

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

| | | | | | |
|------------------------------------|---|---------------|-----------|----------------|------------|
| Property Reference | 010577 | | | Issued on Date | 10/02/2022 |
| Assessment Reference | B09-TY-01_3 | Prop Type Ref | B09-TY-01 | | |
| Property | London | | | | |
| SAP Rating | 84 B | DER | 9.81 | TER | 21.18 |
| Environmental | 92 A | % DER<TER | 53.69 | | |
| CO ₂ Emissions (t/year) | 0.70 | DFEE | 39.55 | TFEE | 36.62 |
| General Requirements Compliance | Fail | % DFEE<TFEE | -7.99 | | |
| Assessor Details | Miss Emma Jolly, Emma Jolly, Tel: 01454806691, emmajolly@hoarelea.com | | | Assessor ID | T689-0001 |
| Client | | | | | |

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 84 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:Electricity (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 21.18 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.81 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)36.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.5 kWh/m²/yrFail
Excess energy =2.9 kWh/m²/yr (7.9%)

2 Fabric U-values

| Element | Average | Highest | |
|---------------------|------------------|------------------|----|
| External wall | 0.14 (max. 0.30) | 0.20 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor (no floor) | | | |
| Roof (no roof) | | | |
| Openings | 1.31 (max. 2.00) | 1.40 (max. 3.30) | OK |

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Community heating scheme -

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Charging system linked to use of community heating, TRVsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system
Specific fan power: 0.55
Maximum 1.5 OK
MVHR efficiency: 92%
Minimum: 70% OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing South: 13.15 m², No overhang
Windows facing West: 15.38 m², No overhang
Air change rate: 2.50 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

| | |
|-----------------------|--------------------------------------|
| External wall U-value | 0.12 W/m ² K |
| External wall U-value | 0.12 W/m ² K |
| Party wall U-value | 0.00 W/m ² K |
| Party wall U-value | 0.00 W/m ² K |
| Air permeability | 3.0 m ³ /m ² h |
| Photovoltaic array | 350.00 kWh/Year |

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m2) | Storey height (m) | Volume (m3) |
|--|--------------|---------------------------------|------------------------|
| Ground floor | 84.4000 (1b) | x 2.6000 (2b) | = 219.4400 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 84.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 219.4400 (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 | | | | 0 * 10 = | 0.0000 (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) = | | | | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test | | | | Yes | |
| Measured/design AP50 | | | | 3.0000 | |
| Infiltration rate | | | | 0.1500 | (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) = | | 0.1275 (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 | | | | | 0.1371 | 0.1211 | 0.1211 | 0.1179 | 0.1275 | 0.1371 | 0.1434 | 0.1498 (22b) |
| Balanced mechanical ventilation with heat recovery | 0.1626 | 0.1594 | 0.1562 | 0.1403 | | | | | | | | |
| If mechanical ventilation: | | | | | | | | | | | | 0.5000 (23a) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | | | | | | | | | | | | 78.2000 (23c) |
| Effective ac | 0.2716 | 0.2684 | 0.2652 | 0.2493 | 0.2461 | 0.2301 | 0.2301 | 0.2269 | 0.2365 | 0.2461 | 0.2524 | 0.2588 (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 |
|--|----------|-------------|------------|----------------------|-----------|----------------|---------------|
| Opening Type 1 (Uw = 1.30) | | | 28.5300 | 1.2357 | 35.2557 | | (27) |
| Opening Type 6 | | | 1.8000 | 1.4000 | 2.5200 | | (26) |
| External 1 | 31.2000 | 15.3800 | 15.8200 | 0.1200 | 1.8984 | | (29a) |
| External 2 | 20.2800 | 13.1500 | 7.1300 | 0.1200 | 0.8556 | | (29a) |
| Sheltered 1 | 6.7600 | | 6.7600 | 0.2000 | 1.3520 | | (29a) |
| Sheltered 2 | 4.4200 | 1.8000 | 2.6200 | 0.2000 | 0.5240 | | (29a) |
| Total net area of external elements Aum(A, m2) | | | 62.6600 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 42.4057 | | (33) |
| Part 2 | | | 25.2200 | 0.0000 | 0.0000 | | (32) |
| Party 1 | | | 11.4400 | 0.0000 | 0.0000 | | (32) |
| Party Floor 1 | | | 84.4000 | | | | (32d) |
| Party Ceiling 1 | | | 84.4000 | | | | (32b) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 100.0000 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.9842 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 51.3899 (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 | 19.6653 | 19.4344 | 19.2036 | 18.0495 | 17.8187 | 16.6645 | 16.6645 | 16.4337 | 17.1262 | 17.8187 | 18.2803 | 18.7420 (38) |
| Heat transfer coeff | 71.0552 | 70.8243 | 70.5935 | 69.4394 | 69.2086 | 68.0545 | 68.0545 | 67.8236 | 68.5161 | 69.2086 | 69.6702 | 70.1319 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 69.3817 (39) |
| HLP | 0.8419 | 0.8392 | 0.8364 | 0.8227 | 0.8200 | 0.8063 | 0.8063 | 0.8036 | 0.8118 | 0.8200 | 0.8255 | 0.8309 (40) |
| HLP (average) | | | | | | | | | | | | 0.8221 (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 | | | | | | | | | | | | 2.5411 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 94.5503 (43) |
| Daily hot water use | 104.0054 | 100.2234 | 96.4413 | 92.6593 | 88.8773 | 85.0953 | 85.0953 | 88.8773 | 92.6593 | 96.4413 | 100.2234 | 104.0054 (44) |

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

| | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Energy content (annual) | 154.2370 | 134.8966 | 139.2012 | 121.3590 | 116.4469 | 100.4848 | 93.1139 | 106.8496 | 108.1257 | 126.0101 | 137.5499 | 149.3703 (45) |
| Distribution loss (46)m = 0.15 x (45)m | 23.1355 | 20.2345 | 20.8802 | 18.2039 | 17.4670 | 15.0727 | 13.9671 | 16.0274 | 16.2189 | 18.9015 | 20.6325 | 22.4055 (46) |
| Water storage loss: | | | | | | | | | | | | |
| Store volume | | | | | | | | | | | | 110.0000 (47) |
| b) If manufacturer declared loss factor is not known : | | | | | | | | | | | | |
| Hot water storage loss factor from Table 2 (kWh/litre/day) | | | | | | | | | | | | 0.0152 (51) |
| Volume factor from Table 2a | | | | | | | | | | | | 1.0294 (52) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.6000 (53) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 1.0327 (55) |
| Total storage loss | 32.0144 | 28.9162 | 32.0144 | 30.9817 | 32.0144 | 30.9817 | 32.0144 | 32.0144 | 30.9817 | 32.0144 | 30.9817 | 32.0144 (56) |
| If cylinder contains dedicated solar storage | 32.0144 | 28.9162 | 32.0144 | 30.9817 | 32.0144 | 30.9817 | 32.0144 | 32.0144 | 30.9817 | 32.0144 | 30.9817 | 32.0144 (57) |
| Primary loss | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 (59) |
| Total heat required for water heating calculated for each month | 209.5138 | 184.8241 | 194.4780 | 174.8527 | 171.7237 | 153.9785 | 148.3907 | 162.1264 | 161.6194 | 181.2869 | 191.0436 | 204.6471 (62) |
| Solar input | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (63) |
| Output from w/h | 209.5138 | 184.8241 | 194.4780 | 174.8527 | 171.7237 | 153.9785 | 148.3907 | 162.1264 | 161.6194 | 181.2869 | 191.0436 | 204.6471 (64) |
| Heat gains from water heating, kWh/month | 95.5052 | 84.7951 | 90.5059 | 83.1468 | 82.9400 | 76.2061 | 75.1818 | 79.7489 | 78.7467 | 86.1198 | 88.5303 | 93.8871 (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 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 20.3612 | 18.0846 | 14.7074 | 11.1344 | 8.3231 | 7.0267 | 7.5926 | 9.8692 | 13.2464 | 16.8194 | 19.6307 | 20.9271 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 228.3904 | 230.7604 | 224.7881 | 212.0739 | 196.0244 | 180.9402 | 170.8630 | 168.4930 | 174.4653 | 187.1795 | 203.2290 | 218.3132 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 (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) | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 (71) |
| Water heating gains (Table 5) | 128.3672 | 126.1832 | 121.6477 | 115.4817 | 111.4785 | 105.8419 | 101.0508 | 107.1894 | 109.3705 | 115.7524 | 122.9587 | 126.1923 (72) |
| Total internal gains | 438.2348 | 436.1442 | 422.2592 | 399.8060 | 376.9421 | 354.9248 | 340.6225 | 346.6676 | 358.1982 | 380.8673 | 406.9344 | 426.5486 (73) |

6. Solar gains

| | | | | | | | | | | | | |
|-------------|----------|------------|---------------|---------------|---------------|--------------|----------|----------|----------|----------|----------|---------------|
| [Jan] | Area | Solar flux | g | FF | Access factor | Gains | | | | | | |
| | m2 | Table 6a | Specific data | Specific data | Table 6d | W | | | | | | |
| | | W/m2 | or Table 6b | or Table 6c | | | | | | | | |
| South | 13.1500 | 46.7521 | 0.2900 | 0.8000 | 0.7700 | 98.8434 (78) | | | | | | |
| West | 15.3800 | 19.6403 | 0.2900 | 0.8000 | 0.7700 | 48.5652 (80) | | | | | | |
| Solar gains | 147.4086 | 256.8838 | 362.6641 | 461.2423 | 522.5092 | 519.9904 | 500.8998 | 455.8767 | 397.3738 | 287.3328 | 177.7182 | 125.3474 (83) |
| Total gains | 585.6434 | 693.0280 | 784.9233 | 861.0483 | 899.4513 | 874.9152 | 841.5222 | 802.5444 | 755.5719 | 668.2001 | 584.6526 | 551.8960 (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 | 32.9947 | 33.1022 | 33.2105 | 33.7625 | 33.8751 | 34.4495 | 34.4495 | 34.5668 | 34.2174 | 33.8751 | 33.6506 | 33.4291 |
| alpha | 3.1996 | 3.2068 | 3.2140 | 3.2508 | 3.2583 | 3.2966 | 3.2966 | 3.3045 | 3.2812 | 3.2583 | 3.2434 | 3.2286 |
| util living area | 0.9442 | 0.9094 | 0.8525 | 0.7553 | 0.6255 | 0.4714 | 0.3481 | 0.3781 | 0.5676 | 0.7928 | 0.9126 | 0.9521 (86) |
| MIT | 19.4984 | 19.7901 | 20.1582 | 20.5467 | 20.8064 | 20.9445 | 20.9844 | 20.9794 | 20.8948 | 20.5458 | 19.9629 | 19.4465 (87) |
| Th 2 | 20.2172 | 20.2195 | 20.2219 | 20.2337 | 20.2360 | 20.2478 | 20.2478 | 20.2502 | 20.2431 | 20.2360 | 20.2313 | 20.2266 (88) |
| util rest of house | 0.9373 | 0.8988 | 0.8359 | 0.7293 | 0.5880 | 0.4225 | 0.2913 | 0.3200 | 0.5177 | 0.7644 | 0.9007 | 0.9461 (89) |
| MIT 2 | 18.1970 | 18.6140 | 19.1347 | 19.6775 | 20.0195 | 20.1960 | 20.2368 | 20.2349 | 20.1386 | 19.6895 | 18.8750 | 18.1289 (90) |
| Living area fraction | 18.8662 | 19.2188 | 19.6610 | 20.1245 | 20.4241 | 20.5809 | 20.6212 | 20.6178 | 20.5274 | 20.1298 | 19.4344 | 0.5142 (91) |
| MIT | 18.8662 | 19.2188 | 19.6610 | 20.1245 | 20.4241 | 20.5809 | 20.6212 | 20.6178 | 20.5274 | 20.1298 | 19.4344 | 18.8064 (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 |
| adjusted MIT | 18.8662 | 19.2188 | 19.6610 | 20.1245 | 20.4241 | 20.5809 | 20.6212 | 20.6178 | 20.5274 | 20.1298 | 19.4344 | 18.8064 (93) |

8. Space heating requirement

| | | | | | | | | | | | | |
|-------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Useful gains | 0.9227 | 0.8830 | 0.8226 | 0.7254 | 0.5976 | 0.4445 | 0.3197 | 0.3488 | 0.5369 | 0.7602 | 0.8861 | 0.9324 (94) |
| Ext temp. | 540.3893 | 611.9594 | 645.6486 | 624.5631 | 537.4737 | 388.8823 | 269.0755 | 279.9005 | 405.6904 | 507.9360 | 518.0776 | 514.6089 (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 | 1035.0036 | 1014.1171 | 929.0789 | 779.4191 | 603.7838 | 407.0250 | 273.6636 | 286.0634 | 440.3813 | 659.5468 | 859.3403 | 1024.3769 (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) |
| | 367.9930 | 270.2500 | 210.8721 | 111.4963 | 49.3347 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 112.7985 | 245.7092 | 379.2673 (98) |

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Space heating 1747.7211 (98)
 Space heating per m2 (98) / (4) = 20.7076 (99)

 8c. Space cooling requirement

Not applicable

 9b. Energy requirements

| | |
|---|------------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | 0.0000 (301) |
| Fraction of space heat from community system | 1.0000 (302) |
| Fraction of heat from community Heat pump | 1.0000 (303a) |
| Fraction of total space heat from community Heat pump | 1.0000 (304a) |
| Factor for control and charging method (Table 4c(3)) for community space heating | 1.0000 (305) |
| Factor for control and charging method (Table 4c(3)) for community water heating | 1.0000 (305a) |
| Distribution loss factor (Table 12c) for community heating system | 1.0500 (306) |
| Space heating: | |
| Annual space heating requirement | 1747.7211 (98) |
| Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05 | 1835.1071 (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | 0.0000 (308) |
| Space heating fuel for secondary/supplementary system | 0.0000 (309) |
| Water heating | |
| Annual water heating requirement | 2138.4847 (64) |
| Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05 | 2245.4090 (310a) |
| Electricity used for heat distribution | 40.8052 (313) |
| Annual totals kWh/year | |
| Electricity for pumps and fans: | |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875) | |
| mechanical ventilation fans (SFP = 0.6875) | 184.0553 (330a) |
| Total electricity for the above, kWh/year | 184.0553 (331) |
| Electricity for lighting (calculated in Appendix L) | 359.5847 (332) |
| Energy saving/generation technologies (Appendices M ,N and Q) | |
| Total delivered energy for all uses | 4624.1560 (338) |

 12b. Carbon dioxide emissions - Community heating scheme

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|--|--------------------|-------------------------------|--------------------------|--------|
| Efficiency of heat source Heat pump | | | 300.0000 | (367a) |
| Space heating from Heat pump | 1360.1720 | 0.5190 | 705.9293 | (367) |
| Electrical energy for heat distribution | 40.8052 | 0.5190 | 21.1779 | (372) |
| Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE) | | | 727.1072 | (373) |
| Space and water heating | | | 727.1072 | (376) |
| Pumps and fans | 184.0553 | 0.5190 | 95.5247 | (378) |
| Energy for lighting | 359.5847 | 0.5190 | 186.6244 | (379) |
| Energy saving/generation technologies | | | | |
| PV Unit | -350.0000 | 0.5190 | -181.6500 | (380) |
| Total CO2, kg/year | | | 827.6063 | (383) |
| Dwelling Carbon Dioxide Emission Rate (DER) | | | 9.8100 | (384) |

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

| DER | | | 9.8100 | ZC1 |
|---|--|-----|---------|-----|
| Total Floor Area | | TFA | 84.4000 | |
| Assumed number of occupants | | N | 2.5411 | |
| CO2 emission factor in Table 12 for electricity displaced from grid | | EF | 0.5190 | |
| CO2 emissions from appliances, equation (L14) | | | 16.0355 | ZC2 |
| CO2 emissions from cooking, equation (L16) | | | 2.1325 | ZC3 |
| Total CO2 emissions | | | 27.9780 | 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 | | | 27.9780 | ZC8 |

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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 | 84.4000 (1b) | x 2.6000 (2b) | = 219.4400 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 84.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 219.4400 (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 | | | | 3 * 10 = | 30.0000 (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) = | | | | 30.0000 / (5) = | 0.1367 (8) |
| Pressure test | | | | | Yes |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.3867 (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) = | | 0.3287 (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 | 0.4191 | 0.4109 | 0.4027 | 0.3616 | 0.3534 | 0.3123 | 0.3123 | 0.3041 | 0.3287 | 0.3534 | 0.3698 | 0.3862 (22b) |
| | 0.5878 | 0.5844 | 0.5811 | 0.5654 | 0.5624 | 0.5488 | 0.5488 | 0.5462 | 0.5540 | 0.5624 | 0.5684 | 0.5746 (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 | | | 1.8000 | 1.0000 | 1.8000 | | (26) | | | | | |
| TER Opening Type (Uw = 1.40) | | | 19.2900 | 1.3258 | 25.5739 | | (27) | | | | | |
| External 1 | 31.2000 | 10.4000 | 20.8000 | 0.1800 | 3.7440 | | (29a) | | | | | |
| External 2 | 20.2800 | 8.8900 | 11.3900 | 0.1800 | 2.0502 | | (29a) | | | | | |
| Sheltered 1 | 6.7600 | | 6.7600 | 0.1800 | 1.2168 | | (29a) | | | | | |
| Sheltered 2 | 4.4200 | 1.8000 | 2.6200 | 0.1800 | 0.4716 | | (29a) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 62.6600 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 34.8565 | (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) | | | | | | | 6.0280 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 40.8845 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | 42.5672 | 42.3203 | 42.0782 | 40.9413 | 40.7285 | 39.7383 | 39.7383 | 39.5549 | 40.1197 | 40.7285 | 41.1589 | 41.6088 (38) |
| Heat transfer coeff | 83.4517 | 83.2047 | 82.9627 | 81.8257 | 81.6130 | 80.6228 | 80.6228 | 80.4394 | 81.0042 | 81.6130 | 82.0433 | 82.4932 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 81.8247 (39) |
| HLP | 0.9888 | 0.9858 | 0.9830 | 0.9695 | 0.9670 | 0.9552 | 0.9552 | 0.9531 | 0.9598 | 0.9670 | 0.9721 | 0.9774 (40) |
| HLP (average) | | | | | | | | | | | | 0.9695 (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 | | | | | | | | | | | | 2.5411 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 94.5503 (43) |
| Daily hot water use | 104.0054 | 100.2234 | 96.4413 | 92.6593 | 88.8773 | 85.0953 | 85.0953 | 88.8773 | 92.6593 | 96.4413 | 100.2234 | 104.0054 (44) |
| Energy conte | 154.2370 | 134.8966 | 139.2012 | 121.3590 | 116.4469 | 100.4848 | 93.1139 | 106.8496 | 108.1257 | 126.0101 | 137.5499 | 149.3703 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1487.6450 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |
| Water storage loss: | 23.1355 | 20.2345 | 20.8802 | 18.2039 | 17.4670 | 15.0727 | 13.9671 | 16.0274 | 16.2189 | 18.9015 | 20.6325 | 22.4055 (46) |
| Store volume | | | | | | | | | | | | 150.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 1.3938 (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 (49) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------------|------|
| Enter (49) or (54) in (55) | | | | | | | | | | | | 0.7527 (55) | |
| Total storage loss | 23.3325 | 21.0745 | 23.3325 | 22.5798 | 23.3325 | 22.5798 | 23.3325 | 23.3325 | 22.5798 | 23.3325 | 22.5798 | 23.3325 | (56) |
| If cylinder contains dedicated solar storage | 23.3325 | 21.0745 | 23.3325 | 22.5798 | 23.3325 | 22.5798 | 23.3325 | 23.3325 | 22.5798 | 23.3325 | 22.5798 | 23.3325 | (57) |
| Primary loss | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | (59) |
| Total heat required for water heating calculated for each month | 200.8319 | 176.9823 | 185.7961 | 166.4509 | 163.0418 | 145.5766 | 139.7088 | 153.4445 | 153.2176 | 172.6050 | 182.6417 | 195.9652 | (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 | 200.8319 | 176.9823 | 185.7961 | 166.4509 | 163.0418 | 145.5766 | 139.7088 | 153.4445 | 153.2176 | 172.6050 | 182.6417 | 195.9652 | (64) |
| Heat gains from water heating, kWh/month | 88.5597 | 78.5217 | 83.5603 | 76.4253 | 75.9945 | 69.4847 | 68.2363 | 72.8034 | 72.0253 | 79.1743 | 81.8088 | 86.9415 | (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 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | 127.0533 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 20.3612 | 18.0846 | 14.7074 | 11.1344 | 8.3231 | 7.0267 | 7.5926 | 9.8692 | 13.2464 | 16.8194 | 19.6307 | 20.9271 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 228.3904 | 230.7604 | 224.7881 | 212.0739 | 196.0244 | 180.9402 | 170.8630 | 168.4930 | 174.4653 | 187.1795 | 203.2290 | 218.3132 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | 35.7053 | (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) | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | -101.6427 | (71) |
| Water heating gains (Table 5) | 119.0319 | 116.8478 | 112.3123 | 106.1463 | 102.1432 | 96.5065 | 91.7155 | 97.8540 | 100.0351 | 106.4170 | 113.6233 | 116.8569 | (72) |
| Total internal gains | 431.8995 | 429.8088 | 415.9238 | 393.4706 | 370.6067 | 348.5894 | 334.2871 | 340.3323 | 351.8628 | 374.5319 | 400.5990 | 420.2132 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b g | FF Specific data or Table 6c | Access factor Table 6d | Gains W | (78) | | | | | | |
|-------------|----------|--------------------------|-----------------------------|------------------------------|------------------------|-----------|----------|----------|----------|----------|----------|----------|------|
| South | 8.8900 | 46.7521 | 0.6300 | 0.7000 | 0.7700 | 127.0207 | (78) | | | | | | |
| West | 10.4000 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 62.4241 | (80) | | | | | | |
| Solar gains | 189.4448 | 330.1420 | 466.0954 | 592.7966 | 671.5442 | 668.3093 | 643.7725 | 585.9033 | 510.7073 | 369.2763 | 228.3984 | 161.0921 | (83) |
| Total gains | 621.3443 | 759.9507 | 882.0192 | 986.2672 | 1042.1509 | 1016.8987 | 978.0596 | 926.2355 | 862.5701 | 743.8083 | 628.9974 | 581.3053 | (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 | (85) |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 0.9943 | 0.9825 | 0.9482 | 0.8540 | 0.6926 | 0.5026 | 0.3621 | 0.3984 | 0.6288 | 0.9027 | 0.9852 | 0.9960 | (86) |
| tau | 70.2336 | 70.4420 | 70.6476 | 71.6292 | 71.8159 | 72.6980 | 72.6980 | 72.8637 | 72.3557 | 71.8159 | 71.4392 | 71.0496 | (87) |
| alpha | 5.6822 | 5.6961 | 5.7098 | 5.7753 | 5.7877 | 5.8465 | 5.8465 | 5.8576 | 5.8237 | 5.7877 | 5.7626 | 5.7366 | (88) |
| util living area | 0.9943 | 0.9825 | 0.9482 | 0.8540 | 0.6926 | 0.5026 | 0.3621 | 0.3984 | 0.6288 | 0.9027 | 0.9852 | 0.9960 | (86) |
| MIT | 20.1106 | 20.3198 | 20.5792 | 20.8300 | 20.9571 | 20.9944 | 20.9993 | 20.9988 | 20.9809 | 20.7958 | 20.4012 | 20.0730 | (87) |
| Th 2 | 20.0927 | 20.0952 | 20.0975 | 20.1088 | 20.1109 | 20.1208 | 20.1208 | 20.1226 | 20.1170 | 20.1109 | 20.1067 | 20.1022 | (88) |
| util rest of house | 0.9926 | 0.9773 | 0.9338 | 0.8197 | 0.6374 | 0.4357 | 0.2901 | 0.3230 | 0.5560 | 0.8702 | 0.9799 | 0.9948 | (89) |
| MIT 2 | 18.9153 | 19.2188 | 19.5857 | 19.9257 | 20.0735 | 20.1174 | 20.1205 | 20.1222 | 20.1038 | 19.8936 | 19.3474 | 18.8678 | (90) |
| Living area fraction | 19.5300 | 19.7850 | 20.0966 | 20.3907 | 20.5279 | 20.5684 | 20.5724 | 20.5730 | 20.5548 | 20.3575 | 19.8893 | 19.4875 | (92) |
| Temperature adjustment | 19.5300 | 19.7850 | 20.0966 | 20.3907 | 20.5279 | 20.5684 | 20.5724 | 20.5730 | 20.5548 | 20.3575 | 19.8893 | 19.4875 | (93) |
| adjusted MIT | 19.5300 | 19.7850 | 20.0966 | 20.3907 | 20.5279 | 20.5684 | 20.5724 | 20.5730 | 20.5548 | 20.3575 | 19.8893 | 19.4875 | (93) |

8. Space heating requirement

| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (94) | |
|----------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------------|---------|------|
| Useful gains | 615.8556 | 741.0524 | 823.5904 | 819.8661 | 691.8780 | 477.9753 | 319.9522 | 335.1087 | 511.3312 | 654.6469 | 615.3682 | 577.5996 | (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 | 1270.9662 | 1238.5015 | 1128.0106 | 940.2338 | 720.4691 | 481.1863 | 320.2676 | 335.6695 | 522.8688 | 796.3409 | 1049.2758 | 1261.1192 | (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 | 487.4023 | 334.2858 | 226.4887 | 86.6648 | 21.2718 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 105.4203 | 312.4134 | 508.5386 | (98) | |
| Space heating | | | | | | | | | | | | 2082.4856 | (98) | |
| Space heating per m2 | | | | | | | | | | | | (98) / (4) = | 24.6740 | (99) |

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

| | 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 %) | | | | | | | | | | | | | 93.5000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 2227.2573 (211) |
| Space heating requirement | 487.4023 | 334.2858 | 226.4887 | 86.6648 | 21.2718 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 105.4203 | 312.4134 | 508.5386 | (98) |
| Space heating efficiency (main heating system 1) | 93.5000 | 93.5000 | 93.5000 | 93.5000 | 93.5000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 93.5000 | 93.5000 | 93.5000 | (210) |
| Space heating fuel (main heating system) | 521.2858 | 357.5250 | 242.2339 | 92.6896 | 22.7505 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 112.7490 | 334.1320 | 543.8915 | (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 | 200.8319 | 176.9823 | 185.7961 | 166.4509 | 163.0418 | 145.5766 | 139.7088 | 153.4445 | 153.2176 | 172.6050 | 182.6417 | 195.9652 | (64) |
| Efficiency of water heater (217)m | 87.0923 | 86.4857 | 85.3431 | 83.1667 | 80.9040 | 79.8000 | 79.8000 | 79.8000 | 79.8000 | 83.5454 | 86.2341 | 87.2460 | (216) |
| Fuel for water heating, kWh/month | 230.5965 | 204.6376 | 217.7049 | 200.1412 | 201.5251 | 182.4269 | 175.0737 | 192.2863 | 192.0020 | 206.6003 | 211.7975 | 224.6123 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 2439.4042 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2227.2573 (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) | | | | | | | | | | | | | 359.5847 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 5101.2461 (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 | 2227.2573 | 0.2160 | 481.0876 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 2439.4042 | 0.2160 | 526.9113 (264) |
| Space and water heating | | | 1007.9989 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 359.5847 | 0.5190 | 186.6244 (268) |
| Total CO2, kg/m2/year | | | 1233.5483 (272) |
| Emissions per m2 for space and water heating | | | 11.9431 (272a) |
| Fuel factor (electricity) | | | 1.5500 |
| Emissions per m2 for lighting | | | 2.2112 (272b) |
| Emissions per m2 for pumps and fans | | | 0.4612 (272c) |
| Target Carbon Dioxide Emission Rate (TER) = (11.9431 * 1.55) + 2.2112 + 0.4612, rounded to 2 d.p. | | | 21.1800 (273) |