

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



Property and Energy  
Services Ltd.

|                      |                                    |                |            |
|----------------------|------------------------------------|----------------|------------|
| Property Reference   | 3260-1                             | Issued on Date | 10/05/2019 |
| Assessment Reference | 3260-1                             | Prop Type Ref  |            |
| Property             | 1, Aldworth Rise, READING, RG1 7NA |                |            |

|                                    |      |             |       |      |       |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating                         | 84 B | DER         | 18.15 | TER  | 18.08 |
| Environmental                      | 86 B | % DER<TER   | -0.41 |      |       |
| CO <sub>2</sub> Emissions (t/year) | 1.22 | DFEE        | 45.09 | TFEE | 53.44 |
| General Requirements Compliance    | Fail | % DFEE<TFEE | 15.63 |      |       |

|                  |                                                                                                     |             |           |
|------------------|-----------------------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Ian Lloyd, Property and Energy Services Limited, Tel: 01367240212, ianl@propertyandenergy.co.uk | Assessor ID | H044-0001 |
| Client           | Keen Partnership, Keen                                                                              |             |           |

### CALCULATION OF HEAT DEMAND 09 Jan 2014

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

#### 1. Overall dwelling dimensions

|                                                        | Area (m <sup>2</sup> ) | Storey height (m)               | Volume (m <sup>3</sup> ) |
|--------------------------------------------------------|------------------------|---------------------------------|--------------------------|
| Ground floor                                           | 45.2500 (1b)           | x 2.4200 (2b)                   | = 109.5050 (1b) - (3b)   |
| First floor                                            | 36.0900 (1c)           | x 2.5500 (2c)                   | = 92.0295 (1c) - (3c)    |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 81.3400                |                                 | (4)                      |
| Dwelling volume                                        |                        | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 201.5345 (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                          |                              |        |                   |        |        |        |        | 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) =             | 0.1489 (8)           |        |        |              |
| Pressure test                                        |                              |        |                   |        |        |        |        | Yes                         |                      |        |        |              |
| Measured/design AP50                                 |                              |        |                   |        |        |        |        | 5.0300                      |                      |        |        |              |
| Infiltration rate                                    |                              |        |                   |        |        |        |        | 0.4004 (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) =        | 0.3403 (21)          |        |        |              |
|                                                      | Jan                          | Feb    | Mar               | Apr    | May    | Jun    | Jul    | Aug                         | Sep                  | Oct    | Nov    | Dec          |
| Wind speed                                           | 4.3000                       | 4.1000 | 4.1000            | 3.8000 | 3.9000 | 3.4000 | 3.4000 | 3.3000                      | 3.4000               | 3.8000 | 3.7000 | 4.0000 (22)  |
| Wind factor                                          | 1.0750                       | 1.0250 | 1.0250            | 0.9500 | 0.9750 | 0.8500 | 0.8500 | 0.8250                      | 0.8500               | 0.9500 | 0.9250 | 1.0000 (22a) |
| Adj infilt rate                                      | 0.3658                       | 0.3488 | 0.3488            | 0.3233 | 0.3318 | 0.2893 | 0.2893 | 0.2808                      | 0.2893               | 0.3233 | 0.3148 | 0.3403 (22b) |
| Effective ac                                         | 0.5669                       | 0.5608 | 0.5608            | 0.5523 | 0.5550 | 0.5418 | 0.5418 | 0.5394                      | 0.5418               | 0.5523 | 0.5495 | 0.5579 (25)  |

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

| Element                                                             | Gross          |                |                | Openings       | NetArea        | U-value              | A x U          |                | K-value        | A x K          |                |                     |
|---------------------------------------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------------|----------------|----------------|----------------|----------------|----------------|---------------------|
|                                                                     | m2             |                |                | m2             | m2             | W/m2K                | W/K            |                | kJ/m2K         | kJ/K           |                |                     |
| Door -1                                                             |                |                |                |                | 2.3000         | 1.0000               | 2.3000         |                |                |                | (26)           |                     |
| W-1.4 (Uw = 1.40)                                                   |                |                |                |                | 18.9700        | 1.3258               | 25.1496        |                |                |                | (27)           |                     |
| Velux (Uw = 1.40)                                                   |                |                |                |                | 1.6200         | 1.3258               | 2.1477         |                |                |                | (27a)          |                     |
| Ground floor                                                        |                |                |                |                | 45.2500        | 0.0900               | 4.0725         |                |                |                | (28a)          |                     |
| Cavity wall                                                         | 89.5500        |                | 21.2700        |                | 68.2800        | 0.2200               | 15.0216        |                |                |                | (29a)          |                     |
| Ceiling                                                             | 15.9600        |                |                |                | 15.9600        | 0.1100               | 1.7556         |                |                |                | (30)           |                     |
| Skelling                                                            | 30.9300        |                | 1.6200         |                | 29.3100        | 0.1600               | 4.6896         |                |                |                | (30)           |                     |
| Total net area of external elements Aum(A, m2)                      |                |                |                |                | 181.6900       |                      |                |                |                |                | (31)           |                     |
| Fabric heat loss, W/K = Sum (A x U)                                 |                |                |                |                |                | (26)...(30) + (32) = | 55.1366        |                |                |                | (33)           |                     |
| Party Wall                                                          |                |                |                |                | 47.5400        | 0.0000               | 0.0000         |                |                |                | (32)           |                     |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                   |                |                |                |                |                |                      |                |                |                |                | 250.0000 (35)  |                     |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)          |                |                |                |                |                |                      |                |                |                |                | 6.3148 (36)    |                     |
| Total fabric heat loss                                              |                |                |                |                |                |                      |                |                | (33) + (36) =  |                | 61.4514 (37)   |                     |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |                |                |                |                |                |                      |                |                |                |                |                |                     |
| (38)m                                                               | Jan<br>37.7034 | Feb<br>37.2991 | Mar<br>37.2991 | Apr<br>36.7287 | May<br>36.9140 | Jun<br>36.0355       | Jul<br>36.0355 | Aug<br>35.8742 | Sep<br>36.0355 | Oct<br>36.7287 | Nov<br>36.5482 | Dec<br>37.1041 (38) |

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### CALCULATION OF HEAT DEMAND 09 Jan 2014

|                           |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Heat transfer coeff       | 99.1548 | 98.7505 | 98.7505 | 98.1801 | 98.3654 | 97.4869 | 97.4869 | 97.3256 | 97.4869 | 98.1801 | 97.9996 | 98.5555 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 98.1436 (39) |
| HLP                       | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)             | 1.2190  | 1.2140  | 1.2140  | 1.2070  | 1.2093  | 1.1985  | 1.1985  | 1.1965  | 1.1985  | 1.2070  | 1.2048  | 1.2116 (40)  |
| Days in month             |         |         |         |         |         |         |         |         |         |         |         | 1.2066 (40)  |
|                           | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31 (41)      |

#### 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                    |          |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|----------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                    |          | 2.4878 (42)    |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                    |          | 93.2851 (43)   |
|                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec            |
| Daily hot water use                                             | 102.6136 | 98.8822  | 95.1508  | 91.4194  | 87.6880  | 83.9566  | 83.9566  | 87.6880  | 91.4194  | 95.1508            | 98.8822  | 102.6136 (44)  |
| Energy conte                                                    | 152.1731 | 133.0915 | 137.3385 | 119.7351 | 114.8886 | 99.1402  | 91.8679  | 105.4198 | 106.6788 | 124.3239           | 135.7093 | 147.3715 (45)  |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 1467.7382 (45) |
| Distribution loss (46)m = 0.15 x (45)m                          | 22.8260  | 19.9637  | 20.6008  | 17.9603  | 17.2333  | 14.8710  | 13.7802  | 15.8130  | 16.0018  | 18.6486            | 20.3564  | 22.1057 (46)   |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |                    |          |                |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |                    |          | 180.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |                    |          | 1.5300 (48)    |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |                    |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |                    |          | 0.8262 (55)    |
| Total storage loss                                              | 25.6122  | 23.1336  | 25.6122  | 24.7860  | 25.6122  | 24.7860  | 25.6122  | 25.6122  | 24.7860  | 25.6122            | 24.7860  | 25.6122 (56)   |
| If cylinder contains dedicated solar storage                    | 25.6122  | 23.1336  | 25.6122  | 24.7860  | 25.6122  | 24.7860  | 25.6122  | 25.6122  | 24.7860  | 25.6122            | 24.7860  | 25.6122 (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 | 201.0477 | 177.2363 | 186.2131 | 167.0331 | 163.7632 | 146.4382 | 140.7425 | 154.2944 | 153.9768 | 173.1985           | 183.0073 | 196.2461 (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                                                 | 201.0477 | 177.2363 | 186.2131 | 167.0331 | 163.7632 | 146.4382 | 140.7425 | 154.2944 | 153.9768 | 173.1985           | 183.0073 | 196.2461 (64)  |
| RHI water heating demand                                        |          |          |          |          |          |          |          |          |          |                    |          | 2043.1972 (64) |
| Heat gains from water heating, kWh/month                        | 89.6972  | 79.5688  | 84.7647  | 77.6503  | 77.3002  | 70.8025  | 69.6458  | 74.1518  | 73.3091  | 80.4374            | 82.9617  | 88.1007 (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                                                                               | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 49.5273  | 43.9897  | 35.7748  | 27.0839  | 20.2455  | 17.0921  | 18.4686  | 24.0062  | 32.2211  | 40.9121  | 47.7504  | 50.9038 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 331.6691 | 335.1108 | 326.4378 | 307.9742 | 284.6671 | 262.7618 | 248.1277 | 244.6860 | 253.3589 | 271.8226 | 295.1296 | 317.0350 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146 (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)                                 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 (71) |
| Water heating gains (Table 5)                                                       | 120.5608 | 118.4059 | 113.9311 | 107.8476 | 103.8981 | 98.3368  | 93.6099  | 99.6663  | 101.8182 | 108.1148 | 115.2246 | 118.4149 (72) |
| Total internal gains                                                                | 606.9276 | 602.6769 | 581.3142 | 548.0761 | 513.9811 | 483.3611 | 465.3766 | 473.5290 | 492.5687 | 526.0199 | 563.2751 | 591.5242 (73) |

#### 6. Solar gains

| [Jan]       |          |          |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b |           | FF<br>Specific data<br>or Table 6c |           | Access<br>factor<br>Table 6d |          | Gains<br>W    |
|-------------|----------|----------|-----------|------------|--------------------------------|-----------------------------------|-----------|------------------------------------|-----------|------------------------------|----------|---------------|
| North       |          |          |           | 8.3900     | 12.7650                        | 0.6300                            |           | 0.7000                             |           | 0.7700                       |          | 32.7308 (74)  |
| South       |          |          |           | 6.7800     | 54.2217                        | 0.6300                            |           | 0.7000                             |           | 0.7700                       |          | 112.3504 (78) |
| West        |          |          |           | 3.8000     | 23.8018                        | 0.6300                            |           | 0.7000                             |           | 0.7700                       |          | 27.6417 (80)  |
| North       |          |          |           | 1.0800     | 21.1256                        | 0.6300                            |           | 0.7000                             |           | 1.0000                       |          | 9.0555 (82)   |
| West        |          |          |           | 0.5400     | 32.6211                        | 0.6300                            |           | 0.7000                             |           | 1.0000                       |          | 6.9915 (82)   |
| -----       |          |          |           |            |                                |                                   |           |                                    |           |                              |          |               |
| Solar gains | 188.7699 | 290.8001 | 424.3137  | 588.8135   | 694.5484                       | 754.2271                          | 709.7026  | 626.4739                           | 508.7215  | 353.1522                     | 224.6559 | 161.2679 (83) |
| Total gains | 795.6976 | 893.4770 | 1005.6279 | 1136.8896  | 1208.5295                      | 1237.5882                         | 1175.0792 | 1100.0029                          | 1001.2902 | 879.1721                     | 787.9311 | 752.7920 (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                                                                         | 56.9676 | 57.2008 | 57.2008 | 57.5332 | 57.4248 | 57.9423 | 57.9423 | 58.0383 | 57.9423 | 57.5332 | 57.6391 | 57.3140      |
| alpha                                                                       | 4.7978  | 4.8134  | 4.8134  | 4.8355  | 4.8283  | 4.8628  | 4.8628  | 4.8692  | 4.8628  | 4.8355  | 4.8426  | 4.8209       |
| util living area                                                            | 0.9810  | 0.9658  | 0.9233  | 0.8106  | 0.6263  | 0.4064  | 0.2734  | 0.3002  | 0.5656  | 0.8522  | 0.9604  | 0.9846 (86)  |
| MIT                                                                         | 20.2627 | 20.3890 | 20.5889 | 20.7998 | 20.9097 | 20.9408 | 20.9438 | 20.9437 | 20.9282 | 20.7866 | 20.5005 | 20.2366 (87) |

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|                        |         |         |         |         |         |         |         |         |                           |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Th 2                   | 19.9048 | 19.9088 | 19.9088 | 19.9144 | 19.9126 | 19.9212 | 19.9212 | 19.9228 | 19.9212                   | 19.9144 | 19.9162 | 19.9107 (88) |
| util rest of house     | 0.9750  | 0.9554  | 0.9010  | 0.7635  | 0.5538  | 0.3237  | 0.1842  | 0.2054  | 0.4721                    | 0.8019  | 0.9462  | 0.9797 (89)  |
| MIT 2                  | 18.9551 | 19.1373 | 19.4135 | 19.6876 | 19.8045 | 19.8380 | 19.8394 | 19.8411 | 19.8306                   | 19.6801 | 19.3039 | 18.9225 (90) |
| Living area fraction   |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.1962 (91)  |
| MIT                    | 19.2116 | 19.3829 | 19.6441 | 19.9058 | 20.0214 | 20.0544 | 20.0561 | 20.0574 | 20.0460                   | 19.8973 | 19.5387 | 19.1803 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | -0.1500      |
| adjusted MIT           | 19.0616 | 19.2329 | 19.4941 | 19.7558 | 19.8714 | 19.9044 | 19.9061 | 19.9074 | 19.8960                   | 19.7473 | 19.3887 | 19.0303 (93) |

#### 8. Space heating requirement

|                          | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec       |       |
|--------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-------|
| Utilisation              | 0.9689    | 0.9472    | 0.8907    | 0.7558   | 0.5509   | 0.3224   | 0.1830   | 0.2041   | 0.4698   | 0.7928   | 0.9373    | 0.9743    | (94)  |
| Useful gains             | 770.9603  | 846.2901  | 895.7561  | 859.2611 | 665.7761 | 399.0099 | 215.0228 | 224.4938 | 470.3979 | 697.0496 | 738.5575  | 733.4391  | (95)  |
| Ext temp.                | 5.1000    | 5.7000    | 7.4000    | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000  | 8.0000    | 5.1000    | (96)  |
| Heat loss rate W         | 1384.3648 | 1336.3935 | 1194.3008 | 967.6436 | 685.7412 | 400.1282 | 215.0684 | 224.5718 | 477.2922 | 809.7159 | 1116.0838 | 1372.9113 | (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        | 456.3730  | 329.3428  | 222.1173  | 78.0354  | 14.8540  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 83.8237  | 271.8189  | 475.7674  | (98)  |
| Space heating            |           |           |           |          |          |          |          |          |          |          |           | 1932.1325 | (98)  |
| RHI space heating demand |           |           |           |          |          |          |          |          |          |          |           | 1932      | (98)  |

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### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 45.2500 (1b)              | x 2.4200 (2b)                   | = 109.5050 (1b) - (3b)      |
| First floor                                            | 36.0900 (1c)              | x 2.5500 (2c)                   | = 92.0295 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 81.3400                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 201.5345 (5)              |

#### 2. Ventilation rate

|                                                                           | main<br>heating | secondary<br>heating | other | total                       | m <sup>3</sup> per hour    |
|---------------------------------------------------------------------------|-----------------|----------------------|-------|-----------------------------|----------------------------|
| Number of chimneys                                                        | 0               | +                    | 0     | =                           | 0 * 40 = 0.0000 (6a)       |
| Number of open flues                                                      | 0               | +                    | 0     | =                           | 0 * 20 = 0.0000 (6b)       |
| Number of intermittent fans                                               |                 |                      |       |                             | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                   |                 |                      |       |                             | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                              |                 |                      |       |                             | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = |                 |                      |       |                             | 30.0000 / (5) = 0.1489 (8) |
| Pressure test                                                             |                 |                      |       |                             | Yes                        |
| Measured/design AP50                                                      |                 |                      |       |                             | 5.0300                     |
| Infiltration rate                                                         |                 |                      |       |                             | 0.4004 (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) =        | 0.3403 (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 | 0.4339 | 0.4254 | 0.4169 | 0.3743 | 0.3658 | 0.3233 | 0.3233 | 0.3148 | 0.3403 | 0.3658 | 0.3828 | 0.3999 (22b) |
| Effective ac    | 0.5941 | 0.5905 | 0.5869 | 0.5701 | 0.5669 | 0.5523 | 0.5523 | 0.5495 | 0.5579 | 0.5669 | 0.5733 | 0.5799 (25)  |

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

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|---------------|
| Door -1                                                     |                         |                            | 2.3000                    | 1.0000                        | 2.3000               |                                | (26)          |
| W-1.4 (Uw = 1.40)                                           |                         |                            | 18.9700                   | 1.3258                        | 25.1496              |                                | (27)          |
| Velux (Uw = 1.40)                                           |                         |                            | 1.6200                    | 1.3258                        | 2.1477               |                                | (27a)         |
| Ground floor                                                |                         |                            | 45.2500                   | 0.0900                        | 4.0725               |                                | (28a)         |
| Cavity wall                                                 | 89.5500                 | 21.2700                    | 68.2800                   | 0.2200                        | 15.0216              |                                | (29a)         |
| Ceiling                                                     | 15.9600                 |                            | 15.9600                   | 0.1100                        | 1.7556               |                                | (30)          |
| Skelling                                                    | 30.9300                 | 1.6200                     | 29.3100                   | 0.1600                        | 4.6896               |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 181.6900                  |                               |                      |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           |                               | (26)...(30) + (32) = | 55.1366                        | (33)          |
| Party Wall                                                  |                         |                            | 47.5400                   | 0.0000                        | 0.0000               |                                | (32)          |

|                                                                |                            |
|----------------------------------------------------------------|----------------------------|
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K | 250.0000 (35)              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)     | 6.3148 (36)                |
| Total fabric heat loss                                         | (33) + (36) = 61.4514 (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                     | 39.5134  | 39.2703  | 39.0320  | 37.9128 | 37.7034 | 36.7287 | 36.7287 | 36.5482 | 37.1041 | 37.7034 | 38.1271 | 38.5699 (38)  |
| Heat transfer coeff       | 100.9648 | 100.7217 | 100.4834 | 99.3642 | 99.1548 | 98.1801 | 98.1801 | 97.9996 | 98.5555 | 99.1548 | 99.5785 | 100.0213 (39) |
| Average = Sum(39)m / 12 = |          |          |          |         |         |         |         |         |         |         |         | 99.3632 (39)  |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.2413 | 1.2383 | 1.2354 | 1.2216 | 1.2190 | 1.2070 | 1.2070 | 1.2048 | 1.2116 | 1.2190 | 1.2242 | 1.2297 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.2216 (40) |
| Days in month | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31 (41)     |

#### 4. Water heating energy requirements (kWh/year)

|                                          |              |
|------------------------------------------|--------------|
| Assumed occupancy                        | 2.4878 (42)  |
| Average daily hot water use (litres/day) | 93.2851 (43) |

|                                        | Jan      | Feb      | Mar      | Apr      | May      | Jun     | Jul     | Aug      | Sep      | Oct      | Nov      | Dec                               |
|----------------------------------------|----------|----------|----------|----------|----------|---------|---------|----------|----------|----------|----------|-----------------------------------|
| Daily hot water use                    | 102.6136 | 98.8822  | 95.1508  | 91.4194  | 87.6880  | 83.9566 | 83.9566 | 87.6880  | 91.4194  | 95.1508  | 98.8822  | 102.6136 (44)                     |
| Energy conte                           | 152.1731 | 133.0915 | 137.3385 | 119.7351 | 114.8886 | 99.1402 | 91.8679 | 105.4198 | 106.6788 | 124.3239 | 135.7093 | 147.3715 (45)                     |
| Energy content (annual)                |          |          |          |          |          |         |         |          |          |          |          | Total = Sum(45)m = 1467.7382 (45) |
| Distribution loss (46)m = 0.15 x (45)m | 22.8260  | 19.9637  | 20.6008  | 17.9603  | 17.2333  | 14.8710 | 13.7802 | 15.8130  | 16.0018  | 18.6486  | 20.3564  | 22.1057 (46)                      |
| Water storage loss:                    |          |          |          |          |          |         |         |          |          |          |          |                                   |

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.10r08

Property and Energy  
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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



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### CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

|                                                                       |          |          |          |          |          |          |          |          |          |          |          |           |                 |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (201)    |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          |           | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |           | 89.8000 (206)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (208)    |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          |           | 2687.0855 (211) |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |                 |
| Space heating requirement                                             | 538.6808 | 391.2835 | 285.8585 | 122.5294 | 33.7177  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 132.7101 | 348.3047 | 559.9180  | (98)            |
| Space heating efficiency (main heating system 1)                      | 89.8000  | 89.8000  | 89.8000  | 89.8000  | 89.8000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 89.8000  | 89.8000  | 89.8000   | (210)           |
| Space heating fuel (main heating system)                              | 599.8673 | 435.7277 | 318.3279 | 136.4470 | 37.5476  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 147.7841 | 387.8672 | 623.5167  | (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                                             | 201.0477 | 177.2363 | 186.2131 | 167.0331 | 163.7632 | 146.4382 | 140.7425 | 154.2944 | 153.9768 | 173.1985 | 183.0073 | 196.2461  | (64)            |
| Efficiency of water heater (217)m                                     | 86.6156  | 86.1663  | 85.2511  | 83.3000  | 80.7426  | 79.1000  | 79.1000  | 79.1000  | 79.1000  | 83.4117  | 85.8022  | 86.7543   | (216)           |
| Fuel for water heating, kWh/month                                     | 232.1149 | 205.6911 | 218.4291 | 200.5199 | 202.8213 | 185.1304 | 177.9299 | 195.0624 | 194.6610 | 207.6430 | 213.2898 | 226.2090  | (219)           |
| Water heating fuel used                                               |          |          |          |          |          |          |          |          |          |          |          | 2459.5016 | (219)           |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          |           |                 |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          | 2687.0855 | (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)                   |          |          |          |          |          |          |          |          |          |          |          | 349.8671  | (232)           |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          | 5571.4542 | (238)           |

10a. Fuel costs - using Table 12 prices

|                               | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|-------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1 | 2687.0855        | 3.4800              | 93.5106 (240)       |
| Space heating - secondary     | 0.0000           | 0.0000              | 0.0000 (242)        |
| Water heating (other fuel)    | 2459.5016        | 3.4800              | 85.5907 (247)       |
| Pumps and fans for heating    | 75.0000          | 13.1900             | 9.8925 (249)        |
| Energy for lighting           | 349.8671         | 13.1900             | 46.1475 (250)       |
| Additional standing charges   |                  |                     | 120.0000 (251)      |
| Total energy cost             |                  |                     | 355.1412 (255)      |

11a. SAP rating - Individual heating systems

|                                  |                                  |              |
|----------------------------------|----------------------------------|--------------|
| Energy cost deflator (Table 12): |                                  | 0.4200 (256) |
| Energy cost factor (ECF)         | [(255) x (256)] / [(4) + 45.0] = | 1.1806 (257) |
| SAP value                        |                                  | 83.5304      |
| SAP rating (Section 12)          |                                  | 84 (258)     |
| SAP band                         |                                  | B            |

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

|                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1 | 2687.0855          | 0.2160                        | 580.4105 (261)           |
| Space heating - secondary     | 0.0000             | 0.0000                        | 0.0000 (263)             |
| Water heating (other fuel)    | 2459.5016          | 0.2160                        | 531.2523 (264)           |
| Space and water heating       |                    |                               | 1111.6628 (265)          |
| Pumps and fans                | 75.0000            | 0.5190                        | 38.9250 (267)            |
| Energy for lighting           | 349.8671           | 0.5190                        | 181.5810 (268)           |
| Total kg/year                 |                    |                               | 1332.1688 (272)          |
| CO2 emissions per m2          |                    |                               | 16.3800 (273)            |
| EI value                      |                    |                               | 85.8706                  |
| EI rating                     |                    |                               | 86 (274)                 |
| EI band                       |                    |                               | B                        |

Calculation of stars for heating and DHW

|                                    |                                                                     |
|------------------------------------|---------------------------------------------------------------------|
| Main heating energy efficiency     | $3.48 \times (1 + 0.29 \times 0.25) / 0.8980 = 4.156$ , stars = 4   |
| Main heating environmental impact  | $0.216 \times (1 + 0.29 \times 0.25) / 0.8980 = 0.2580$ , stars = 4 |
| Water heating energy efficiency    | $3.48 / 0.8287 = 4.199$ , stars = 4                                 |
| Water heating environmental impact | $0.216 / 0.8287 = 0.2606$ , stars = 4                               |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



Property and Energy  
Services Ltd.

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



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

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

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 45.2500 (1b)              | x 2.4200 (2b)                   | = 109.5050 (1b) - (3b)      |
| First floor                                            | 36.0900 (1c)              | x 2.5500 (2c)                   | = 92.0295 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 81.3400                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 201.5345 (5)              |

#### 2. Ventilation rate

|                                                                         | main<br>heating | secondary<br>heating | other | total                       | m <sup>3</sup> per hour    |
|-------------------------------------------------------------------------|-----------------|----------------------|-------|-----------------------------|----------------------------|
| Number of chimneys                                                      | 0               | +                    | 0     | =                           | 0 * 40 = 0.0000 (6a)       |
| Number of open flues                                                    | 0               | +                    | 0     | =                           | 0 * 20 = 0.0000 (6b)       |
| Number of intermittent fans                                             |                 |                      |       |                             | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                 |                 |                      |       |                             | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                            |                 |                      |       |                             | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) |                 |                      |       |                             | 30.0000 / (5) = 0.1489 (8) |
| Pressure test                                                           |                 |                      |       |                             | Yes                        |
| Measured/design AP50                                                    |                 |                      |       |                             | 5.0300                     |
| Infiltration rate                                                       |                 |                      |       |                             | 0.4004 (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) =        | 0.3403 (21)                |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 4.3000 | 4.1000 | 4.1000 | 3.8000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000 | 4.0000 (22)  |
| Wind factor     | 1.0750 | 1.0250 | 1.0250 | 0.9500 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250 | 1.0000 (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac    | 0.3658 | 0.3488 | 0.3488 | 0.3233 | 0.3318 | 0.2893 | 0.2893 | 0.2808 | 0.2893 | 0.3233 | 0.3148 | 0.3403 (22b) |
|                 | 0.5669 | 0.5608 | 0.5608 | 0.5523 | 0.5550 | 0.5418 | 0.5418 | 0.5394 | 0.5418 | 0.5523 | 0.5495 | 0.5579 (25)  |

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

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|---------------|
| Door -1                                                        |                         |                            | 2.3000                    | 1.0000                        | 2.3000               |                                | (26)          |
| W-1.4 (Uw = 1.40)                                              |                         |                            | 18.9700                   | 1.3258                        | 25.1496              |                                | (27)          |
| Velux (Uw = 1.40)                                              |                         |                            | 1.6200                    | 1.3258                        | 2.1477               |                                | (27a)         |
| Ground floor                                                   |                         |                            | 45.2500                   | 0.0900                        | 4.0725               |                                | (28a)         |
| Cavity wall                                                    | 89.5500                 | 21.2700                    | 68.2800                   | 0.2200                        | 15.0216              |                                | (29a)         |
| Ceiling                                                        | 15.9600                 |                            | 15.9600                   | 0.1100                        | 1.7556               |                                | (30)          |
| Skelling                                                       | 30.9300                 | 1.6200                     | 29.3100                   | 0.1600                        | 4.6896               |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 181.6900                  |                               |                      |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           |                               | (26)...(30) + (32) = | 55.1366                        | (33)          |
| Party Wall                                                     |                         |                            | 47.5400                   | 0.0000                        | 0.0000               |                                | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                      |                                | 250.0000 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)     |                         |                            |                           |                               |                      |                                | 6.3148 (36)   |
| Total fabric heat loss                                         |                         |                            |                           |                               |                      | (33) + (36) =                  | 61.4514 (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                     | 37.7034 | 37.2991 | 37.2991 | 36.7287 | 36.9140 | 36.0355 | 36.0355 | 35.8742 | 36.0355 | 36.7287 | 36.5482 | 37.1041 (38) |
| Heat transfer coeff       | 99.1548 | 98.7505 | 98.7505 | 98.1801 | 98.3654 | 97.4869 | 97.4869 | 97.3256 | 97.4869 | 98.1801 | 97.9996 | 98.5555 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 98.1436 (39) |
|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP                       | 1.2190  | 1.2140  | 1.2140  | 1.2070  | 1.2093  | 1.1985  | 1.1985  | 1.1965  | 1.1985  | 1.2070  | 1.2048  | 1.2116 (40)  |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.2066 (40)  |
| Days in month             | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31 (41)      |

#### 4. Water heating energy requirements (kWh/year)

| Assumed occupancy                        |          |          |          |          |          |         |         |          |          |          |          | 2.4878 (42)                       |
|------------------------------------------|----------|----------|----------|----------|----------|---------|---------|----------|----------|----------|----------|-----------------------------------|
| Average daily hot water use (litres/day) |          |          |          |          |          |         |         |          |          |          |          | 93.2851 (43)                      |
|                                          | Jan      | Feb      | Mar      | Apr      | May      | Jun     | Jul     | Aug      | Sep      | Oct      | Nov      | Dec                               |
| Daily hot water use                      | 102.6136 | 98.8822  | 95.1508  | 91.4194  | 87.6880  | 83.9566 | 83.9566 | 87.6880  | 91.4194  | 95.1508  | 98.8822  | 102.6136 (44)                     |
| Energy conte                             | 152.1731 | 133.0915 | 137.3385 | 119.7351 | 114.8886 | 99.1402 | 91.8679 | 105.4198 | 106.6788 | 124.3239 | 135.7093 | 147.3715 (45)                     |
| Energy content (annual)                  |          |          |          |          |          |         |         |          |          |          |          | Total = Sum(45)m = 1467.7382 (45) |
| Distribution loss (46)m = 0.15 x (45)m   |          |          |          |          |          |         |         |          |          |          |          |                                   |
|                                          | 22.8260  | 19.9637  | 20.6008  | 17.9603  | 17.2333  | 14.8710 | 13.7802 | 15.8130  | 16.0018  | 18.6486  | 20.3564  | 22.1057 (46)                      |
| Water storage loss:                      |          |          |          |          |          |         |         |          |          |          |          |                                   |

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.10r08



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

|                                                                 |          |          |          |          |          |          |          |                                          |          |          |          |          |           |      |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|------------------------------------------|----------|----------|----------|----------|-----------|------|
| Store volume                                                    |          |          |          |          |          |          |          |                                          |          |          |          |          | 180.0000  | (47) |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |                                          |          |          |          |          | 1.5300    | (48) |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |                                          |          |          |          |          | 0.5400    | (49) |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |                                          |          |          |          |          | 0.8262    | (55) |
| Total storage loss                                              |          |          |          |          |          |          |          |                                          |          |          |          |          |           |      |
|                                                                 | 25.6122  | 23.1336  | 25.6122  | 24.7860  | 25.6122  | 24.7860  | 25.6122  | 25.6122                                  | 24.7860  | 25.6122  | 24.7860  | 25.6122  | (56)      |      |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |                                          |          |          |          |          |           |      |
|                                                                 | 25.6122  | 23.1336  | 25.6122  | 24.7860  | 25.6122  | 24.7860  | 25.6122  | 25.6122                                  | 24.7860  | 25.6122  | 24.7860  | 25.6122  | (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 |          |          |          |          |          |          |          |                                          |          |          |          |          |           |      |
|                                                                 | 201.0477 | 177.2363 | 186.2131 | 167.0331 | 163.7632 | 146.4382 | 140.7425 | 154.2944                                 | 153.9768 | 173.1985 | 183.0073 | 196.2461 | (62)      |      |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63)      |      |
|                                                                 |          |          |          |          |          |          |          | Solar input (sum of months) = Sum(63)m = |          |          |          |          | 0.0000    | (63) |
| Output from w/h                                                 |          |          |          |          |          |          |          |                                          |          |          |          |          |           |      |
|                                                                 | 201.0477 | 177.2363 | 186.2131 | 167.0331 | 163.7632 | 146.4382 | 140.7425 | 154.2944                                 | 153.9768 | 173.1985 | 183.0073 | 196.2461 | (64)      |      |
|                                                                 |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m =   |          |          |          |          | 2043.1972 | (64) |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |                                          |          |          |          |          |           |      |
|                                                                 | 89.6972  | 79.5688  | 84.7647  | 77.6503  | 77.3002  | 70.8025  | 69.6458  | 74.1518                                  | 73.3091  | 80.4374  | 82.9617  | 88.1007  | (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                                                                               | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 | 149.2677 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 49.5273  | 43.9897  | 35.7748  | 27.0839  | 20.2455  | 17.0921  | 18.4686  | 24.0062  | 32.2211  | 40.9121  | 47.7504  | 50.9038 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 331.6691 | 335.1108 | 326.4378 | 307.9742 | 284.6671 | 262.7618 | 248.1277 | 244.6860 | 253.3589 | 271.8226 | 295.1296 | 317.0350 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146  | 52.4146 (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)                                 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 | -99.5118 (71) |
| Water heating gains (Table 5)                                                       | 120.5608 | 118.4059 | 113.9311 | 107.8476 | 103.8981 | 98.3368  | 93.6099  | 99.6663  | 101.8182 | 108.1148 | 115.2246 | 118.4149 (72) |
| Total internal gains                                                                | 606.9276 | 602.6769 | 581.3142 | 548.0761 | 513.9811 | 483.3611 | 465.3766 | 473.5290 | 492.5687 | 526.0199 | 563.2751 | 591.5242 (73) |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W    |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|---------------|
| North | 8.3900                 | 12.7650                                    | 0.6300                            | 0.7000                             | 0.7700                       | 32.7308 (74)  |
| South | 6.7800                 | 54.2217                                    | 0.6300                            | 0.7000                             | 0.7700                       | 112.3504 (78) |
| West  | 3.8000                 | 23.8018                                    | 0.6300                            | 0.7000                             | 0.7700                       | 27.6417 (80)  |
| North | 1.0800                 | 21.1256                                    | 0.6300                            | 0.7000                             | 1.0000                       | 9.0555 (82)   |
| West  | 0.5400                 | 32.6211                                    | 0.6300                            | 0.7000                             | 1.0000                       | 6.9915 (82)   |

|             |          |          |           |           |           |           |           |           |           |          |          |               |
|-------------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|---------------|
| Solar gains | 188.7699 | 290.8001 | 424.3137  | 588.8135  | 694.5484  | 754.2271  | 709.7026  | 626.4739  | 508.7215  | 353.1522 | 224.6559 | 161.2679 (83) |
| Total gains | 795.6976 | 893.4770 | 1005.6279 | 1136.8896 | 1208.5295 | 1237.5882 | 1175.0792 | 1100.0029 | 1001.2902 | 879.1721 | 787.9311 | 752.7920 (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                                                                         | 56.9676 | 57.2008 | 57.2008 | 57.5332 | 57.4248 | 57.9423 | 57.9423 | 58.0383 | 57.9423 | 57.5332 | 57.6391 | 57.3140      |
| alpha                                                                       | 4.7978  | 4.8134  | 4.8134  | 4.8355  | 4.8283  | 4.8628  | 4.8628  | 4.8692  | 4.8628  | 4.8355  | 4.8426  | 4.8209       |
| util living area                                                            | 0.9810  | 0.9658  | 0.9233  | 0.8106  | 0.6263  | 0.4064  | 0.2734  | 0.3002  | 0.5656  | 0.8522  | 0.9604  | 0.9846 (86)  |
| MIT                                                                         | 20.2627 | 20.3890 | 20.5889 | 20.7998 | 20.9097 | 20.9408 | 20.9438 | 20.9437 | 20.9282 | 20.7866 | 20.5005 | 20.2366 (87) |
| Th 2                                                                        | 19.9048 | 19.9088 | 19.9088 | 19.9144 | 19.9126 | 19.9212 | 19.9212 | 19.9228 | 19.9212 | 19.9144 | 19.9162 | 19.9107 (88) |
| util rest of house                                                          | 0.9750  | 0.9554  | 0.9010  | 0.7635  | 0.5538  | 0.3237  | 0.1842  | 0.2054  | 0.4721  | 0.8019  | 0.9462  | 0.9797 (89)  |
| MIT 2                                                                       | 18.9551 | 19.1373 | 19.4135 | 19.6876 | 19.8045 | 19.8380 | 19.8394 | 19.8411 | 19.8306 | 19.6801 | 19.3039 | 18.9225 (90) |
| Living area fraction                                                        | 19.2116 | 19.3829 | 19.6441 | 19.9058 | 20.0214 | 20.0544 | 20.0561 | 20.0574 | 20.0460 | 19.8973 | 19.5387 | 0.1962 (91)  |
| MIT                                                                         |         |         |         |         |         |         |         |         |         |         |         | 19.1803 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | -0.1500      |
| adjusted MIT                                                                | 19.0616 | 19.2329 | 19.4941 | 19.7558 | 19.8714 | 19.9044 | 19.9061 | 19.9074 | 19.8960 | 19.7473 | 19.3887 | 19.0303 (93) |

## 8. Space heating requirement

|                      | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct          | Nov       | Dec            |
|----------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|--------------|-----------|----------------|
| Utilisation          | 0.9689    | 0.9472    | 0.8907    | 0.7558   | 0.5509   | 0.3224   | 0.1830   | 0.2041   | 0.4698   | 0.7928       | 0.9373    | 0.9743 (94)    |
| Useful gains         | 770.9603  | 846.2901  | 895.7561  | 859.2611 | 665.7761 | 399.0099 | 215.0228 | 224.4938 | 470.3979 | 697.0496     | 738.5575  | 733.4391 (95)  |
| Ext temp.            | 5.1000    | 5.7000    | 7.4000    | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000      | 8.0000    | 5.1000 (96)    |
| Heat loss rate W     | 1384.3648 | 1336.3835 | 1194.3008 | 967.6436 | 685.7412 | 400.1282 | 215.0684 | 224.5718 | 477.2922 | 809.7159     | 1116.0838 | 1372.9113 (97) |
| Month fracti         | 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    | 456.3730  | 329.3428  | 222.1173  | 78.0354  | 14.8540  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 83.8237      | 271.8189  | 475.7674 (98)  |
| Space heating        |           |           |           |          |          |          |          |          |          |              |           | 1932.1325 (98) |
| Space heating per m2 |           |           |           |          |          |          |          |          |          | (98) / (4) = |           | 23.7538 (99)   |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



Property and Energy  
Services Ltd.

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

8c. Space cooling requirement

Not applicable

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

|                                                                       |          |          |          |          |          |          |          |          |          |          |          |          |                 |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |          | 89.8000 (206)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          |          | 2151.5952 (211) |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                 |
| Space heating requirement                                             | 456.3730 | 329.3428 | 222.1173 | 78.0354  | 14.8540  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 83.8237  | 271.8189 | 475.7674 | (98)            |
| Space heating efficiency (main heating system 1)                      | 89.8000  | 89.8000  | 89.8000  | 89.8000  | 89.8000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 89.8000  | 89.8000  | 89.8000  | (210)           |
| Space heating fuel (main heating system)                              | 508.2105 | 366.7514 | 247.3466 | 86.8991  | 16.5412  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 93.3449  | 302.6937 | 529.8078 | (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                                             | 201.0477 | 177.2363 | 186.2131 | 167.0331 | 163.7632 | 146.4382 | 140.7425 | 154.2944 | 153.9768 | 173.1985 | 183.0073 | 196.2461 | (64)            |
| Efficiency of water heater (217)m                                     | 86.2327  | 85.7421  | 84.5822  | 82.2195  | 79.8916  | 79.1000  | 79.1000  | 79.1000  | 79.1000  | 82.2981  | 85.1646  | 86.3874  | (216)           |
| Fuel for water heating, kWh/month                                     | 233.1454 | 206.7088 | 220.1563 | 203.1550 | 204.9817 | 185.1304 | 177.9299 | 195.0624 | 194.6610 | 210.4526 | 214.8866 | 227.1697 | (219)           |
| Water heating fuel used                                               |          |          |          |          |          |          |          |          |          |          |          |          | 2473.4398 (219) |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          |          | 2151.5952 (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)                   |          |          |          |          |          |          |          |          |          |          |          |          | 349.8671 (232)  |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          |          | 5049.9021 (238) |

10a. Fuel costs - using BEDF prices (442)

|                               | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|-------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1 | 2151.5952        | 3.9200              | 84.3425 (240)       |
| Space heating - secondary     | 0.0000           | 0.0000              | 0.0000 (242)        |
| Water heating (other fuel)    | 2473.4398        | 3.9200              | 96.9588 (247)       |
| Pumps and fans for heating    | 75.0000          | 16.9600             | 12.7200 (249)       |
| Energy for lighting           | 349.8671         | 16.9600             | 59.3375 (250)       |
| Additional standing charges   |                  |                     | 88.0000 (251)       |
| Total energy cost             |                  |                     | 341.3588 (255)      |

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

|                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1 | 2151.5952          | 0.2160                        | 464.7446 (261)           |
| Space heating - secondary     | 0.0000             | 0.0000                        | 0.0000 (263)             |
| Water heating (other fuel)    | 2473.4398          | 0.2160                        | 534.2630 (264)           |
| Space and water heating       |                    |                               | 999.0076 (265)           |
| Pumps and fans                | 75.0000            | 0.5190                        | 38.9250 (267)            |
| Energy for lighting           | 349.8671           | 0.5190                        | 181.5810 (268)           |
| Total kg/year                 |                    |                               | 1219.5136 (272)          |

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

|                               | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|-------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1 | 2151.5952          | 1.2200                              | 2624.9461 (261)            |
| Space heating - secondary     | 0.0000             | 0.0000                              | 0.0000 (263)               |
| Water heating (other fuel)    | 2473.4398          | 1.2200                              | 3017.5966 (264)            |
| Space and water heating       |                    |                                     | 5642.5427 (265)            |
| Pumps and fans                | 75.0000            | 3.0700                              | 230.2500 (267)             |
| Energy for lighting           | 349.8671           | 3.0700                              | 1074.0920 (268)            |
| Primary energy kWh/year       |                    |                                     | 6946.8847 (272)            |
| Primary energy kWh/m2/year    |                    |                                     | 85.4055 (273)              |

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 84

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



Property and Energy  
Services Ltd.

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

Current environmental impact rating:

B 86

(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       | Recommended       |
| O                           | Not considered    |
| P                           | Not considered    |
| R                           | Not considered    |
| S                           | Not considered    |
| T                           | Not considered    |
| U Solar photovoltaic panels | Recommended       |
| 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       |
|-----------------------------|------------|-------------|------------------|
| N Solar water heating       | + 1.7      | -£ 43       | -258 kg (21.1%)  |
| U Solar photovoltaic panels | + 10.6     | -£ 317      | -971 kg (101.0%) |

| Recommended measures      | Typical annual savings | Energy efficiency | Environmental impact |
|---------------------------|------------------------|-------------------|----------------------|
| Solar water heating       | £43                    | 3.17 kg/m²        | B 85                 |
| Solar photovoltaic panels | £317                   | 11.94 kg/m²       | A 96                 |
| Total Savings             | £360                   | 15.11 kg/m²       | B 89                 |

Potential energy efficiency rating: A 96  
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 442 TEST (29 Apr 2019)  
Recommendation texts revision number 4.9c (22 Feb 2014)

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

|                          | Current    | Potential  | Saving     |
|--------------------------|------------|------------|------------|
| Electricity              | £72        | £81        | -£8        |
| Mains gas                | £269       | £218       | £51        |
| Space heating            | £185       | £187       | -£1        |
| Water heating            | £97        | £52        | £44        |
| Lighting                 | £59        | £59        | £0         |
| Generated (PV)           | -£0        | -£317      | £317       |
| Total cost of fuels      | £341       | -£18       | £360       |
| Total cost of uses       | £341       | -£19       | £360       |
| Delivered energy         | 62 kWh/m²  | 24 kWh/m²  | 39 kWh/m²  |
| Carbon dioxide emissions | 1.2 tonnes | 0.0 tonnes | 1.2 tonnes |
| CO2 emissions per m²     | 15 kg/m²   | 0 kg/m²    | 15 kg/m²   |
| Primary energy           | 85 kWh/m²  | -3 kWh/m²  | 88 kWh/m²  |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



Property and Energy  
Services Ltd.

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 45.2500 (1b)              | x 2.4200 (2b)                   | = 109.5050 (1b) - (3b)      |
| First floor                                            | 36.0900 (1c)              | x 2.5500 (2c)                   | = 92.0295 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 81.3400                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 201.5345 (5)              |

#### 2. Ventilation rate

|                                                                         | main<br>heating | secondary<br>heating | other | total                       | m <sup>3</sup> per hour    |
|-------------------------------------------------------------------------|-----------------|----------------------|-------|-----------------------------|----------------------------|
| Number of chimneys                                                      | 0               | +                    | 0     | =                           | 0 * 40 = 0.0000 (6a)       |
| Number of open flues                                                    | 0               | +                    | 0     | =                           | 0 * 20 = 0.0000 (6b)       |
| Number of intermittent fans                                             |                 |                      |       |                             | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                 |                 |                      |       |                             | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                            |                 |                      |       |                             | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) |                 |                      |       |                             | 30.0000 / (5) = 0.1489 (8) |
| Pressure test                                                           |                 |                      |       |                             | Yes                        |
| Measured/design AP50                                                    |                 |                      |       |                             | 5.0300                     |
| Infiltration rate                                                       |                 |                      |       |                             | 0.4004 (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) =        | 0.3403 (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 | 0.4339 | 0.4254 | 0.4169 | 0.3743 | 0.3658 | 0.3233 | 0.3233 | 0.3148 | 0.3403 | 0.3658 | 0.3828 | 0.3999 (22b) |
| Effective ac    | 0.5941 | 0.5905 | 0.5869 | 0.5701 | 0.5669 | 0.5523 | 0.5523 | 0.5495 | 0.5579 | 0.5669 | 0.5733 | 0.5799 (25)  |

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

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Door -1                                                     |                         |                            | 2.3000                    | 1.0000                        | 2.3000       |                                | (26)          |
| W-1.4 (Uw = 1.40)                                           |                         |                            | 18.9700                   | 1.3258                        | 25.1496      |                                | (27)          |
| Velux (Uw = 1.40)                                           |                         |                            | 1.6200                    | 1.3258                        | 2.1477       |                                | (27a)         |
| Ground floor                                                |                         |                            | 45.2500                   | 0.0900                        | 4.0725       |                                | (28a)         |
| Cavity wall                                                 | 89.5500                 | 21.2700                    | 68.2800                   | 0.2200                        | 15.0216      |                                | (29a)         |
| Ceiling                                                     | 15.9600                 |                            | 15.9600                   | 0.1100                        | 1.7556       |                                | (30)          |
| Skelling                                                    | 30.9300                 | 1.6200                     | 29.3100                   | 0.1600                        | 4.6896       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 181.6900                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 55.1366      |                                | (33)          |
| Party Wall                                                  |                         |                            | 47.5400                   | 0.0000                        | 0.0000       |                                | (32)          |

|                                                                |               |               |
|----------------------------------------------------------------|---------------|---------------|
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |               | 250.0000 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)     |               | 6.3148 (36)   |
| Total fabric heat loss                                         | (33) + (36) = | 61.4514 (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                     | 39.5134  | 39.2703  | 39.0320  | 37.9128 | 37.7034 | 36.7287 | 36.7287 | 36.5482 | 37.1041 | 37.7034 | 38.1271 | 38.5699 (38)  |
| Heat transfer coeff       | 100.9648 | 100.7217 | 100.4834 | 99.3642 | 99.1548 | 98.1801 | 98.1801 | 97.9996 | 98.5555 | 99.1548 | 99.5785 | 100.0213 (39) |
| Average = Sum(39)m / 12 = |          |          |          |         |         |         |         |         |         |         |         | 99.3632 (39)  |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.2413 | 1.2383 | 1.2354 | 1.2216 | 1.2190 | 1.2070 | 1.2070 | 1.2048 | 1.2116 | 1.2190 | 1.2242 | 1.2297 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.2216 (40) |
| Days in month | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31 (41)     |

#### 4. Water heating energy requirements (kWh/year)

|                                          |  |              |
|------------------------------------------|--|--------------|
| Assumed occupancy                        |  | 2.4878 (42)  |
| Average daily hot water use (litres/day) |  | 93.2851 (43) |

|                                        | Jan      | Feb      | Mar      | Apr      | May      | Jun     | Jul     | Aug      | Sep      | Oct      | Nov      | Dec                               |
|----------------------------------------|----------|----------|----------|----------|----------|---------|---------|----------|----------|----------|----------|-----------------------------------|
| Daily hot water use                    | 102.6136 | 98.8822  | 95.1508  | 91.4194  | 87.6880  | 83.9566 | 83.9566 | 87.6880  | 91.4194  | 95.1508  | 98.8822  | 102.6136 (44)                     |
| Energy conte                           | 152.1731 | 133.0915 | 137.3385 | 119.7351 | 114.8886 | 99.1402 | 91.8679 | 105.4198 | 106.6788 | 124.3239 | 135.7093 | 147.3715 (45)                     |
| Energy content (annual)                |          |          |          |          |          |         |         |          |          |          |          | Total = Sum(45)m = 1467.7382 (45) |
| Distribution loss (46)m = 0.15 x (45)m | 22.8260  | 19.9637  | 20.6008  | 17.9603  | 17.2333  | 14.8710 | 13.7802 | 15.8130  | 16.0018  | 18.6486  | 20.3564  | 22.1057 (46)                      |
| Water storage loss:                    |          |          |          |          |          |         |         |          |          |          |          |                                   |

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.10r08



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



Property and Energy  
Services Ltd.

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

#### 8. Space heating requirement

|                      | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec       |                           |
|----------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|-----------|---------------------------|
| Utilisation          | 0.9787    | 0.9598    | 0.9180    | 0.8197    | 0.6516   | 0.4470   | 0.2948   | 0.3363   | 0.5837   | 0.8568   | 0.9591    | 0.9828    | (94)                      |
| Useful gains         | 740.7371  | 838.8740  | 900.4895  | 892.0095  | 757.4111 | 513.2954 | 323.2881 | 341.7995 | 547.1823 | 713.1131 | 715.9290  | 705.0552  | (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     |           |           |           |           |          |          |          |          |          |          |           |           |                           |
| Month fracti         | 1472.8887 | 1428.5637 | 1291.6973 | 1068.6161 | 805.8322 | 519.4977 | 323.9161 | 342.9814 | 568.3827 | 896.6484 | 1207.0802 | 1465.9177 | (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        | 544.7207  | 396.2715  | 291.0586  | 127.1567  | 36.0253  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 136.5502 | 353.6289  | 566.0817  | (98)                      |
| Space heating per m2 |           |           |           |           |          |          |          |          |          |          |           |           | (98) / (4) = 30.1388 (99) |

#### 8c. Space cooling requirement

Not applicable

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

|                                                                       |          |          |          |          |         |         |         |         |            |          |          |            |                 |
|-----------------------------------------------------------------------|----------|----------|----------|----------|---------|---------|---------|---------|------------|----------|----------|------------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |         |         |         |         |            |          |          |            | 0.0000 (201)    |
| Fraction of space heat from main system(s)                            |          |          |          |          |         |         |         |         |            |          |          |            | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |         |         |         |         |            |          |          |            | 89.8000 (206)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |         |         |         |         |            |          |          |            | 0.0000 (208)    |
| Space heating requirement                                             |          |          |          |          |         |         |         |         |            |          |          |            | 2729.9483 (211) |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May     | Jun     | Jul     | Aug     | Sep        | Oct      | Nov      | Dec        |                 |
| Space heating requirement                                             | 544.7207 | 396.2715 | 291.0586 | 127.1567 | 36.0253 | 0.0000  | 0.0000  | 0.0000  | 0.0000     | 136.5502 | 353.6289 | 566.0817   | (98)            |
| Space heating efficiency (main heating system 1)                      | 89.8000  | 89.8000  | 89.8000  | 89.8000  | 89.8000 | 0.0000  | 0.0000  | 0.0000  | 0.0000     | 89.8000  | 89.8000  | 89.8000    | (210)           |
| Space heating fuel (main heating system)                              | 606.5933 | 441.2822 | 324.1187 | 141.5999 | 40.1173 | 0.0000  | 0.0000  | 0.0000  | 0.0000     | 152.0604 | 393.7961 | 630.3805   | (211)           |
| Water heating requirement                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000     | 0.0000   | 0.0000   | 0.0000     | (215)           |
| Water heating                                                         |          |          |          |          |         |         |         |         |            |          |          |            |                 |
| Water heating requirement                                             | 165.8497 | 125.8047 | 102.3595 | 53.3232  | 20.6994 | 5.9029  | 1.0478  | 30.3227 | 59.1925    | 107.5299 | 143.3413 | 165.2346   | (64)            |
| Efficiency of water heater                                            | 87.0515  | 86.9652  | 86.7469  | 86.3489  | 85.5758 | 79.1000 | 79.1000 | 79.1000 | 79.1000    | 84.7494  | 86.4279  | 79.1000    | (216)           |
| Fuel for water heating, kWh/month                                     | 190.5191 | 144.6609 | 117.9978 | 61.7532  | 24.1884 | 7.4625  | 1.3247  | 38.3346 | 74.8325    | 126.8798 | 165.8507 | 189.6267   | (219)           |
| Annual totals kWh/year                                                |          |          |          |          |         |         |         |         |            |          |          |            |                 |
| Space heating fuel - main system                                      |          |          |          |          |         |         |         |         |            |          |          |            | 2729.9483 (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)  |
| pump for solar water heating                                          |          |          |          |          |         |         |         |         |            |          |          |            | 50.0000 (230g)  |
| Total electricity for the above, kWh/year                             |          |          |          |          |         |         |         |         |            |          |          |            | 125.0000 (231)  |
| Electricity for lighting (calculated in Appendix L)                   |          |          |          |          |         |         |         |         |            |          |          |            | 349.8671 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)         |          |          |          |          |         |         |         |         |            |          |          |            |                 |
| PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =                               |          |          |          |          |         |         |         |         | -1727.2394 |          |          | -1727.2394 | (233)           |
| Total delivered energy for all uses                                   |          |          |          |          |         |         |         |         |            |          |          |            | 2621.0068 (238) |

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

|                                       | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |       |
|---------------------------------------|---------------|------------------|------------------|-------|
| Space heating - main system 1         | 2729.9483     | 3.4800           | 95.0022          | (240) |
| Space heating - secondary             | 0.0000        | 0.0000           | 0.0000           | (242) |
| Water heating (other fuel)            | 1143.4309     | 3.4800           | 39.7914          | (247) |
| Pumps and fans for heating            | 75.0000       | 13.1900          | 9.8925           | (249) |
| Pump for solar water heating          | 50.0000       | 13.1900          | 6.5950           | (249) |
| Energy for lighting                   | 349.8671      | 13.1900          | 46.1475          | (250) |
| Additional standing charges           |               |                  | 120.0000         | (251) |
| Energy saving/generation technologies |               |                  |                  |       |
| PV Unit                               | -1727.2394    | 13.1900          | -227.8229        | (252) |
| Total energy cost                     |               |                  | 89.6057          | (255) |

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

|                                  |                                  |         |       |
|----------------------------------|----------------------------------|---------|-------|
| Energy cost deflator (Table 12): |                                  | 0.4200  | (256) |
| Energy cost factor (ECF)         | [(255) x (256)] / [(4) + 45.0] = | 0.2979  | (257) |
| SAP value                        |                                  | 95.8445 |       |
| SAP rating (Section 12)          |                                  | 96      | (258) |
| SAP band                         |                                  | A       |       |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



Property and Energy  
Services Ltd.

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

|                                       | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|---------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1         | 2729.9483          | 0.2160                        | 589.6688                 | (261) |
| Space heating - secondary             | 0.0000             | 0.0000                        | 0.0000                   | (263) |
| Water heating (other fuel)            | 1143.4309          | 0.2160                        | 246.9811                 | (264) |
| Space and water heating               |                    |                               | 836.6499                 | (265) |
| Pumps and fans                        | 125.0000           | 0.5190                        | 64.8750                  | (267) |
| Energy for lighting                   | 349.8671           | 0.5190                        | 181.5810                 | (268) |
| Energy saving/generation technologies |                    |                               |                          |       |
| PV Unit                               | -1727.2394         | 0.5190                        | -896.4372                | (269) |
| Total kg/year                         |                    |                               | 186.6687                 | (272) |
| CO2 emissions per m2                  |                    |                               | 2.2900                   | (273) |
| EI value                              |                    |                               | 98.0201                  |       |
| EI rating                             |                    |                               | 98                       | (274) |
| EI band                               |                    |                               | A                        |       |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



Property and Energy  
Services Ltd.

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

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

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 45.2500 (1b)              | x 2.4200 (2b)                   | = 109.5050 (1b) - (3b)      |
| First floor                                            | 36.0900 (1c)              | x 2.5500 (2c)                   | = 92.0295 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 81.3400                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 201.5345 (5)              |

#### 2. Ventilation rate

|                                                                           | main<br>heating | secondary<br>heating | other | total                       | m <sup>3</sup> per hour    |
|---------------------------------------------------------------------------|-----------------|----------------------|-------|-----------------------------|----------------------------|
| Number of chimneys                                                        | 0               | +                    | 0     | =                           | 0 * 40 = 0.0000 (6a)       |
| Number of open flues                                                      | 0               | +                    | 0     | =                           | 0 * 20 = 0.0000 (6b)       |
| Number of intermittent fans                                               |                 |                      |       |                             | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                   |                 |                      |       |                             | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                              |                 |                      |       |                             | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = |                 |                      |       |                             | 30.0000 / (5) = 0.1489 (8) |
| Pressure test                                                             |                 |                      |       |                             | Yes                        |
| Measured/design AP50                                                      |                 |                      |       |                             | 5.0300                     |
| Infiltration rate                                                         |                 |                      |       |                             | 0.4004 (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) =        | 0.3403 (21)                |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 4.3000 | 4.1000 | 4.1000 | 3.8000 | 3.9000 | 3.4000 | 3.4000 | 3.3000 | 3.4000 | 3.8000 | 3.7000 | 4.0000 (22)  |
| Wind factor     | 1.0750 | 1.0250 | 1.0250 | 0.9500 | 0.9750 | 0.8500 | 0.8500 | 0.8250 | 0.8500 | 0.9500 | 0.9250 | 1.0000 (22a) |
| Adj infilt rate | 0.3658 | 0.3488 | 0.3488 | 0.3233 | 0.3318 | 0.2893 | 0.2893 | 0.2808 | 0.2893 | 0.3233 | 0.3148 | 0.3403 (22b) |
| Effective ac    | 0.5669 | 0.5608 | 0.5608 | 0.5523 | 0.5550 | 0.5418 | 0.5418 | 0.5394 | 0.5418 | 0.5523 | 0.5495 | 0.5579 (25)  |

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

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Door -1                                                        |                         |                            | 2.3000                    | 1.0000                        | 2.3000       |                                | (26)          |
| W-1.4 (Uw = 1.40)                                              |                         |                            | 18.9700                   | 1.3258                        | 25.1496      |                                | (27)          |
| Velux (Uw = 1.40)                                              |                         |                            | 1.6200                    | 1.3258                        | 2.1477       |                                | (27a)         |
| Ground floor                                                   |                         |                            | 45.2500                   | 0.0900                        | 4.0725       |                                | (28a)         |
| Cavity wall                                                    | 89.5500                 | 21.2700                    | 68.2800                   | 0.2200                        | 15.0216      |                                | (29a)         |
| Ceiling                                                        | 15.9600                 |                            | 15.9600                   | 0.1100                        | 1.7556       |                                | (30)          |
| Skelling                                                       | 30.9300                 | 1.6200                     | 29.3100                   | 0.1600                        | 4.6896       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 181.6900                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 55.1366      |                                | (33)          |
| Party Wall                                                     |                         |                            | 47.5400                   | 0.0000                        | 0.0000       |                                | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                | 250.0000 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)     |                         |                            |                           |                               |              |                                | 6.3148 (36)   |
| Total fabric heat loss                                         |                         |                            |                           |                               |              | (33) + (36) =                  | 61.4514 (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                     | 37.7034 | 37.2991 | 37.2991 | 36.7287 | 36.9140 | 36.0355 | 36.0355 | 35.8742 | 36.0355 | 36.7287 | 36.5482 | 37.1041 (38) |
| Heat transfer coeff       | 99.1548 | 98.7505 | 98.7505 | 98.1801 | 98.3654 | 97.4869 | 97.4869 | 97.3256 | 97.4869 | 98.1801 | 97.9996 | 98.5555 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 98.1436 (39) |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.2190 | 1.2140 | 1.2140 | 1.2070 | 1.2093 | 1.1985 | 1.1985 | 1.1965 | 1.1985 | 1.2070 | 1.2048 | 1.2116 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.2066 (40) |
| Days in month | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31 (41)     |

#### 4. Water heating energy requirements (kWh/year)

|                                          |          |          |          |          |          |         |         |          |          |                    |          |                |
|------------------------------------------|----------|----------|----------|----------|----------|---------|---------|----------|----------|--------------------|----------|----------------|
| Assumed occupancy                        |          |          |          |          |          |         |         |          |          |                    |          | 2.4878 (42)    |
| Average daily hot water use (litres/day) |          |          |          |          |          |         |         |          |          |                    |          | 93.2851 (43)   |
| Daily hot water use                      | Jan      | Feb      | Mar      | Apr      | May      | Jun     | Jul     | Aug      | Sep      | Oct                | Nov      | Dec            |
| Energy conte                             | 102.6136 | 98.8822  | 95.1508  | 91.4194  | 87.6880  | 83.9566 | 83.9566 | 87.6880  | 91.4194  | 95.1508            | 98.8822  | 102.6136 (44)  |
| Energy content (annual)                  | 152.1731 | 133.0915 | 137.3385 | 119.7351 | 114.8886 | 99.1402 | 91.8679 | 105.4198 | 106.6788 | 124.3239           | 135.7093 | 147.3715 (45)  |
| Distribution loss (46)m = 0.15 x (45)m   |          |          |          |          |          |         |         |          |          | Total = Sum(45)m = |          | 1467.7382 (45) |
| Water storage loss:                      | 22.8260  | 19.9637  | 20.6008  | 17.9603  | 17.2333  | 14.8710 | 13.7802 | 15.8130  | 16.0018  | 18.6486            | 20.3564  | 22.1057 (46)   |

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.10r08

Property and Energy  
Services Ltd.

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Built)



Property and Energy  
Services Ltd.

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

#### 8. Space heating requirement

|                      | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov          | Dec       |       |
|----------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|--------------|-----------|-------|
| Utilisation          | 0.9703    | 0.9491    | 0.8942    | 0.7631   | 0.5606   | 0.3288   | 0.1868   | 0.2085   | 0.4770   | 0.7986   | 0.9399       | 0.9755    | (94)  |
| Useful gains         | 762.0987  | 838.2718  | 888.6856  | 853.9677 | 664.0529 | 398.8929 | 215.0170 | 224.4838 | 469.8676 | 692.7477 | 730.8968     | 724.3590  | (95)  |
| Ext temp.            | 5.1000    | 5.7000    | 7.4000    | 9.9000   | 12.9000  | 15.8000  | 17.7000  | 17.6000  | 15.0000  | 11.5000  | 8.0000       | 5.1000    | (96)  |
| Heat loss rate W     | 1383.3051 | 1335.4210 | 1193.4490 | 967.0185 | 685.5366 | 400.1124 | 215.0672 | 224.5699 | 477.2258 | 809.2005 | 1115.1667    | 1371.8335 | (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    | 462.1776  | 334.0843  | 226.7440  | 81.3965  | 15.9838  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 86.6409  | 276.6744     | 481.7210  | (98)  |
| Space heating        |           |           |           |          |          |          |          |          |          |          |              | 1965.4224 | (98)  |
| Space heating per m2 |           |           |           |          |          |          |          |          |          |          | (98) / (4) = | 24.1630   | (99)  |

#### 8c. Space cooling requirement

Not applicable

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

|                                                                       |          |          |          |         |         |         |         |         |            |          |          |            |           |        |
|-----------------------------------------------------------------------|----------|----------|----------|---------|---------|---------|---------|---------|------------|----------|----------|------------|-----------|--------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |         |         |         |         |         |            |          |          |            | 0.0000    | (201)  |
| Fraction of space heat from main system(s)                            |          |          |          |         |         |         |         |         |            |          |          |            | 1.0000    | (202)  |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |         |         |         |         |         |            |          |          |            | 89.8000   | (206)  |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |         |         |         |         |         |            |          |          |            | 0.0000    | (208)  |
| Space heating requirement                                             |          |          |          |         |         |         |         |         |            |          |          |            | 2188.6664 | (211)  |
|                                                                       | Jan      | Feb      | Mar      | Apr     | May     | Jun     | Jul     | Aug     | Sep        | Oct      | Nov      | Dec        |           |        |
| Space heating requirement                                             | 462.1776 | 334.0843 | 226.7440 | 81.3965 | 15.9838 | 0.0000  | 0.0000  | 0.0000  | 0.0000     | 86.6409  | 276.6744 | 481.7210   | (98)      |        |
| Space heating efficiency (main heating system 1)                      | 89.8000  | 89.8000  | 89.8000  | 89.8000 | 89.8000 | 0.0000  | 0.0000  | 0.0000  | 0.0000     | 89.8000  | 89.8000  | 89.8000    | (210)     |        |
| Space heating fuel (main heating system)                              | 514.6743 | 372.0315 | 252.4988 | 90.6420 | 17.7994 | 0.0000  | 0.0000  | 0.0000  | 0.0000     | 96.4821  | 308.1006 | 536.4376   | (211)     |        |
| Water heating requirement                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000     | 0.0000   | 0.0000   | 0.0000     | (215)     |        |
| Water heating                                                         |          |          |          |         |         |         |         |         |            |          |          |            |           |        |
| Water heating requirement                                             | 162.4546 | 126.2156 | 103.4949 | 53.2537 | 23.6056 | 2.0111  | 0.0000  | 25.4696 | 55.1892    | 104.0545 | 139.8178 | 162.2598   | (64)      |        |
| Efficiency of water heater                                            | 86.7481  | 86.5883  | 86.1479  | 85.2397 | 83.0976 | 79.1000 | 79.1000 | 79.1000 | 79.1000    | 83.6273  | 85.8992  | 86.8402    | (216)     |        |
| Fuel for water heating, kWh/month                                     | 187.2718 | 145.7652 | 120.1362 | 62.4752 | 28.4071 | 2.5424  | 0.0000  | 32.1992 | 69.7714    | 124.4265 | 162.7696 | 186.8488   | (219)     |        |
| Water heating fuel used                                               |          |          |          |         |         |         |         |         |            |          |          | 1122.6134  | (219)     |        |
| Annual totals kWh/year                                                |          |          |          |         |         |         |         |         |            |          |          |            |           |        |
| Space heating fuel - main system                                      |          |          |          |         |         |         |         |         |            |          |          | 2188.6664  | (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) |
| pump for solar water heating                                          |          |          |          |         |         |         |         |         |            |          |          |            | 50.0000   | (230g) |
| Total electricity for the above, kWh/year                             |          |          |          |         |         |         |         |         |            |          |          |            | 125.0000  | (231)  |
| Electricity for lighting (calculated in Appendix L)                   |          |          |          |         |         |         |         |         |            |          |          |            | 349.8671  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)         |          |          |          |         |         |         |         |         |            |          |          |            |           |        |
| PV Unit 0 (0.80 * 2.50 * 1170 * 0.80) =                               |          |          |          |         |         |         |         |         | -1871.3360 |          |          | -1871.3360 | (233)     |        |
| Total delivered energy for all uses                                   |          |          |          |         |         |         |         |         |            |          |          | 1914.8110  | (238)     |        |

#### 10a. Fuel costs - using BEDF prices (442)

|                                       | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |       |
|---------------------------------------|------------------|---------------------|---------------------|-------|
| Space heating - main system 1         | 2188.6664        | 3.9200              | 85.7957             | (240) |
| Space heating - secondary             | 0.0000           | 0.0000              | 0.0000              | (242) |
| Water heating (other fuel)            | 1122.6134        | 3.9200              | 44.0064             | (247) |
| Pumps and fans for heating            | 75.0000          | 16.9600             | 12.7200             | (249) |
| Pump for solar water heating          | 50.0000          | 16.9600             | 8.4800              | (249) |
| Energy for lighting                   | 349.8671         | 16.9600             | 59.3375             | (250) |
| Additional standing charges           |                  |                     | 88.0000             | (251) |
| Energy saving/generation technologies |                  |                     |                     |       |
| PV Unit                               | -1871.3360       | 16.9600             | -317.3786           | (252) |
| Total energy cost                     |                  |                     | -19.0390            | (255) |

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

|                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1 | 2188.6664          | 0.2160                        | 472.7519                 | (261) |
| Space heating - secondary     | 0.0000             | 0.0000                        | 0.0000                   | (263) |
| Water heating (other fuel)    | 1122.6134          | 0.2160                        | 242.4845                 | (264) |
| Space and water heating       |                    |                               | 715.2364                 | (265) |
| Pumps and fans                | 125.0000           | 0.5190                        | 64.8750                  | (267) |
| Energy for lighting           | 349.8671           | 0.5190                        | 181.5810                 | (268) |

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|                                       |            |        |                 |
|---------------------------------------|------------|--------|-----------------|
| Energy saving/generation technologies |            |        |                 |
| PV Unit                               | -1871.3360 | 0.5190 | -971.2234 (269) |
| Total kg/year                         |            |        | -9.5309 (272)   |

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

|                                       | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1         | 2188.6664          | 1.2200                              | 2670.1730 (261)            |
| Space heating - secondary             | 0.0000             | 0.0000                              | 0.0000 (263)               |
| Water heating (other fuel)            | 1122.6134          | 1.2200                              | 1369.5884 (264)            |
| Space and water heating               |                    |                                     | 4039.7614 (265)            |
| Pumps and fans                        | 125.0000           | 3.0700                              | 383.7500 (267)             |
| Energy for lighting                   | 349.8671           | 3.0700                              | 1074.0920 (268)            |
| Energy saving/generation technologies |                    |                                     |                            |
| PV Unit                               | -1871.3360         | 3.0700                              | -5745.0015 (269)           |
| Primary energy kWh/year               |                    |                                     | -247.3981 (272)            |
| Primary energy kWh/m2/year            |                    |                                     | -3.0415 (273)              |