0398 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 1594.0203 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2043.1335 (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) | | | | | | | | | | | | | 291.2356 (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | |
| Total delivered energy for all uses | | | | | | | | | | | | | 4003.3893 (238) |

10a. Fuel costs - using BEDF prices (536)

| | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |
|---------------------------------------|---------------|------------------|------------------|
| Space heating - main system 1 | 2043.1335 | 7.6100 | 155.4825 (240) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (242) |
| Water heating (other fuel) | 1594.0203 | 7.6100 | 121.3049 (247) |
| Pumps and fans for heating | 75.0000 | 31.0800 | 23.3100 (249) |
| Energy for lighting | 291.2356 | 31.0800 | 90.5160 (250) |
| Additional standing charges | | | 105.0000 (251) |
| Energy saving/generation technologies | | | |
| PV Unit | 0.0000 | 31.0800 | 0.0000 (252) |
| Total energy cost | | | 495.6134 (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 | 2043.1335 | 0.2160 | 441.3168 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 1594.0203 | 0.2160 | 344.3084 (264) |
| Space and water heating | | | 785.6252 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 291.2356 | 0.5190 | 151.1513 (268) |
| Energy saving/generation technologies | | | |
| PV Unit | -418.0000 | 0.5190 | -216.9420 (269) |
| Total kg/year | | | 758.7595 (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 | 2043.1335 | 1.2200 | 2492.6228 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 1594.0203 | 1.2200 | 1944.7047 (264) |
| Space and water heating | | | 4437.3275 (265) |
| Pumps and fans | 75.0000 | 3.0700 | 230.2500 (267) |
| Energy for lighting | 291.2356 | 3.0700 | 894.0934 (268) |
| Energy saving/generation technologies | | | |
| PV Unit | -418.0000 | 3.0700 | -1283.2600 (269) |
| Primary energy kWh/year | | | 4278.4109 (272) |
| Primary energy kWh/m2/year | | | 69.7264 (273) |

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 83
 Current environmental impact rating: B 89

(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/m ² | |

Potential energy efficiency rating: B 83
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

| | Current | Potential | Saving |
|----------------------------------|-----------------------|-----------------------|----------------------|
| Electricity | £114 | £114 | £0 |
| Mains gas | £382 | £382 | £0 |
| Space heating | £284 | £284 | £0 |
| Water heating | £121 | £121 | £0 |
| Lighting | £91 | £91 | £0 |
| Total cost of fuels | £496 | £496 | £0 |
| Total cost of uses | £496 | £496 | £0 |
| Delivered energy | 65 kWh/m ² | 65 kWh/m ² | 0 kWh/m ² |
| Carbon dioxide emissions | 0.8 tonnes | 0.8 tonnes | 0.0 tonnes |
| CO2 emissions per m ² | 12 kg/m ² | 12 kg/m ² | 0 kg/m ² |
| Primary energy | 70 kWh/m ² | 70 kWh/m ² | 0 kWh/m ² |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

U-VALUE CALCULATOR REPORT

| | | | | |
|----------------------|-------------------------|---------------|----------------|------------|
| Property Reference | SAP 0931 Plot 32 | | Issued on Date | 08/02/2024 |
| Assessment Reference | Rev B | Prop Type Ref | Block Ev1 | |
| Project | Plot 32 | | | |
| Calculation Type | New Build (As Designed) | | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 83 B | DER | 16.21 | TER | 20.36 |
| Environmental | 89 B | % DER<TER | 20.40 | | |
| CO ₂ Emissions (t/year) | 0.76 | DFEE | 47.85 | TFEE | 55.48 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 13.75 | | |

| | | | |
|------------------|---|-------------|-----------|
| Assessor Details | Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com | Assessor ID | E477-0001 |
| Client | Foreman Homes, FORE | | |

Building Elements

Wall 000001

Wall Type: Standard Wall

| Layer | Description | Thickness (mm) | Conductivity (W/m ² K) | Resistance (m ² K/W) | Fraction (%) | Density (kg/m ³) | Heat Cap. (J/kgK) |
|-------------|--|----------------|-----------------------------------|---------------------------------|--------------|------------------------------|-------------------|
| Ext surface | | | | 0.0400 | | | |
| Layer 1 | Brick, outer leaf | | | | | | |
| | Main construction | 102 | 0.7700 | 0.1325 | 82.81 | | |
| | Main construction | 102 | 0.9407 | 0.1084 | 17.19 | | |
| Layer 2 | Supafil 34 | | | | | | |
| | Main construction | 100 | 0.0340 | 2.9412 | 100.00 | | |
| | Corrections - Air Gap: Level 0, Fasteners: None or plastic | | | | | | |
| Layer 3 | Supabloc | | | | | | |
| | Main construction | 140 | 0.1100 | 1.2727 | 94.04 | 460 | 1000 |
| | Main construction | 140 | 0.8803 | 0.1590 | 5.96 | 460 | 1000 |
| | Corrections - Air Gap: Level 1, Fasteners: None or plastic | | | | | | |
| Layer 4 | airspace/plaster dabs | | | | | | |
| | Main construction | 15 | 0.0882 | 0.1700 | 80.00 | | |
| | Main construction | 15 | 0.0882 | 0.1700 | 20.00 | | |
| | Corrections - Cavity Unventilated, Emissivity: Normal | | | | | | |
| Layer 5 | Plasterboard, standard | | | | | | |
| | Main construction | 12.5 | 0.2100 | 0.0595 | 100.00 | 700 | 1000 |
| Int surface | | | | 0.1300 | | | |

Total resistance: Upper limit = 4.657 m² K/W Lower limit = 4.366 m² K/W Average = 4.511 m² K/W
 Total correction = 0.0004 m² K/W U-value (unrounded) = 0.22 W/m² K

Unheated space: None

Total thickness: 370 mm

U-value: 0.22 W/m² K

Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

| | | | |
|----------------------|-------------------------|----------------|------------|
| Property Reference | SAP 0931 Plot 32 | Issued on Date | 08/02/2024 |
| Assessment Reference | Rev B | Prop Type Ref | Block Ev1 |
| Project | Plot 32 | | |
| Calculation Type | New Build (As Designed) | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 83 B | DER | 16.21 | TER | 20.36 |
| Environmental | 89 B | % DER<TER | 20.40 | | |
| CO ₂ Emissions (t/year) | 0.76 | DFEE | 47.85 | TFEE | 55.48 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 13.75 | | |

| | | | |
|------------------|---|-------------|-----------|
| Assessor Details | Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com | Assessor ID | E477-0001 |
|------------------|---|-------------|-----------|

| | |
|--------|---------------------|
| Client | Foreman Homes, FORE |
|--------|---------------------|

Building Elements

Wall 000004

Wall Type: Standard Wall

| Layer | Description | Thickness (mm) | Conductivity (W/m ² K) | Resistance (m ² K/W) | Fraction (%) | Density (kg/m ³) | Heat Cap. (J/kgK) |
|-------------|--|----------------|-----------------------------------|---------------------------------|--------------|------------------------------|-------------------|
| Ext surface | | | | 0.0400 | | | |
| Layer 1 | Brick, outer leaf | | | | | | |
| | Main construction | 102 | 0.7700 | 0.1325 | 82.81 | | |
| | Main construction | 102 | 0.9407 | 0.1084 | 17.19 | | |
| Layer 2 | Supafil 34 | | | | | | |
| | Main construction | 100 | 0.0340 | 2.9412 | 100.00 | | |
| | Corrections - Air Gap: Level 0, Fasteners: None or plastic | | | | | | |
| Layer 3 | Hemelite standard solid 10.4N | | | | | | |
| | Main construction | 140 | 0.4900 | 0.2857 | 93.43 | 1450 | 1000 |
| | Main construction | 140 | 0.8803 | 0.1590 | 6.57 | 1450 | 1000 |
| | Corrections - Air Gap: Level 1, Fasteners: None or plastic | | | | | | |
| Layer 4 | airspace/plaster dabs | | | | | | |
| | Main construction | 15 | 0.0882 | 0.1700 | 80.00 | | |
| | Main construction | 15 | 0.0882 | 0.1700 | 20.00 | | |
| | Corrections - Cavity Unventilated, Emissivity: Normal | | | | | | |
| Layer 5 | Plasterboard, standard | | | | | | |
| | Main construction | 12.5 | 0.2100 | 0.0595 | 100.00 | 700 | 1000 |
| Int surface | | | | 0.1300 | | | |

| | | | |
|-------------------|--|---|------------------------------------|
| Total resistance: | Upper limit = 3.746 m ² K/W | Lower limit = 3.740 m ² K/W | Average = 3.743 m ² K/W |
| | Total correction = 0.0001 m ² K/W | U-value (unrounded) = 0.27 W/m ² K | |

| | | |
|--------------------------------|--|---|
| Unheated space: | None | |
| Total thickness: 370 mm | U-value: 0.27 W/m² K | Kappa: 113.50 kJ/m² K |

U-VALUE CALCULATOR REPORT

| | | | |
|----------------------|-------------------------|----------------|------------|
| Property Reference | SAP 0931 Plot 32 | Issued on Date | 08/02/2024 |
| Assessment Reference | Rev B | Prop Type Ref | Block Ev1 |
| Project | Plot 32 | | |
| Calculation Type | New Build (As Designed) | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 83 B | DER | 16.21 | TER | 20.36 |
| Environmental | 89 B | % DER<TER | 20.40 | | |
| CO ₂ Emissions (t/year) | 0.76 | DFEE | 47.85 | TFEE | 55.48 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 13.75 | | |

| | | | |
|------------------|---|-------------|-----------|
| Assessor Details | Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com | Assessor ID | E477-0001 |
|------------------|---|-------------|-----------|

| | |
|--------|---------------------|
| Client | Foreman Homes, FORE |
|--------|---------------------|

Building Elements

Wall Wall to Corridor

Wall Type: Standard Wall

| Layer | Description | Thickness (mm) | Conductivity (W/m ² K) | Resistance (m ² K/W) | Fraction (%) | Density (kg/m ³) | Heat Cap. (J/kgK) |
|-------------|--|----------------|-----------------------------------|---------------------------------|--------------|------------------------------|-------------------|
| Ext surface | | | | 0.0400 | | | |
| Layer 1 | Plasterboard, standard | | | | | | |
| | Main construction | 12.5 | 0.2100 | 0.0595 | 100.00 | | |
| Layer 2 | airspace/plaster dabs | | | | | | |
| | Main construction | 15 | 0.0882 | 0.1700 | 80.00 | | |
| | Main construction | 15 | 0.0882 | 0.1700 | 20.00 | | |
| | Corrections - Cavity Unventilated, Emissivity: Normal | | | | | | |
| Layer 3 | Masterblock Masterlite Pro | | | | | | |
| | Main construction | 100 | 0.5700 | 0.1754 | 100.00 | 1450 | 1000 |
| Layer 4 | Supafil 40 | | | | | | |
| | Main construction | 100 | 0.0400 | 2.5000 | 100.00 | | |
| | Corrections - Air Gap: Level 1, Fasteners: None or plastic | | | | | | |
| Layer 5 | Masterblock Masterlite Pro | | | | | | |
| | Main construction | 100 | 0.5700 | 0.1754 | 100.00 | 1450 | 1000 |
| Layer 6 | airspace/plaster dabs | | | | | | |
| | Main construction | 15 | 0.0882 | 0.1700 | 80.00 | | |
| | Main construction | 15 | 0.0882 | 0.1700 | 20.00 | | |
| | Corrections - Cavity Unventilated, Emissivity: Normal | | | | | | |
| Layer 7 | Plasterboard, standard | | | | | | |
| | Main construction | 12.5 | 0.2100 | 0.0595 | 100.00 | 700 | 1000 |
| Int surface | | | | 0.1300 | | | |

| | | | |
|-------------------|--|---|------------------------------------|
| Total resistance: | Upper limit = 3.480 m ² K/W | Lower limit = 3.480 m ² K/W | Average = 3.480 m ² K/W |
| | Total correction = 0.0052 m ² K/W | U-value (unrounded) = 0.29 W/m ² K | |

Unheated space: None

Total thickness: 355 mm

U-value: 0.29 W/m² K

Kappa: 113.50 kJ/m² K

U-VALUE CALCULATOR REPORT

| | | | |
|----------------------|-------------------------|----------------|------------|
| Property Reference | SAP 0931 Plot 32 | Issued on Date | 08/02/2024 |
| Assessment Reference | Rev B | Prop Type Ref | Block Ev1 |
| Project | Plot 32 | | |
| Calculation Type | New Build (As Designed) | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 83 B | DER | 16.21 | TER | 20.36 |
| Environmental | 89 B | % DER<TER | 20.40 | | |
| CO ₂ Emissions (t/year) | 0.76 | DFEE | 47.85 | TFEE | 55.48 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 13.75 | | |

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|------------------|---|-------------|-----------|
| Assessor Details | Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com | Assessor ID | E477-0001 |
|------------------|---|-------------|-----------|

| | |
|--------|---------------------|
| Client | Foreman Homes, FORE |
|--------|---------------------|

Building Elements

Floor 000003

Floor Type: Suspended Floor

Area = 43.48 m², Perimeter = 19.02 m, Wall thickness = 275.00 mm, Soil: Unknown

Depth of underfloor space below ground: 0.200 m Floor wind shielding: Average (suburban)

Floor height above ground: h = 0.200 m

U-value of walls above ground: U_w = 1.500 m

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

| Layer | Description | Thickness (mm) | Conductivity (W/m ² K) | Resistance (m ² K/W) | Fraction (%) | Density (kg/m ³) | Heat Cap. (J/kgK) |
|-------------|--|----------------|-----------------------------------|---------------------------------|--------------|------------------------------|-------------------|
| Ext surface | | | | 0.1700 | | | |
| Layer 1 | EPS 200 Lower portion | | | | | | |
| | Main construction | 55 | 0.0340 | 1.6176 | 80.65 | | |
| | Main construction | 55 | 2.0000 | 0.0275 | 19.35 | | |
| | Corrections - Air Gap: Level 1, Fasteners: None or plastic | | | | | | |
| Layer 2 | EPS Upper portion | | | | | | |
| | Main construction | 100 | 0.0340 | 2.9412 | 87.10 | | |
| | Main construction | 100 | 2.0000 | 0.0500 | 12.90 | | |
| | Corrections - Air Gap: Level 1, Fasteners: None or plastic | | | | | | |
| Layer 3 | Grey EPS 100 Topsheet | | | | | | |
| | Main construction | 155 | 0.0300 | 5.1667 | 100.00 | 15 | 1450 |
| | Corrections - Air Gap: Level 1, Fasteners: None or plastic | | | | | | |
| Layer 4 | Screed | | | | | | |
| | Main construction | 75 | 1.1500 | 0.0652 | 100.00 | 1200 | 1000 |
| Int surface | | | | 0.1700 | | | |

Total resistance: Upper limit = 9.271 m² K/W Lower limit = 6.052 m² K/W Average = 7.661 m² K/W
 Total correction = 0.0046 m² K/W U-value (unrounded) = 0.12 W/m² K

| | |
|--------------------------------|--|
| Unheated space: | None |
| Total thickness: 385 mm | U-value: 0.12 W/m² K |
| | Kappa: 90.00 kJ/m² K |

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

| | | | |
|----------------------|------------------|----------------|------------|
| Property Reference | SAP 0931 Plot 32 | Issued on Date | 08/02/2024 |
| Assessment Reference | Rev B | Prop Type Ref | Block Ev1 |
| Property | Plot 32 | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 83 B | DER | 16.21 | TER | 20.36 |
| Environmental | 89 B | % DER<TER | 20.40 | | |
| CO ₂ Emissions (t/year) | 0.76 | DFEE | 47.85 | TFEE | 55.48 |
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|------------------|---|-------------|-----------|
| Assessor Details | Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com | Assessor ID | E477-0001 |
|------------------|---|-------------|-----------|

| | |
|--------|---------------------|
| Client | Foreman Homes, FORE |
|--------|---------------------|

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

| | |
|-----------------------|--------------------|
| Orientation | South West |
| Property Tenure | Unknown |
| Transaction Type | New dwelling |
| Terrain Type | Suburban |
| 1.0 Property Type | Flat, Detached |
| 2.0 Number of Storeys | 1 |
| 3.0 Date Built | 2023 |
| 4.0 Sheltered Sides | 2 |
| 5.0 Sunlight/Shade | Average or unknown |

| | | | | |
|------------------|---------------|---------------------|----------------------|-----------------------|
| 6.0 Measurements | | Heat Loss Perimeter | Internal Floor Area | Average Storey Height |
| | Ground Floor: | 31.53 m | 61.36 m ² | 2.53 m |

| | | |
|-----------------|-------|----------------|
| 7.0 Living Area | 20.62 | m ² |
|-----------------|-------|----------------|

| | | |
|----------------------------|---------------------|---------------------|
| 8.0 Thermal Mass Parameter | Precise calculation | |
| Thermal Mass | 251.19 | kJ/m ² K |

| 9.0 External Walls | Description | Type | Construction | U-Value (W/m ² K) | Kappa (kJ/m ² K) | Gross Area (m ²) | Nett Area (m ²) |
|--------------------|-----------------------|-------------|--------------|------------------------------|-----------------------------|------------------------------|-----------------------------|
| | Brick and Block | Cavity Wall | Other | 0.22 | 42.22 | 45.81 | 45.81 |
| | 10.4N Brick and Block | Cavity Wall | Other | 0.27 | 113.50 | 16.98 | 7.42 |
| | Wall to Corridor | Cavity Wall | Other | 0.29 | 113.50 | 16.98 | 14.86 |

| 9.1 Party Walls | Description | Type | Construction | U-Value (W/m ² K) | Kappa (kJ/m ² K) | Area (m ²) |
|-----------------|-------------|------|---|------------------------------|-----------------------------|------------------------|
| | | | Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill | | 110.00 | |

| 9.2 Internal Walls | Description | Construction | Kappa (kJ/m ² K) | Area (m ²) |
|--------------------|-------------------|------------------------------|-----------------------------|------------------------|
| | Ground Floor Stud | Plasterboard on timber frame | 9.00 | 125.84 |

| 10.1 Party Ceilings | Description | Construction | Kappa (kJ/m ² K) | Area (m ²) |
|---------------------|------------------|--|-----------------------------|------------------------|
| | Party Ceilings 1 | Precast concrete plank floor (screed laid on rubber), carpeted | 30.00 | 61.36 |

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

11.0 Heat Loss Floors

| Description | Type | Construction | U-Value (W/m ² K) | Kappa (kJ/m ² K) | Area (m ²) |
|--------------|----------------------|--------------|------------------------------|-----------------------------|------------------------|
| Ground Floor | Ground Floor - Solid | Other | 0.12 | 90.00 | 61.36 |

12.0 Opening Types

| Description | Data Source | Type | Glazing | Glazing Gap | Argon Filled | G-value | Frame Type | Frame Factor | U Value (W/m ² K) |
|-------------|--------------|------------|-----------------------|-------------|--------------|---------|------------|--------------|------------------------------|
| Front Door | Manufacturer | Solid Door | | | | | | | 1.10 |
| Windows | Manufacturer | Window | Double Low-E Soft 0.1 | | | 0.63 | | 0.70 | 1.20 |

13.0 Openings

| Name | Opening Type | Location | Orientation | Curtain Type | Overhang Ratio | Wide Overhang | Width (m) | Height (m) | Count | Area (m ²) | Curtain Closed |
|----------------|--------------|---------------------------|-------------|--------------|----------------|---------------|-----------|------------|-------|------------------------|----------------|
| Front Door | Solid Door | [3] Wall to Corridor | South West | | | | | | | 2.12 | |
| Windows | Window | [2] 10.4N Brick and Block | North West | None | 0.00 | | | | | 4.31 | |
| East Elevation | Window | [2] 10.4N Brick and Block | South East | None | 0.00 | | | | | 5.25 | |

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

| Source Type | Bridge Type | Length | Psi | Imported | Reference: |
|------------------------|---|--------|-------|----------|-------------------------|
| Independently assessed | E2 Other lintels (including other steel lintels) | 9.06 | 0.043 | No | Catnic Thermally Broken |
| Independently assessed | E3 Sill | 8.05 | 0.021 | No | Knauf P5 |
| Independently assessed | E4 Jamb | 18.30 | 0.016 | No | Knauf P6 |
| Table K1 - Approved | E5 Ground floor (normal) | 31.53 | 0.160 | No | |
| Table K1 - Approved | E7 Party floor between dwellings (in blocks of flats) | 31.53 | 0.070 | No | Knauf P15 |
| Independently assessed | E16 Corner (normal) | 9.42 | 0.061 | No | Knauf P23 |

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Cross ventilation possible

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

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 | | | | 2 |
| Number of passive vents | | | | 1 |
| Number of flueless gas fires | | | | 0 |

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

| | | |
|--|---|---|
| 21.0 Fixed Cooling System | <input type="text" value="No"/> | |
| 22.0 Lighting | | |
| Internal | | |
| Total number of light fittings | <input type="text" value="10"/> | |
| Total number of L.E.L. fittings | <input type="text" value="10"/> | |
| Percentage of L.E.L. fittings | <input type="text" value="100.00"/> | % |
| External | | |
| External lights fitted | <input type="text" value="Yes"/> | |
| Light and motion sensor | <input type="text" value="Yes"/> | |
| 23.0 Electricity Tariff | <input type="text" value="Standard"/> | |
| 24.0 Main Heating 1 | <input type="text" value="Database"/> | |
| Description | <input type="text" value="Gas Combi"/> | |
| Percentage of Heat | <input type="text" value="100"/> | % |
| Database Ref. No. | <input type="text" value="17959"/> | |
| Fuel Type | <input type="text" value="Mains gas"/> | |
| Main Heating | <input type="text" value="BGW"/> | |
| SAP Code | <input type="text" value="104"/> | |
| In Winter | <input type="text" value="90.2"/> | |
| In Summer | <input type="text" value="76.2"/> | |
| Controls | <input type="text" value="CBE Programmer, room thermostat and TRVs"/> | |
| PCDF Controls | <input type="text" value="0"/> | |
| Delayed Start Stat | <input type="text" value="No"/> | |
| Sap Code | <input type="text" value="2106"/> | |
| Flue Type | <input type="text" value="Balanced"/> | |
| Fan Assisted Flue | <input type="text" value="Yes"/> | |
| Is MHS Pumped | <input type="text" value="Pump in heated space"/> | |
| Heat Emitter | <input type="text" value="Radiators"/> | |
| Flow Temperature | <input type="text" value="Normal (> 45°C)"/> | |
| Combi boiler type | <input type="text" value="Standard Combi"/> | |
| Combi keep hot type | <input type="text" value="None"/> | |
| 25.0 Main Heating 2 | <input type="text" value="None"/> | |
| Community Heating | <input type="text" value="None"/> | |
| 28.0 Water Heating | <input type="text" value="HWP From main heating 1"/> | |
| Water Heating | <input type="text" value="Main Heating 1"/> | |
| Flue Gas Heat Recovery System | <input type="text" value="No"/> | |
| Waste Water Heat Recovery Instantaneous System 1 | <input type="text" value="No"/> | |
| Waste Water Heat Recovery Instantaneous System 2 | <input type="text" value="No"/> | |
| Waste Water Heat Recovery Storage System | <input type="text" value="No"/> | |
| Solar Panel | <input type="text" value="No"/> | |
| Water use <= 125 litres/person/day | <input type="text" value="Yes"/> | |
| SAP Code | <input type="text" value="901"/> | |

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

| | | |
|-------------------------|---------------------------|----------|
| 29.0 Hot Water Cylinder | None | |
| 32.0 Photovoltaic Unit | More Dwellings, One Block | |
| Apportioned | 418.00 | kWh/Year |

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

BLOCK COMPLIANCE

Calculation Type: New Build (As Designed)

| | | | |
|-------------------------|---|-----------------------|------------|
| Block Reference | SAP 0931 EV1 | Issued on Date | 08/02/2024 |
| Block Name | Block Ev1 | | |
| Assessor Details | Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com | Assessor ID | E477-0001 |
| Client | Foreman Homes, FORE | | |

Block Compliance Report - DER

| Block Reference: SAP 0931 EV1 | | Block Name: Block Ev1 | | | |
|---|------------|------------------------------|--|--|-----------|
| Property-Assessment Reference | Multiplier | Floor Area (m ²) | DER (kgCO ₂ /m ²) | TER (kgCO ₂ /m ²) | % DER/TER |
| SAP 0931 Plot 31-Rev B | 1 | 61.4 | 16.69 | 20.60 | 18.98 % |
| SAP 0931 Plot 32-Rev B | 1 | 61.36 | 16.21 | 20.36 | 20.40 % |
| SAP 0931 Plot 35-Rev B | 1 | 61.4 | 15.14 | 19.66 | 23.00 % |
| SAP 0931 Plot 36-Rev B | 1 | 61.36 | 15.07 | 19.77 | 23.76 % |
| SAP 0931 Plot 33-Rev B | 1 | 61.4 | 13.93 | 18.04 | 22.80 % |
| SAP 0931 Plot 34-Rev B | 1 | 61.36 | 15.24 | 17.89 | 14.80 % |
| Totals: | 6 | 368.28 | 92.28 | 116.32 | |
| Average DER = 15.38 kgCO ₂ /m ² | | % DER/TER | | PASS | |
| Average TER = 19.39 kgCO ₂ /m ² | | 20.68 % | | | |

Block Compliance Report - DFEE

| Block Reference: SAP 0931 EV1 | | Block Name: Block Ev1 | | | |
|---|------------|------------------------------|-------------------------------|-------------------------------|-------------|
| Property-Assessment Reference | Multiplier | Floor Area (m ²) | DFEE (kWh/m ² /yr) | TFEE (kWh/m ² /yr) | % DFEE/TFEE |
| SAP 0931 Plot 31-Rev B | 1 | 61.4 | 49.89 | 56.54 | 11.76 % |
| SAP 0931 Plot 32-Rev B | 1 | 61.36 | 47.85 | 55.48 | 13.75 % |
| SAP 0931 Plot 35-Rev B | 1 | 61.4 | 43.79 | 51.58 | 15.11 % |
| SAP 0931 Plot 36-Rev B | 1 | 61.36 | 43.05 | 51.84 | 16.97 % |
| SAP 0931 Plot 33-Rev B | 1 | 61.4 | 38.67 | 43.34 | 10.78 % |
| SAP 0931 Plot 34-Rev B | 1 | 61.36 | 37.36 | 42.70 | 12.49 % |
| Totals: | 6 | 368.28 | 260.61 | 301.49 | |
| Average DFEE = 43.44 kWh/m ² /yr | | % DFEE/TFEE | | PASS | |
| Average TFEE = 50.25 kWh/m ² /yr | | 13.55 % | | | |