| | | | User E | Notoile: | | | | | | |
|----------------------------------|-------------------------------------------------------|---------------------|------------|------------------|-------------|------------|----------|-----------|------------------------|----------|
| Assessor Name: Software Name: | Neil Ingham Stroma FSAP 20 | | | Strom Softwa | are Vei | | | | 0002943 on: 1.0.1.9 | |
| Address : | Flat 1, 16, Roches | | | Address | | | | | | |
| 1. Overall dwelling dim | | iter iviews, | , LOND | 314, 1477 | 30D | | | | | |
| | | | Are | a(m²) | | Av. He | ight(m) | | Volume(m | 3) |
| Ground floor | | | | | (1a) x | | 2.8 | (2a) = | 169.23 | (3a) |
| Total floor area TFA = (| (1a)+(1b)+(1c)+(1d)+(1 | le)+(1r | n) (| 60.44 | (4) | | | _ | | |
| Dwelling volume | | | | | (3a)+(3b) |)+(3c)+(3c | d)+(3e)+ | (3n) = | 169.23 | (5) |
| 2. Ventilation rate: | | | | | | | | | | |
| | main heating | secondar heating | 'y | other | _ | total | | | m³ per hou | ır |
| Number of chimneys | 0 + | 0 | + | 0 | = | 0 | X | 40 = | 0 | (6a) |
| Number of open flues | 0 + | 0 | + | 0 |] = [| 0 | X : | 20 = | 0 | (6b) |
| Number of intermittent | fans | | | | | 2 | X | 10 = | 20 | (7a) |
| Number of passive ven | ts | | | | Γ | 0 | x | 10 = | 0 | (7b) |
| Number of flueless gas | fires | | | | Ī | 0 | x - | 40 = | 0 | (7c) |
| | | | | | | | | A : I | | - |
| | | (a.) (a.) (a.) | - > / > . | <u>-</u> \ | _ | | | | nanges per he | _ |
| Infiltration due to chimn | eys, flues and fans = been carried out or is inten | | | | ontinuo fr | 20 | | ÷ (5) = | 0.12 | (8) |
| Number of storeys in | | dea, procee | u 10 (17), | ou iei wise i | onunue m | om (9) to | (10) | | 0 | (9) |
| Additional infiltration | and an oming (no) | | | | | | [(9) | -1]x0.1 = | 0 | (10) |
| Structural infiltration: | 0.25 for steel or timbe | r frame or | 0.35 fo | r masoni | y constr | uction | - , | | 0 | (11) |
| | present, use the value corre | esponding to | the grea | ter wall are | a (after | | | | | |
| • | nings); if equal user 0.35 | alad) ar O | 1 (000) | ممار مامم | antar A | | | | _ | 7(40) |
| • | n floor, enter 0.2 (unse enter 0.05, else enter 0 | , | . i (Seai | ea), eise | enter 0 | | | | 0 | (12) |
| • , | ws and doors draught | | | | | | | | 0 | (13) |
| Window infiltration | ws and doors draught | sirippeu | | 0.25 - [0.2 | x (14) ÷ 1 | 001 = | | | 0 | (14) |
| Infiltration rate | | | | (8) + (10) | | | + (15) = | | 0 | (16) |
| | e, q50, expressed in cu | ubic metre | es per ho | . , , , , | , , , | , , , | , , | area | 5 | (17) |
| If based on air permeat | • | | • | • | • | | | - C C. | 0.37 | (18) |
| · | lies if a pressurisation test h | | | | | is being u | sed | | | ` ′ |
| Number of sides shelte | red | | | | | | | | 3 | (19) |
| Shelter factor | | | | (20) = 1 - | [0.075 x (1 | 9)] = | | | 0.78 | (20) |
| Infiltration rate incorpor | ating shelter factor | | | (21) = (18 |) x (20) = | | | | 0.29 | (21) |
| Infiltration rate modified | for monthly wind spec | ed | | _ | | | | | - | |
| Jan Feb | Mar Apr May | / Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| Monthly average wind s | speed from Table 7 | | | | | | | | _ | |
| (22)m= 5.1 5 | 4.9 4.4 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 | | |
| Wind Factor (22a)m = (| 22)m ∸ 4 | | | | | | | | | |
| (22a)m = 1.27 1.25 | 1.23 1.1 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |] | |
| · ' | | | | 1 | | <u> </u> | | | 1 | |

| Adjusted infiltr | ation rate (allo | wing for sl | nelter ar | nd wind s | speed) = | : (21a) x | (22a)m | | | | | |
|------------------|----------------------------------------|---------------|-------------|----------------|------------|---------------|-----------------------------|----------------------------------|----------------------------|------------------|-----------------|---------------|
| 0.36 | 0.36 0.35 | 1 - | 0.31 | 0.27 | 0.27 | 0.26 | 0.29 | 0.31 | 0.32 | 0.34 | | |
| | ctive air chang | e rate for i | he appli | cable ca | ise | - | - | - | - | - | | |
| | al ventilation: eat pump using A | anondiy N. (C | 93h) - (23 | a) × Emy (| oguation (| NEV othe | rwico (22h | v) = (23a) | | | 0 | (23 |
| | n heat recovery: e | | | | | | |)) = (23a) | | | 0 | (23 |
| | - | - | _ | | | | | Ol- \ / | (00-) [| 4 (00- | 0 | (23 |
| (24a)m= 0 | ed mechanical | ventilation 0 | with ne | at recov | ery (MV) | HR) (24) | $\frac{a)m = (2a)}{a}$ | 26)m + (1 0 | $\frac{(230) \times [}{0}$ | 1 - (230 |) ÷ 100]] | (24 |
| | | | <u> </u> | | | | | | | | _ | (24 |
| 24b)m= 0 | ed mechanical | 0 | 0 | 0 | | 0 0 | $\frac{1}{1} = \frac{2}{2}$ | 0 | 0 | 0 | 1 | (24 |
| | | | | | | | | | | | _ | (= . |
| , | ouse extract v n < 0.5 × (23b) | | • | • | | | | .5 × (23k | o) | | | |
| 24c)m= 0 | 0 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (24 |
| , | ventilation or v | | | | | | | 0.5] | | | _ | |
| 24d)m= 0.57 | 0.56 0.56 | | 0.55 | 0.54 | 0.54 | 0.53 | 0.54 | 0.55 | 0.55 | 0.56 | | (24 |
| Effective air | change rate - | enter (24a | ı) or (24l | b) or (24 | c) or (24 | ld) in bo | x (25) | | | • | _ | |
| 25)m= 0.57 | 0.56 0.56 | 0.55 | 0.55 | 0.54 | 0.54 | 0.53 | 0.54 | 0.55 | 0.55 | 0.56 | | (25 |
| 3. Heat losse | s and heat los | s paramet | er: | • | • | , | , | • | , | | | |
| ELEMENT | Gross area (m²) | Openir | | Net Ar A ,r | | U-val W/m2 | | A X U (W/ | | k-valu kJ/m²· | | A X k kJ/K |
| Vindows Type | e 1 | | | 10.34 | 4 x1 | /[1/(1.4)+ | - 0.04] = | 13.71 | | | | (27 |
| Windows Type | 2 | | | 2.76 | x1 | /[1/(1.4)+ | - 0.04] = | 3.66 | | | | (27 |
| Vindows Type | 3 | | | 2.01 | x1 | /[1/(1.4)+ | - 0.04] = | 2.66 | | | | (27 |
| Floor | | | | 60.44 | 4 x | 0.13 | | 7.8572 | <u> </u> | | \neg \vdash | (28 |
| Walls Type1 | 64.4 | 15.1 | 1 | 49.29 |) x | 0.18 | = | 8.87 | = i | | 7 7 | (29 |
| Nalls Type2 | 21.84 | 0 | | 21.84 | 4 × | 0.15 | _ | 3.38 | | | = | (29 |
| Roof | 11.05 | 0 | = | 11.05 | _ | 0.13 | = | 1.44 | = | | = = | (30 |
| Total area of e | | | | 157.7 | = | | | | | | | ` (31 |
| Party wall | , | | | 13.44 | = | 0 | | 0 | | | \neg \vdash | (32 |
| Party ceiling | | | | 49.39 | = | | | | | | 룩 누 | (32 |
| nternal wall ** | | | | 66.64 | = | | | |] [| | 러 누 | (32 |
| | roof windows, us | e effective w | indow U-v | | | n formula i | 1/[(1/U-valı | ле)+0.041 г |] as aiven in | naragrap | | (32 |
| | as on both sides o | | | | atou domi | y rommana : | n _I (n o vale | <i>10)</i> 10.0 1 ₁ 0 | ao givoiriii | paragrap | | |
| abric heat los | ss, $W/K = S$ (A | x U) | | | | (26)(30 |) + (32) = | | | | 41.5 | 3 (33 |
| leat capacity | $Cm = S(A \times k)$ |) | | | | | ((28). | (30) + (3 | 2) + (32a) | (32e) = | 11586. | 51 (34 |
| hermal mass | parameter (T | MP = Cm - | - TFA) iı | n kJ/m²K | | | Indica | ative Value | : Medium | | 250 | (35 |
| - | sments where the ad of a detailed c | | construc | tion are no | t known pi | recisely th | e indicative | e values of | f TMP in T | able 1f | | |
| Thermal bridge | es : S (L x Y) o | alculated | using Ap | pendix l | K | | | | | | 6.69 | (36 |
| | al bridging are not | known (36) : | = 0.15 x (3 | 31) | | | | | | | | |
| Γotal fabric he | at loss | | | | | | (33) + | (36) = | | | 48.2 | 7 (37 |

| Ventilati | ion hea | nt loss ca | alculated | l monthly | y | | | | (38)m | = 0.33 × (| (25)m x (5) | | | |
|-------------|---------------|---------------------|-------------------------|-------------------|-----------------|----------------------------------------|-------------------|-------------------|------------|------------------------|---------------------------------|----------------|---------|-------------------------|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| (38)m= | 31.62 | 31.48 | 31.34 | 30.68 | 30.55 | 29.97 | 29.97 | 29.87 | 30.2 | 30.55 | 30.8 | 31.06 | | (38) |
| Heat tra | ınsfer c | oefficier | nt, W/K | | | | | | (39)m | = (37) + (| 38)m | | | |
| (39)m= | 79.89 | 79.75 | 79.61 | 78.95 | 78.82 | 78.24 | 78.24 | 78.14 | 78.47 | 78.82 | 79.08 | 79.33 | | |
| Heat los | ss para | meter (H | HLP), W/ | m²K | | | | • | | Average = = (39)m ÷ | Sum(39) ₁ - (4) | 12 /12= | 78.95 | (39) |
| (40)m= | 1.32 | 1.32 | 1.32 | 1.31 | 1.3 | 1.29 | 1.29 | 1.29 | 1.3 | 1.3 | 1.31 | 1.31 | | |
| Number | of day | s in moi | nth (Tab | le 1a) | | | | | | Average = | Sum(40) ₁ | 12 /12= | 1.31 | (40) |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | | (41) |
| | | | | | | | | | | | | | | |
| 4. Wat | er heat | ing ene | rgy requi | irement: | | | | | | | | kWh/ye | ear: | |
| Assume | אל טכנוו | pancy, I | N | | | | | | | | | 00 | | (42) |
| if TFA | A > 13.9 | | | [1 - exp | (-0.0003 | 349 x (TF | FA -13.9 |)2)] + 0.0 | 0013 x (| ΓFA -13. | | 99 | | (42) |
| | | | | | | | | (25 x N) | | | | .56 | | (43 |
| | | _ | hot water person per | | | _ | _ | to achieve | a water u | se target o | of | | | |
| Г | | | | <u> </u> | | i . | | . . | 0 | | | | | |
| Hot water | Jan Jan ir | Feb | Mar day for ea | Apr ach month | May $Vd m = fa$ | Jun | Jul Table 1c x | Aug (43) | Sep | Oct | Nov | Dec | | |
| г | | • | , | 1 | | 1 | ı | · <i>'</i> | 70.00 | 00.40 | 00.45 | 00.74 | | |
| (44)m= | 89.71 | 86.45 | 83.19 | 79.93 | 76.66 | 73.4 | 73.4 | 76.66 | 79.93 | 83.19 | 86.45 m(44) ₁₁₂ = | 89.71 | 978.69 | (44) |
| Energy co | ontent of | hot water | used - cal | culated mo | onthly = 4. | 190 x Vd,r | m x nm x E | OTm / 3600 | | | ables 1b, 1 | | 970.09 | (++, |
| (45)m= | 133.04 | 116.36 | 120.07 | 104.68 | 100.44 | 86.68 | 80.32 | 92.17 | 93.27 | 108.69 | 118.65 | 128.84 | | _ |
| lf instanta | neous w | ater heatii | ng at point | of use (no | hot water | storage), | enter 0 in | boxes (46 | | Total = Su | m(45) ₁₁₂ = | = | 1283.22 | (45 |
| | 19.96 | 17.45 | 18.01 | 15.7 | 15.07 | 13 | 12.05 | 13.82 | 13.99 | 16.3 | 17.8 | 19.33 | | (46 |
| Water s | _ | | | | | /\/\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ | | 201.2 | | 1 | | | | |
| - | | ` , | | • | | | _ | within sa | ame ves | sel | | 0 | | (47 |
| | se if no | stored | nd no ta | | _ | | | (47) ombi boil | ers) ente | er '0' in (| (47) | | | |
| | • | | eclared l | oss facto | or is kno | wn (kWł | n/day): | | | | | 0 | | (48 |
| Temper | ature fa | actor fro | m Table | 2b | | | | | | | | 0 | | (49 |
| Energy | lost fro | m water | storage | , kWh/ye | ear | | | (48) x (49) |) = | | | 0 | | (50 |
| • | | | eclared o | - | | | | | | | | | | |
| | | | factor fr | | e 2 (kW | h/litre/da | ay) | | | | | 0 | | (51 |
| | • | eating s from Ta | ee section | on 4.3 | | | | | | | | | | (50 |
| | | | m Table | 2b | | | | | | | | 0 | | (52 ₎ (53 |
| • | | | storage | | ear | | | (47) x (51) | x (52) x (| 53) = | | | | |
| • | | 54) in (5 | - | , 1. v v i i/ y t | Jui | | | (TI) X (UI) | , | - | | 0 | | (54) (55) |
| • | , | , , | culated f | for each | month | | | ((56)m = (| 55) × (41) | m | | <u> </u> | | (55) |
| _ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (56 |
| (56)m= | U | U | | L " | U | | <u> </u> | | | L | | ı ^v | | (50 |

| If cylinder | contains | s dedicate | d solar sto | rage, (57)ı | m = (56)m | x [(50) – (| H11)] ÷ (5 | 0), else (5 | 7)m = (56) | m where (| H11) is fro | om Append | lix H | |
|-------------|-----------|------------|-------------|-------------|------------|-------------|-------------|--------------|-----------------|-------------|-------------------------|-------------|---------------|------|
| (57)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (57) |
| Primary | circuit | loss (an | nual) fro | m Table | ∋ 3 | • | • | • | | | | 0 | | (58) |
| Primary | circuit | loss cal | culated t | for each | month (| 59)m = (| (58) ÷ 36 | 65 × (41) | m | | | | • | |
| (modif | fied by | factor fi | rom Tab | le H5 if t | here is s | solar wat | ter heatii | ng and a | cylinde | r thermo | stat) | | | |
| (59)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (59) |
| Combi lo | oss ca | lculated | for each | month (| (61)m = | (60) ÷ 36 | 65 × (41) |)m | | | | | | |
| (61)m= | 45.72 | 39.79 | 42.39 | 39.42 | 39.07 | 36.2 | 37.4 | 39.07 | 39.42 | 42.39 | 42.63 | 45.72 | | (61) |
| Total he | at requ | uired for | water he | eating ca | alculated | for eac | h month | (62)m = | : 0.85 × (| (45)m + | (46)m + | (57)m + | (59)m + (61)m | |
| (62)m= | 178.76 | 156.15 | 162.46 | 144.1 | 139.51 | 122.87 | 117.72 | 131.23 | 132.68 | 151.09 | 161.28 | 174.56 | | (62) |
| Solar DHV | V input o | calculated | using App | endix G oı | r Appendix | H (negati | ve quantity | /) (enter '0 | if no sola | r contribut | ion to wate | er heating) | • | |
| (add add | ditiona | I lines if | FGHRS | and/or \ | WWHRS | applies | , see Ap | pendix (| G) | | | | | |
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (63) |
| Output fi | rom w | ater hea | ter | | | | | | | | | | | |
| (64)m= | 178.76 | 156.15 | 162.46 | 144.1 | 139.51 | 122.87 | 117.72 | 131.23 | 132.68 | 151.09 | 161.28 | 174.56 | | _ |
| | | | | | | | | Outp | out from wa | ater heate | r (annual) ₁ | 12 | 1772.43 | (64) |
| Heat gai | ins fro | m water | heating, | kWh/m | onth 0.2 | 5 ´ [0.85 | × (45)m | + (61)m | n] + 0.8 x | k [(46)m | + (57)m | + (59)m | 1 | |
| (65)m= | 55.67 | 48.64 | 50.52 | 44.66 | 43.16 | 37.87 | 36.06 | 40.41 | 40.87 | 46.74 | 50.11 | 54.27 | | (65) |
| includ | e (57) | m in cald | culation o | of (65)m | only if o | ylinder i | s in the o | dwelling | or hot w | ater is fr | om com | munity h | eating | |
| 5. Inter | rnal ga | ains (see | Table 5 | and 5a |): | | | | | | | | | |
| Metaboli | ic gain | ıs (Table | 5), Wat | ts | | | | | | | | | _ | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| (66)m= | 99.7 | 99.7 | 99.7 | 99.7 | 99.7 | 99.7 | 99.7 | 99.7 | 99.7 | 99.7 | 99.7 | 99.7 | | (66) |
| Lighting | gains | (calcula | ted in Ap | pendix | L, equat | ion L9 o | r L9a), a | lso see | Table 5 | | | | _ | |
| (67)m= | 15.52 | 13.78 | 11.21 | 8.49 | 6.34 | 5.36 | 5.79 | 7.52 | 10.09 | 12.82 | 14.96 | 15.95 | | (67) |
| Applianc | es ga | ins (calc | ulated in | Append | dix L, eq | uation L | 13 or L1 | 3a), alsc | see Ta | ble 5 | | | | |
| (68)m= | 174.05 | 175.86 | 171.31 | 161.62 | 149.39 | 137.89 | 130.21 | 128.41 | 132.96 | 142.65 | 154.88 | 166.37 | | (68) |
| Cooking | gains | (calcula | ited in A | ppendix | L, equat | tion L15 | or L15a) |), also se | ee Table | 5 | | | - | |
| (69)m= | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | | (69) |
| Pumps a | and fai | ns gains | (Table 5 | 5a) | | | | | | | | | | |
| (70)m= | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | (70) |
| Losses | e.g. ev | aporatio | n (nega | tive valu | es) (Tab | le 5) | • | • | | | • | | • | |
| (71)m= | -79.76 | -79.76 | -79.76 | -79.76 | -79.76 | -79.76 | -79.76 | -79.76 | -79.76 | -79.76 | -79.76 | -79.76 | | (71) |
| Water he | eating | gains (T | able 5) | | • | | | • | • | • | | • | • | |
| (72)m= | 74.82 | 72.38 | 67.91 | 62.03 | 58.02 | 52.6 | 48.46 | 54.32 | 56.76 | 62.82 | 69.6 | 72.94 | | (72) |
| Total in | ternal | gains = | | | | (66) | m + (67)m | n + (68)m + | + (69)m + (| (70)m + (7 | 1)m + (72) |)m | • | |
| (73)m= | 320.3 | 317.93 | 306.33 | 288.04 | 269.66 | 251.75 | 240.37 | 246.16 | 255.72 | 274.2 | 295.34 | 311.18 | | (73) |
| 6. Sola | r gains | 5: | | | | | | | | | | | | |
| Color coi | | a laulatad | : | | T-1-1-0- | | iotod ogua | · | way come to the | o applicat | la arianta | ion | | |
| Solar gai | ns are c | calculated | using sola | r flux from | rable 6a | and assoc | iateu equa | itions to co | mvert to th | ie applicat | ne onema | lion. | | |

| Southwest _{0.9x} | 0.77 | X | 2.01 | X | 36.79 | | 0.63 | X | 0.7 | = | 22.6 | (79) |
|---------------------------|---------------|----------------------|-------------------------------------------|--------------|----------------|-------|---------------|--------|-----------------|----------|--------|---------|
| Southwest _{0.9x} | 0.77 | x | 2.01 | x | 62.67 |] | 0.63 | X | 0.7 | = | 38.5 | (79) |
| Southwest _{0.9x} | 0.77 | X | 2.01 | x | 85.75 |] | 0.63 | X | 0.7 | = | 52.68 | (79) |
| Southwest _{0.9x} | 0.77 | X | 2.01 | x | 106.25 | | 0.63 | X | 0.7 | = | 65.27 | (79) |
| Southwest _{0.9x} | 0.77 | X | 2.01 | х | 119.01 | | 0.63 | X | 0.7 | = | 73.11 | (79) |
| Southwest _{0.9x} | 0.77 | x | 2.01 | x | 118.15 | | 0.63 | x | 0.7 | = | 72.58 | (79) |
| Southwest _{0.9x} | 0.77 | x | 2.01 | x | 113.91 | Ī | 0.63 | x | 0.7 | = | 69.97 | (79) |
| Southwest _{0.9x} | 0.77 | x | 2.01 | x | 104.39 | Ī | 0.63 | x | 0.7 | = | 64.13 | (79) |
| Southwest _{0.9x} | 0.77 | x | 2.01 | x | 92.85 | Ī | 0.63 | x | 0.7 | = | 57.04 | (79) |
| Southwest _{0.9x} | 0.77 | х | 2.01 | x | 69.27 | ĺ | 0.63 | x | 0.7 | = | 42.55 | (79) |
| Southwest _{0.9x} | 0.77 | х | 2.01 | х | 44.07 | ĺ | 0.63 | x | 0.7 | = | 27.07 | (79) |
| Southwest _{0.9x} | 0.77 | х | 2.01 | х | 31.49 | j | 0.63 | x | 0.7 | = | 19.34 | (79) |
| Northwest _{0.9x} | 0.77 | х | 10.34 | х | 11.28 | x | 0.63 | x | 0.7 | = | 35.65 | (81) |
| Northwest _{0.9x} | 0.77 | x | 2.76 | х | 11.28 | x | 0.63 | x | 0.7 | = | 9.52 | (81) |
| Northwest _{0.9x} | 0.77 | х | 10.34 | x | 22.97 | x | 0.63 | x | 0.7 | = | 72.58 | (81) |
| Northwest _{0.9x} | 0.77 | x | 2.76 | x | 22.97 | x | 0.63 | x | 0.7 | = | 19.37 | (81) |
| Northwest _{0.9x} | 0.77 | х | 10.34 | x | 41.38 | x | 0.63 | x | 0.7 | <u> </u> | 130.76 | (81) |
| Northwest _{0.9x} | 0.77 | х | 2.76 | x | 41.38 | x | 0.63 | x | 0.7 | = | 34.9 | (81) |
| Northwest _{0.9x} | 0.77 | x | 10.34 | x | 67.96 | x | 0.63 | x | 0.7 | = | 214.74 | (81) |
| Northwest _{0.9x} | 0.77 | x | 2.76 | x | 67.96 | x | 0.63 | x | 0.7 | _ = | 57.32 | (81) |
| Northwest _{0.9x} | 0.77 | X | 10.34 | x | 91.35 | X | 0.63 | x | 0.7 | = | 288.66 | (81) |
| Northwest _{0.9x} | 0.77 | x | 2.76 | x | 91.35 | x | 0.63 | x | 0.7 | = | 77.05 | (81) |
| Northwest _{0.9x} | 0.77 | x | 10.34 | x | 97.38 | x | 0.63 | x | 0.7 | = | 307.74 | (81) |
| Northwest _{0.9x} | 0.77 | X | 2.76 | x | 97.38 | X | 0.63 | x | 0.7 | = | 82.14 | (81) |
| Northwest _{0.9x} | 0.77 | X | 10.34 | x | 91.1 | x | 0.63 | x | 0.7 | = | 287.88 | (81) |
| Northwest _{0.9x} | 0.77 | X | 2.76 | x | 91.1 | X | 0.63 | X | 0.7 | = | 76.84 | (81) |
| Northwest _{0.9x} | 0.77 | X | 10.34 | X | 72.63 | X | 0.63 | X | 0.7 | | 229.5 | (81) |
| Northwest _{0.9x} | 0.77 | X | 2.76 | X | 72.63 | X | 0.63 | x | 0.7 | = | 61.26 | (81) |
| Northwest _{0.9x} | 0.77 | X | 10.34 | X | 50.42 | X | 0.63 | X | 0.7 | = | 159.33 | (81) |
| Northwest 0.9x | 0.77 | X | 2.76 | x | 50.42 | X | 0.63 | X | 0.7 | = | 42.53 | (81) |
| Northwest _{0.9x} | 0.77 | X | 10.34 | X | 28.07 | X | 0.63 | x | 0.7 | = | 88.69 | (81) |
| Northwest _{0.9x} | 0.77 | X | 2.76 | X | 28.07 | X | 0.63 | X | 0.7 | = | 23.67 | (81) |
| Northwest 0.9x | 0.77 | X | 10.34 | X | 14.2 | x | 0.63 | X | 0.7 | = | 44.86 | (81) |
| Northwest _{0.9x} | 0.77 | X | 2.76 | X | 14.2 | X | 0.63 | X | 0.7 | = | 11.97 | (81) |
| Northwest _{0.9x} | 0.77 | X | 10.34 | x | 9.21 | X | 0.63 | X | 0.7 | = | 29.12 | (81) |
| Northwest 0.9x | 0.77 | X | 2.76 | x | 9.21 | X | 0.63 | X | 0.7 | = | 7.77 | (81) |
| | | | | | | | | | | | | |
| Solar gains in w | | | | | | | n = Sum(74)m. | | . 1 1 | | | (00) |
| ` ′ | 130.45 218 | | 337.33 438.8° | | 62.46 434.7 | 354 | .89 258.9 | 154.92 | 2 83.91 | 56.23 | | (83) |
| Total gains – int | 448.38 524 | _ | $\frac{(64)111 = (73)11}{625.37 708.43}$ | ` | 14.21 675.07 | 601 | .04 514.62 | 429.1 | 379.25 | 367.41 | | (84) |
| ` ' | | | | | 14.21 6/5.0/ | 601 | .04 514.62 | 429.1 | 3/9.25 | 307.41 | | (04) |
| 7. Mean intern | • | • | | | , | | TI 4 (0.0) | | | | | |
| Temperature d | • | • | | _ | | ole 9 | , Ih1 (°C) | | | | 21 | (85) |
| Utilisation facto | | | <u> </u> | Ť | | | ua Car | 0-1 | NI ₅ | Da - | | |
| Stroma FSAP 2012 | VErsion! 1.d. | 1.9 ^r (9. | (P'9!92) http:/// | Ww.s | troffia.comJUI | l A | ug Sep | Oct | Nov | Dec | Page | 5 of 7 |

| (86)m= | 1 | 0.99 | 0.98 | 0.94 | 0.83 | 0.65 | 0.5 | 0.57 | 0.84 | 0.97 | 0.99 | 1 | | (86) |
|--------------|-----------|-----------|---------------------|-----------------|-----------|-------------|-----------|---------------|-------------------|-------------|----------------------|------------------------|----------|-------|
| Mean i | internal | temper | ature in | living are | ea T1 (fo | ollow ste | ps 3 to 7 | in Tabl | e 9c) | | | | • | |
| (87)m= | 19.57 | 19.74 | 20.04 | 20.45 | 20.78 | 20.95 | 20.99 | 20.98 | 20.84 | 20.39 | 19.91 | 19.54 | | (87) |
| Tempe | erature | durina h | eating n | eriods ir | rest of | dwelling | from Ta | hle 9 T | h2 (°C) | | | | | |
| (88)m= | 19.82 | 19.83 | 19.83 | 19.84 | 19.84 | 19.85 | 19.85 | 19.85 | 19.84 | 19.84 | 19.83 | 19.83 | | (88) |
| L | tion foo | tor for a | nina far ı | rest of d | walling | h2 m (oc | L Tabla | 00) | | | l | | | |
| (89)m= | 1 | 0.99 | 0.98 | 0.92 | 0.78 | 0.55 | 0.37 | 9a) 0.44 | 0.76 | 0.96 | 0.99 | 1 | | (89) |
| _ | | | | | | | <u> </u> | <u> </u> | | <u> </u> | 0.00 | · | | () |
| Г | | | 18.62 | the rest | of dwelli | <u> </u> | ollow ste | ps 3 to 19.84 | 7 in Tabl | | 10.44 | 17.0 | | (90) |
| (90)m= | 17.94 | 18.18 | 10.02 | 19.2 | 19.04 | 19.81 | 19.64 | 19.64 | | 19.14 | 18.44 g area ÷ (4 | 17.9 4) – | 0.45 | (91) |
| | | | | | | | | | ' | LA - LIVIII | g arca - (- | -, - | 0.45 | (91) |
| Г | 1 | | | r the wh | ole dwe | lling) = fl | LA × T1 | + (1 – fL | A) × T2 | 1 | | | İ | |
| (92)m= | 18.67 | 18.88 | 19.25 | 19.76 | 20.15 | 20.32 | 20.35 | 20.35 | 20.21 | 19.7 | 19.1 | 18.63 | | (92) |
| ΄΄ Έ | | | | | | | | | ere appro | · | 40.4 | 40.00 | Ī | (02) |
| (93)m= | 18.67 | 18.88 | 19.25 | 19.76 | 20.15 | 20.32 | 20.35 | 20.35 | 20.21 | 19.7 | 19.1 | 18.63 | | (93) |
| | | | uirement | | ro obtoin | and at at | on 11 of | Table 0 | o oo tha | + Ti m_/ | 76\m an | d ro oolo | vuloto | |
| | | | | using Ta | | ieu ai sii | ғр і і оі | i able 9i |), 50 illa | ıt 11,111=(| 76)m an | u re-carc | Julate | |
| Γ | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| Utilisat | tion fac | | ains, hm | <u> </u> | , | | ļ. | | <u>'</u> | <u>I</u> | ļ | ļ. | | |
| (94)m= | 1 | 0.99 | 0.97 | 0.92 | 0.79 | 0.6 | 0.43 | 0.5 | 0.79 | 0.96 | 0.99 | 1 | | (94) |
| Useful | gains, | hmGm , | W = (94 | 4)m x (84 | 4)m | | | | | | | | | |
| (95)m= | 386.13 | 443.94 | 511.45 | 576.53 | 562.24 | 426.31 | 290.01 | 301.24 | 406.81 | 411.43 | 375.69 | 365.94 | | (95) |
| Month | ly avera | age exte | rnal tem | perature | from Ta | able 8 | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | | (96) |
| Heat Ic | oss rate | for mea | an intern | al tempe | erature, | Lm , W = | =[(39)m | x [(93)m | – (96)m |] | | | • | |
| (97)m= | 1148.06 | 1114.62 | 1015.23 | 857.4 | 666.03 | 447.61 | 293.72 | 308.47 | 479.8 | 717.26 | 948.68 | 1145.1 | | (97) |
| · - | | | | | | | th = 0.02 | 24 x [(97 |)m – (95 | | | | I | |
| (98)m= | 566.88 | 450.7 | 374.82 | 202.23 | 77.22 | 0 | 0 | 0 | 0 | 227.53 | 412.55 | 579.7 | | _ |
| | | | | | | | | Tota | l per year | (kWh/year | r) = Sum(9 | 8) _{15,912} = | 2891.62 | (98) |
| Space | heating | g require | ement in | kWh/m² | ?/year | | | | | | | | 47.84 | (99) |
| 9a. Ene | ergy req | uiremer | nts – Indi | ividual h | eating sy | ystems i | ncluding | micro-C | CHP) | | | | | |
| Space | heatin | ıg: | | | | | | | | | | | | |
| Fractio | on of sp | ace hea | t from se | econdar | y/supple | mentary | system | | | | | | 0 | (201) |
| Fractio | on of sp | ace hea | t from m | nain syst | em(s) | | | (202) = 1 | - (201) = | | | | 1 | (202) |
| Fractio | on of tot | al heatii | ng from | main sys | stem 1 | | | (204) = (2 | 02) x [1 – | (203)] = | | | 1 | (204) |
| Efficier | ncy of r | nain spa | ce heat | ing syste | em 1 | | | | | | | | 93.4 | (206) |
| Efficier | ncv of s | econda | rv/supple | ementar | v heatin | a svsten | າ. % | | | | | | 0 | (208) |
| Г | | Feb | Mar | | May | Jun | Jul | Λιια | Son | Oct | Nov | Dec | kWh/ye | |
| Snace | Jan | | | Apr alculate | | | Jui | Aug | Sep | Oct | INOV | Dec | KVVII/ye | ai |
| · - | 566.88 | 450.7 | 374.82 | 202.23 | 77.22 | 0 | 0 | 0 | 0 | 227.53 | 412.55 | 579.7 | | |
| L | ! | | | l | | | | | | L | I | I | 1 | (211) |
| ` <i>′</i> _ | 606.94 | 482.55 | 4)] + (2 l 401.3 | 0)m } x | 82.68 | 06) | 0 | 0 | 0 | 243.61 | 441.7 | 620.66 | | (411) |
| L | 300.04 | 102.00 | .01.0 | L 70.02 | 02.00 | | | | _ | | 211),,,,5,10,,,,12 | | 3095.96 | (211) |
| | | | | | | | | | , ,,,,, | , | r 15,1012 | | 3033.30 | |

| Space heating fuel (secondary), kWh/month | | | | | | | | |
|-----------------------------------------------------------------|--------------------------|---------------|-----------------|-----------------------|-------------------------|--------|-------------------------|--------|
| = {[(98)m x (201)] + (214) m } x 100 ÷ (208) | | Τ ο | | | Ι , | | | |
| (215)m= 0 0 0 0 0 | 0 0 | 0 Tota | 0 I (kWh/yea | 0 ar) =Sum(3 | 0 | 0 | 0 | (215) |
| Water heating | | 7010 | ii (ittiii) yoo | ar) =0am(2 | - 10/15,101 | 2 | 0 | (213) |
| Output from water heater (calculated above) | | | | | | | | |
| | 22.87 117.72 | 131.23 | 132.68 | 151.09 | 161.28 | 174.56 | | |
| Efficiency of water heater | | - | | | | | 80.3 | (216) |
| (217)m= 87.75 87.57 87.09 85.9 83.63 | 80.3 | 80.3 | 80.3 | 86.08 | 87.31 | 87.84 | | (217) |
| Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m | | | | | | | | |
| | 53.02 146.6 | 163.43 | 165.23 | 175.52 | 184.72 | 198.72 | | |
| | • | Tota | I = Sum(2 | 19a) ₁₁₂ = | | | 2090.39 | (219) |
| Annual totals | | | | k' | Wh/yea | r | kWh/year | _ |
| Space heating fuel used, main system 1 | | | | | | | 3095.96 | ╛ |
| Water heating fuel used | | | | | | | 2090.39 | |
| Electricity for pumps, fans and electric keep-hot | | | | | | | | |
| central heating pump: | | | | | | 30 | | (230c) |
| boiler with a fan-assisted flue | | | | | | 45 | | (230e) |
| Total electricity for the above, kWh/year | | sum | of (230a). | (230g) = | | | 75 | (231) |
| Electricity for lighting | | | | | | | 274.03 | (232) |
| 12a. CO2 emissions – Individual heating system | s including m | nicro-CHF |) | | | | | |
| | Energy kWh/yea | r | | Emiss kg CO | ion fac 2/kWh | tor | Emissions kg CO2/yea | |
| Space heating (main system 1) | (211) x | | | 0.2 | 16 | = | 668.73 | (261) |
| Space heating (secondary) | (215) x | | | 0.5 | 19 | = | 0 | (263) |
| Water heating | (219) x | | | 0.2 | 16 | = | 451.52 | (264) |
| Space and water heating | (261) + (262 |) + (263) + (| (264) = | | | | 1120.25 | (265) |
| Electricity for pumps, fans and electric keep-hot | (231) x | | | 0.5 | 19 | = | 38.93 | (267) |
| Electricity for lighting | (232) x | | | 0.5 | 19 | = | 142.22 | (268) |
| | | | | | | | | |

TER =

(273)

21.53

| | | | User [| Details: | | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------------|--------------|--------------|--------------|------------|----------|------------|--------------|----------------|
| Assessor Name: | Neil Inghar | n | | Strom | a Num | ber: | | STRO | 002943 | |
| Software Name: | Stroma FS | | | Softwa | are Ve | rsion: | | Versio | n: 1.0.1.9 | |
| | | | Property | Address | : Flat 2 | | | | | |
| Address : | Flat 2, 16, R | ochester Mew | | | | | | | | |
| Overall dwelling dime | | | -, | - , | | | | | | |
| <u> </u> | | | Are | a(m²) | | Av. He | eight(m) | | Volume(m | 3) |
| Ground floor | | | | 36.98 | (1a) x | | 2.8 | (2a) = | 243.54 | , (3a) |
| Total floor area TFA = (1 | a)+(1b)+(1c)+(| 1d)+(1e)+(| 1n) | 36.98 | (4) | | | _ | | |
| Dwelling volume | | | <u> </u> | | (3a)+(3b |)+(3c)+(3c | d)+(3e)+ | (3n) = | 243.54 | (5) |
| 2. Ventilation rate: | | | | | | | | | | |
| 2. Voltalation rate. | main heating | second heating | | other | | total | | | m³ per hou | ır |
| Number of chimneys | 0 | + 0 | + [| 0 |] = [| 0 | x | 40 = | 0 | (6a) |
| Number of open flues | 0 | + 0 | = + | 0 | | 0 | x | 20 = | 0 | (6b) |
| Number of intermittent fa | ans | | | | | 3 | x | 10 = | 30 | (7a) |
| Number of passive vents | 5 | | | | F | 0 | × | 10 = | 0 | (7b) |
| Number of flueless gas f | ires | | | | F | 0 | x | 40 = | 0 | (7c) |
| | | | | | L | | | | | |
| | | | | | | | | Air ch | anges per ho | our |
| Infiltration due to chimne | ys, flues and fa | ans = $(6a)+(6b)$ | +(7a)+(7b)+ | (7c) = | | 30 | | ÷ (5) = | 0.12 | (8) |
| If a pressurisation test has b | been carried out or | is intended, proc | eed to (17), | otherwise (| continue fr | rom (9) to | (16) | | | |
| Number of storeys in t | he dwelling (ns | 5) | | | | | | | 0 | (9) |
| Additional infiltration | | | | | | | [(9) |)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0 | 0.25 for steel or | timber frame | or 0.35 fo | r masoni | ry consti | ruction | | | 0 | (11) |
| if both types of wall are p deducting areas of openi | | | to the grea | ter wall are | a (after | | | | | |
| If suspended wooden | floor, enter 0.2 | (unsealed) or | 0.1 (seale | ed), else | enter 0 | | | | 0 | (12) |
| If no draught lobby, en | nter 0.05, else e | enter 0 | | | | | | | 0 | (13) |
| Percentage of window | s and doors dr | aught stripped | | | | | | | 0 | (14) |
| Window infiltration | | | | 0.25 - [0.2 | 2 x (14) ÷ 1 | 00] = | | | 0 | (15) |
| Infiltration rate | | | | (8) + (10) | + (11) + (1 | 12) + (13) | + (15) = | | 0 | (16) |
| Air permeability value, | q50, expresse | d in cubic met | res per ho | our per s | quare m | etre of e | envelope | area | 5 | (17) |
| If based on air permeabi | lity value, then | $(18) = [(17) \div 20]$ | +(8), otherw | rise (18) = | (16) | | | | 0.37 | (18) |
| Air permeability value applie | es if a pressurisatio | on test has been o | done or a de | gree air pe | rmeability | is being u | ised | | | |
| Number of sides sheltered | ed | | | | | | | | 3 | (19) |
| Shelter factor | | | | (20) = 1 - | [0.075 x (′ | 19)] = | | | 0.78 | (20) |
| Infiltration rate incorpora | ting shelter fac | tor | | (21) = (18 |) x (20) = | | | | 0.29 | (21) |
| Infiltration rate modified | for monthly win | d speed | _ | | | , | | | • | |
| Jan Feb | Mar Apr | May Jur | Jul | Aug | Sep | Oct | Nov | Dec | | |
| Monthly average wind sp | peed from Table | e 7 | | | | | | | | |
| (22)m= 5.1 5 | 4.9 4.4 | 4.3 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 | | |
| Wind Easter (22a) (2 | (2)m · 4 | | | | | | | | | |
| Wind Factor $(22a)m = (2a)m =$ | . <u>4</u> | 1.00 0.05 | 0.05 | T 0.02 | | T | T | T | 1 | |

1.1

1.08

0.95

0.95

0.92

1.08

1.12

1.18

1.23

(22a)m=

1.27

1.25

| Adjusted infiltra | ation rate (a | allowin | g for sh | elter an | d wind s | peed) = | (21a) x | (22a)m | | | | | |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------|-----------|-------------|---------------------------------------------------|--------------------------|----------------|--------------------------------------------------|-----------------|--------------------|-------------|---------------|
| 0.37 | 0.36 | 0.35 | 0.32 | 0.31 | 0.27 | 0.27 | 0.27 | 0.29 | 0.31 | 0.33 | 0.34 | | |
| Calculate effec | | • | ate for ti | he appli | cable ca | se | | | ! | | | · | |
| If mechanica | | | alia NI (Or | 0b) (00- | · | | VIC)\ | | \ (00-\ | | | 0 | (23a) |
| If exhaust air he | | • | | , , | , | . , | | • |) = (23a) | | | 0 | (23b) |
| If balanced with | | - | - | _ | | | | | | - | | 0 | (23c) |
| a) If balance | | - | ı | | i | - ` ` | , `` | í ` | , | | <u>`</u> | ÷ 100] 1 | (0.4-) |
| (24a)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (24a) |
| b) If balance | | | | | ı — | - | , `` | ŕ | r ´ ` | | ı | 1 | (5.41) |
| (24b)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (24b) |
| c) If whole h | | | | • | | | | | F (00h | ` | | | |
| | $0.5 \times (2)$ | - | <u> </u> | , , | | · ` ` | r`` | ŕ | · ` · | <u> </u> | 1 0 | 1 | (24c) |
| (24c)m= 0 | <u> </u> | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | | (240) |
| d) If natural if (22b)n | ventilation on the second ventilation of the second ventilation ventilation of the second ventilation of the second ventilation vent | | | • | • | | | | 0.5] | | | _ | |
| (24d)m= 0.57 | 0.57 | 0.56 | 0.55 | 0.55 | 0.54 | 0.54 | 0.54 | 0.54 | 0.55 | 0.55 | 0.56 | | (24d) |
| Effective air | change rat | te - ent | er (24a) | or (24b | o) or (24 | c) or (24 | d) in bo | x (25) | - | - | | | |
| (25)m= 0.57 | 0.57 | 0.56 | 0.55 | 0.55 | 0.54 | 0.54 | 0.54 | 0.54 | 0.55 | 0.55 | 0.56 | | (25) |
| 3. Heat losse | s and heat | loss na | aramete | ar. | | | | | | | | | |
| ELEMENT | Gross | (| Openin | gs | Net Ar | | U-val W/m2 | | A X U (W/ł | () | k-value kJ/m²-ł | | A X k kJ/K |
| Windows Type | area (m | i-) | 111 | _ | A ,r | | ۷۷/۱۱۱2 +(1.4)/[1]/ | | ` | \ <u>\</u> | KJ/III-iI | ` | |
| | | | | | 5.6 | _ | | | 7.42 | | | | (27) |
| Windows Type | | | | | 8.12 | _ | /[1/(1.4)+ | | 10.77 | _ | | | (27) |
| Windows Type | | | | | 1.96 | | /[1/(1.4)+ | | 2.6 | _ | | | (27) |
| Windows Type | 9 4 | | | | 2.8 | x1 | /[1/(1.4)+ | 0.04] = | 3.71 | ╛, | | | (27) |
| Floor | | | | | 86.98 | 3 X | 0.13 | = | 11.3074 | <u> </u> | | ᆜ | (28) |
| Walls Type1 | 81.48 | | 20.44 | <u> </u> | 61.04 | X | 0.18 | = | 10.99 | | | | (29) |
| Walls Type2 | 19.88 | | 0 | | 19.88 | 3 X | 0.15 | = | 3.08 | | | | (29) |
| Roof | 34.85 | | 0 | | 34.85 | , X | 0.13 | | 4.53 | | | | (30) |
| Total area of e | lements, m | 1 ² | | | 223.1 | 9 | | | | | | | (31) |
| Party wall | | | | | 13.44 | X | 0 | | 0 | | | | (32) |
| Party ceiling | | | | | 52.13 | 3 | | | | | | 7 F | (32b) |
| Internal wall ** | | | | | 136.6 | 4 | | | | Ţ | | ī | (32c) |
| * for windows and | roof windows | s, use eff | ective wii | ndow U-va | alue calcul | ated using | formula 1 | /[(1/U-valu | ıe)+0.04] a | ב s given in | paragraph | n 3.2 | |
| ** include the area | | | | s and par | titions | | | | | | | | |
| Fabric heat los | | , | J) | | | | (26)(30) |) + (32) = | | | | 57 | (33) |
| Heat capacity | , | , | | | | | | ((28). | (30) + (32 | 2) + (32a). | (32e) = | 15090.8 | (34) |
| Thermal mass | • | • | | • | | | | | tive Value: | | | 250 | (35) |
| For design assess can be used instead | | | | construct | ion are no | t known pr | ecisely the | e indicative | e values of | TMP in Ta | able 1f | | |
| Thermal bridge | | | | ısina Ar | pendix I | < | | | | | | 6.69 | (36) |
| if details of therma | , | • | | • . | • | • | | | | | | L 0.09 | (00) |
| | | | (-0) | | , | | | | | | | | |

| Total fabric heat loss calculated monthly Ventilation heat loss calculated monthly (38)m = (33) + (56) = (53)m × (5) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m = (37) × (38 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec |
| (38) (38) (38) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (35) (3 |
| Heat transfer coefficient, W/K (39)m= 109.34 109.13 108.93 107.94 107.76 106.91 106.91 106.76 107.24 107.76 108.13 108.52 **Nerage = Sum(39)v/12= 107.94 (39)** Heat loss parameter (HLP), W/m²K (40)m= 1.26 1.25 1.25 1.24 1.24 1.23 1.23 1.23 1.23 1.23 1.24 1.24 1.25 **Average = Sum(40)v/12= 1.24 (40)** Number of days in month (Table 1a) **Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (41)m= 31 28 31 30 31 30 31 30 31 31 30 31 30 31 30 31 30 31 (41)** **Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)** if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 (25 x |
| (39)me |
| Average = Sum(39),; /12= 107.94 (39) Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4) (40)m = 1.26 1.25 1.25 1.24 1.24 1.24 1.23 1.23 1.23 1.23 1.24 1.24 1.25 Average = Sum(40),; /12= 1.24 (40) Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (41)m = 31 28 31 30 31 30 31 31 30 31 31 30 31 30 31 (41) 4. Water heating energy requirement: **Whi/year** Assumed occupancy, N 2.58 (42) if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 (43) Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usege in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m = 105.08 101.26 97.44 93.61 89.79 85.97 89.79 93.61 97.44 101.26 105.08 Total = Sum(44)1 = 1146.3 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m = 155.83 136.29 140.64 122.61 117.65 101.52 94.07 107.95 109.24 127.31 138.97 150.91 Total = Sum(45)1 = 1502.98 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) |
| (40)m= |
| Average = Sum(40)12/12= 1.24 (40) |
| Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec |
| 4. Water heating energy requirement: KWh/year: |
| 4. Water heating energy requirement: Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 105.08 101.26 97.44 93.61 89.79 85.97 85.97 89.79 93.61 97.44 101.26 105.08 Total = Sum(44)1 |
| Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43) (44)m= 105.08 101.26 97.44 93.61 89.79 85.97 85.97 89.79 93.61 97.44 101.26 105.08 Total = Sum(44) ₁₁₂ = 1146.3 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd, m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 155.83 136.29 140.64 122.61 117.65 101.52 94.07 107.95 109.24 127.31 138.97 150.91 Total = Sum(45) ₁₁₂ = 1502.98 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) |
| Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 105.08 101.26 97.44 93.61 89.79 85.97 85.97 89.79 93.61 97.44 101.26 105.08 Total = Sum(44) ₁₁₂ 1146.3 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 155.83 136.29 140.64 122.61 117.65 101.52 94.07 107.95 109.24 127.31 138.97 150.91 Total = Sum(45) ₁₁₂ 1502.98 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) |
| if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 105.08 101.26 97.44 93.61 89.79 85.97 85.97 89.79 93.61 97.44 101.26 105.08 Total = Sum(44) ₁₁₂ = 1146.3 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 155.83 136.29 140.64 122.61 117.65 101.52 94.07 107.95 109.24 127.31 138.97 150.91 Total = Sum(45) ₁₁₂ = 1502.98 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 23.37 20.44 21.1 18.39 17.65 15.23 14.11 16.19 16.39 19.1 20.85 22.64 |
| if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 105.08 101.26 97.44 93.61 89.79 85.97 85.97 89.79 93.61 97.44 101.26 105.08 Total = Sum(44) ₁₁₂ = 1146.3 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 155.83 136.29 140.64 122.61 117.65 101.52 94.07 107.95 109.24 127.31 138.97 150.91 Total = Sum(45) ₁₁₂ = 1502.98 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 23.37 20.44 21.1 18.39 17.65 15.23 14.11 16.19 16.39 19.1 20.85 22.64 |
| if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43) (44)m= 105.08 101.26 97.44 93.61 89.79 85.97 85.97 89.79 93.61 97.44 101.26 105.08 Total = Sum(44) 112 = 1146.3 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd, m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 155.83 136.29 140.64 122.61 117.65 101.52 94.07 107.95 109.24 127.31 138.97 150.91 Total = Sum(45) 112 = 1502.98 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) |
| Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec |
| Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec |
| Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 105.08 101.26 97.44 93.61 89.79 85.97 85.97 89.79 93.61 97.44 101.26 105.08 Total = Sum(44) ₁₁₂ = 1146.3 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 155.83 136.29 140.64 122.61 117.65 101.52 94.07 107.95 109.24 127.31 138.97 150.91 Total = Sum(45) ₁₁₂ = 1502.98 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 23.37 20.44 21.1 18.39 17.65 15.23 14.11 16.19 16.39 19.1 20.85 22.64 (46) |
| Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 105.08 101.26 97.44 93.61 89.79 85.97 85.97 89.79 93.61 97.44 101.26 105.08 Total = Sum(44) ₁₁₂ = 1146.3 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 155.83 136.29 140.64 122.61 117.65 101.52 94.07 107.95 109.24 127.31 138.97 150.91 Total = Sum(45) ₁₁₂ = 1502.98 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 23.37 20.44 21.1 18.39 17.65 15.23 14.11 16.19 16.39 19.1 20.85 22.64 (46) |
| Total = Sum(44) ₁₁₂ = 1146.3 (44) Energy content of hot water used - calculated monthly = $4.190 \times Vd$, $m \times nm \times DTm / 3600 \times Wh/month$ (see Tables 1b, 1c, 1d) (45)m= 155.83 136.29 140.64 122.61 117.65 101.52 94.07 107.95 109.24 127.31 138.97 150.91 Total = Sum(45) ₁₁₂ = 1502.98 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 23.37 20.44 21.1 18.39 17.65 15.23 14.11 16.19 16.39 19.1 20.85 22.64 (46) |
| Energy content of hot water used - calculated monthly = $4.190 \times Vd$, $m \times nm \times DTm / 3600 \times Wh/month$ (see Tables 1b, 1c, 1d) (45)m= 155.83 136.29 140.64 122.61 117.65 101.52 94.07 107.95 109.24 127.31 138.97 150.91 Total = Sum(45) ₁₁₂ = 1502.98 (45) (46)m= 23.37 20.44 21.1 18.39 17.65 15.23 14.11 16.19 16.39 19.1 20.85 22.64 (46) |
| (45)m= 155.83 136.29 140.64 122.61 117.65 101.52 94.07 107.95 109.24 127.31 138.97 150.91 Total = Sum(45) ₁₁₂ = 1502.98 (45) (46)m= 23.37 20.44 21.1 18.39 17.65 15.23 14.11 16.19 16.39 19.1 20.85 22.64 (46) |
| Total = Sum(45) ₁₁₂ = 1502.98 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) $(46)m = 23.37 20.44 21.1 18.39 17.65 15.23 14.11 16.19 16.39 19.1 20.85 22.64 $ (46) |
| If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 23.37 20.44 21.1 18.39 17.65 15.23 14.11 16.19 16.39 19.1 20.85 22.64 (46) |
| (46)m= 23.37 20.44 21.1 18.39 17.65 15.23 14.11 16.19 16.39 19.1 20.85 22.64 (46) |
| |
| |
| Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) |
| If community heating and no tank in dwelling, enter 110 litres in (47) |
| Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) |
| Water storage loss: |
| a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) |
| Temperature factor from Table 2b Energy lost from water storage, kWh/year $(48) \times (49) = 0$ (50) |
| Energy lost from water storage, kWh/year (48) x (49) = 0 b) If manufacturer's declared cylinder loss factor is not known: |
| Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51) |
| If community heating see section 4.3 |
| Volume factor from Table 2a 0 (52) |
| Temperature factor from Table 2b 0 (53) |
| Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) = 0$ (54) Enter (50) or (54) in (55) |
| Enter (50) or (54) in (55) 0 (55) |

| vvator sto | rage loss ca | culated f | for each | month | | | ((56)m = (| 55) × (41)ı | m | | | | |
|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------|-----------------------------------------|---------------------------------------------------|---------------|--------------------------------------|
| (56)m= | 0 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (56) |
| If cylinder co | ontains dedicate | d solar sto | rage, (57) | m = (56)m | x [(50) – (| H11)] ÷ (5 | 0), else (5 | 7)m = (56) | m where (| H11) is fro | m Append | i lix H | |
| (57)m= | 0 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (57) |
| Primary c | ircuit loss (aı | nnual) fro | om Table | 3 | | | | | | | 0 | | (58) |
| • | ircuit loss ca | | | , | • | ` ' | ` ' | | | | | | |
| ` — | ed by factor f | rom Tab | le H5 if t | here is s | solar wat | er heatii | ng and a | cylinde | r thermo | stat) | | • | |
| (59)m= | 0 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (59) |
| Combi los | s calculated | for each | month (| (61)m = | (60) ÷ 36 | 65 × (41) | m | | | | | | |
| (61)m= 50 | 0.96 46.03 | 49.65 | 46.17 | 45.76 | 42.4 | 43.81 | 45.76 | 46.17 | 49.65 | 49.32 | 50.96 | | (61) |
| Total heat | t required for | water h | eating ca | alculated | for eacl | h month | (62)m = | 0.85 × (| (45)m + | (46)m + | (57)m + | (59)m + (61)m | |
| (62)m= 20 | 06.79 182.31 | 190.29 | 168.78 | 163.4 | 143.92 | 137.88 | 153.71 | 155.41 | 176.96 | 188.28 | 201.87 | | (62) |
| Solar DHW | input calculated | using App | endix G o | Appendix | H (negati | ve quantity |) (enter '0 | if no sola | r contribut | ion to wate | er heating) | • | |
| (add addi | tional lines if | FGHRS | and/or \ | VWHRS | applies | , see Ap | pendix (| 3) | | _ | _ | | |
| (63)m= | 0 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (63) |
| Output fro | om water hea | iter | | | | | | | | | | | |
| (64)m= 20 | 06.79 182.31 | 190.29 | 168.78 | 163.4 | 143.92 | 137.88 | 153.71 | 155.41 | 176.96 | 188.28 | 201.87 | | |
| | | | | | | | Outp | out from wa | ater heate | r (annual)₁ | 12 | 2069.6 | (64) |
| Heat gain | s from water | heating, | kWh/m | onth 0.2 | 5 ´ [0.85 | × (45)m | + (61)m | n] + 0.8 x | ((46)m | + (57)m | + (59)m |] | |
| (65)m= 64 | 4.55 56.82 | 59.17 | 52.31 | 50.56 | 44.35 | 42.23 | 47.33 | 47.86 | 54.74 | 58.54 | 62.92 | | (65) |
| include | (57)m in cal | culation of | of (65)m | only if c | ylinder i | s in the o | dwelling | or hot w | ater is fr | om com | munity h | eating | |
| 5. Intern | nal gains (see | e Table 5 | and 5a | ١. | | | | | | | | | |
| Metabolic | gains (Table | | |). | | | | | | | | | |
| | | e 5), Wat | ts |). | | | | | | | | | |
| ' | Jan Feb | e 5), Wat Mar | ts Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| — | Jan Feb 29.1 129.1 | | | | Jun 129.1 | Jul 129.1 | Aug 129.1 | Sep 129.1 | Oct | Nov 129.1 | Dec 129.1 | | (66) |
| (66)m= 12 | | Mar 129.1 | Apr 129.1 | May 129.1 | 129.1 | 129.1 | 129.1 | 129.1 | | | - | | (66) |
| (66)m= 12 Lighting g | 29.1 129.1 | Mar 129.1 | Apr 129.1 | May 129.1 | 129.1 | 129.1 | 129.1 | 129.1 | | | - | | (66) (67) |
| (66)m= 12 Lighting g (67)m= 20 | 29.1 129.1 ains (calcula | Mar 129.1 ated in Ap 15.03 | Apr 129.1 opendix 11.38 | May 129.1 L, equat 8.51 | 129.1 ion L9 o | 129.1 r L9a), a 7.76 | 129.1 Iso see | 129.1 Table 5 | 129.1 17.19 | 129.1 | 129.1 | | ` , |
| (66)m= 1: Lighting g (67)m= 20 Appliance | 29.1 129.1 pains (calcula 0.81 18.48 | Mar 129.1 ated in Ap 15.03 | Apr 129.1 opendix 11.38 | May 129.1 L, equat 8.51 | 129.1 ion L9 o | 129.1 r L9a), a 7.76 | 129.1 Iso see | 129.1 Table 5 | 129.1 17.19 | 129.1 | 129.1 | | ` , |
| (66)m= 12 Lighting g (67)m= 20 Appliance (68)m= 23 | 29.1 129.1 ains (calcula 0.81 18.48 es gains (calc | Mar 129.1 tted in Ap 15.03 culated in 229.73 | Apr 129.1 opendix 11.38 Append 216.74 | May 129.1 L, equat 8.51 dix L, eq 200.33 | 129.1 ion L9 of 7.18 uation L 184.92 | 129.1 r L9a), a 7.76 13 or L1 174.62 | 129.1 Iso see 10.09 3a), also | 129.1 Table 5 13.54 see Tal 178.3 | 129.1 17.19 ble 5 191.29 | 129.1 20.06 | 129.1 21.39 | | (67) |
| (66)m= 1: Lighting g (67)m= 20 Appliance (68)m= 23 Cooking g | 29.1 129.1 rains (calcula 0.81 18.48 res gains (calcula 33.41 235.83 | Mar 129.1 tted in Ap 15.03 culated in 229.73 | Apr 129.1 opendix 11.38 Append 216.74 | May 129.1 L, equat 8.51 dix L, eq 200.33 | 129.1 ion L9 of 7.18 uation L 184.92 | 129.1 r L9a), a 7.76 13 or L1 174.62 | 129.1 Iso see 10.09 3a), also | 129.1 Table 5 13.54 see Tal 178.3 | 129.1 17.19 ble 5 191.29 | 129.1 20.06 | 129.1 21.39 | | (67) |
| (66)m= 1: Lighting g (67)m= 20 Appliance (68)m= 23 Cooking g (69)m= 38 | 29.1 129.1 pains (calcula 0.81 18.48 ps gains (calcula 0.3.41 235.83 gains (calcula 5.91 35.91 | Mar 129.1 Ited in Ap 15.03 culated in 229.73 ated in A 35.91 | Apr 129.1 opendix 11.38 Appendix 216.74 opendix 35.91 | May 129.1 L, equat 8.51 dix L, eq 200.33 L, equat | 129.1 ion L9 of 7.18 uation L 184.92 tion L15 | 129.1 r L9a), a 7.76 13 or L1 174.62 or L15a) | 129.1 lso see 10.09 3a), also 172.2 | 129.1 Table 5 13.54 see Talle | 129.1 17.19 ble 5 191.29 | 20.06 207.7 | 129.1 21.39 223.11 | | (67) (68) |
| (66)m= 1: Lighting g (67)m= 20 Appliance (68)m= 23 Cooking g (69)m= 38 | 29.1 129.1 rains (calcula 0.81 18.48 res gains (calcula 33.41 235.83 res gains (calcula | Mar 129.1 Ited in Ap 15.03 culated in 229.73 ated in A 35.91 | Apr 129.1 opendix 11.38 Appendix 216.74 opendix 35.91 | May 129.1 L, equat 8.51 dix L, eq 200.33 L, equat | 129.1 ion L9 of 7.18 uation L 184.92 tion L15 | 129.1 r L9a), a 7.76 13 or L1 174.62 or L15a) | 129.1 lso see 10.09 3a), also 172.2 | 129.1 Table 5 13.54 see Talle | 129.1 17.19 ble 5 191.29 | 20.06 207.7 | 129.1 21.39 223.11 | | (67) (68) |
| (66)m= 1.2 Lighting g (67)m= 20 Appliance (68)m= 23 Cooking g (69)m= 30 Pumps ar (70)m= | 29.1 129.1 rains (calcula 0.81 18.48 rs gains (calcula 33.41 235.83 rgains (calcula 5.91 35.91 rnd fans gains | Mar 129.1 Ited in Ap 15.03 culated in 229.73 ated in A 35.91 s (Table § | Apr 129.1 opendix 11.38 Append 216.74 opendix 35.91 5a) | May 129.1 L, equat 8.51 dix L, eq 200.33 L, equat 35.91 | 129.1 ion L9 of 7.18 uation L 184.92 tion L15 35.91 | 129.1 r L9a), a 7.76 13 or L1 174.62 or L15a) 35.91 | 129.1 lso see 10.09 3a), also 172.2 , also se 35.91 | 129.1 Table 5 13.54 see Tal 178.3 ee Table 35.91 | 129.1 17.19 ble 5 191.29 5 35.91 | 20.06 207.7 35.91 | 21.39 223.11 35.91 | | (67) (68) (69) |
| Lighting g (67)m= 20 Appliance (68)m= 23 Cooking g (69)m= 30 Pumps ar (70)m= Losses e. | 29.1 129.1 rains (calcula 0.81 18.48 res gains (calcula 33.41 235.83 regains (calcula 5.91 35.91 red fans gains | Mar 129.1 Ited in Ap 15.03 culated in 229.73 ated in A 35.91 s (Table § | Apr 129.1 opendix 11.38 Append 216.74 opendix 35.91 5a) | May 129.1 L, equat 8.51 dix L, eq 200.33 L, equat 35.91 | 129.1 ion L9 of 7.18 uation L 184.92 tion L15 35.91 | 129.1 r L9a), a 7.76 13 or L1 174.62 or L15a) 35.91 | 129.1 lso see 10.09 3a), also 172.2 , also se 35.91 | 129.1 Table 5 13.54 see Tal 178.3 ee Table 35.91 | 129.1 17.19 ble 5 191.29 5 35.91 | 20.06 207.7 35.91 | 21.39 223.11 35.91 | | (67) (68) (69) |
| (66)m= 1: Lighting g (67)m= 20 Appliance (68)m= 23 Cooking g (69)m= 3: Pumps ar (70)m= Losses e. (71)m= -10 | 29.1 129.1 pains (calcular) 0.81 18.48 es gains (calcular) 33.41 235.83 gains (calcular) 5.91 35.91 and fans gains 3 3 g. evaporation 03.28 -103.28 | Mar 129.1 Ited in Ap 15.03 culated in Ap 229.73 ated in Ap 35.91 c (Table 5 3 on (negar | Apr 129.1 opendix 11.38 n Appendix 216.74 ppendix 35.91 5a) 3 | May 129.1 L, equat 8.51 dix L, eq 200.33 L, equat 35.91 3 es) (Tab | 129.1 ion L9 of 7.18 uation L 184.92 tion L15 35.91 3 | 129.1 r L9a), a 7.76 13 or L1 174.62 or L15a) 35.91 | 129.1 lso see 10.09 3a), also 172.2 , also se 35.91 | 129.1 Table 5 13.54 see Tal 178.3 ee Table 35.91 | 17.19 ble 5 191.29 5 35.91 | 20.06 207.7 35.91 | 21.39 223.11 35.91 | | (67) (68) (69) (70) |
| Lighting g (67)m= 20 Appliance (68)m= 23 Cooking g (69)m= 30 Pumps ar (70)m= Losses e. (71)m= -10 Water hea | 29.1 129.1 ains (calcula 0.81 18.48 as gains (calcula 3.41 235.83 gains (calcula 5.91 35.91 and fans gains 3 3 g. evaporatio | Mar 129.1 Ited in Ap 15.03 culated in Ap 229.73 ated in Ap 35.91 c (Table 5 3 on (negar | Apr 129.1 opendix 11.38 n Appendix 216.74 ppendix 35.91 5a) 3 | May 129.1 L, equat 8.51 dix L, eq 200.33 L, equat 35.91 3 es) (Tab | 129.1 ion L9 of 7.18 uation L 184.92 tion L15 35.91 3 | 129.1 r L9a), a 7.76 13 or L1 174.62 or L15a) 35.91 | 129.1 lso see 10.09 3a), also 172.2 , also se 35.91 | 129.1 Table 5 13.54 see Tal 178.3 ee Table 35.91 | 17.19 ble 5 191.29 5 35.91 | 20.06 207.7 35.91 | 21.39 223.11 35.91 | | (67) (68) (69) (70) |
| (66)m= 1: Lighting g (67)m= 20 Appliance (68)m= 23 Cooking g (69)m= 3: Pumps ar (70)m= Losses e. (71)m= -10 Water hea (72)m= 80 | 29.1 129.1 rains (calcula 0.81 18.48 rs gains (calcula 33.41 235.83 rgains (calcula 5.91 35.91 rnd fans gains 3 3 rg. evaporatio 03.28 -103.28 rating gains (** | Mar 129.1 Ited in Ap 15.03 culated in Ap 229.73 ated in Ap 35.91 c (Table 5 3 on (negation of the color) -103.28 Table 5) 79.54 | Apr 129.1 opendix 11.38 Append 216.74 ppendix 35.91 5a) 3 tive valu | May 129.1 L, equat 8.51 dix L, eq 200.33 L, equat 35.91 3 es) (Tab | 129.1 ion L9 of 7.18 uation L 184.92 tion L15 35.91 3 ole 5) -103.28 | 129.1 r L9a), a 7.76 13 or L1 174.62 or L15a) 35.91 | 129.1 lso see 10.09 3a), also 172.2 , also se 35.91 3 | 129.1 Table 5 13.54 see Tal 178.3 ee Table 35.91 3 -103.28 | 129.1 17.19 ble 5 191.29 5 35.91 3 -103.28 | 20.06 207.7 35.91 3 -103.28 | 129.1 21.39 223.11 35.91 3 -103.28 | | (67) (68) (69) (70) (71) |
| (66)m= 1: Lighting g (67)m= 20 Appliance (68)m= 23 Cooking g (69)m= 3: Pumps ar (70)m= | 29.1 129.1 ains (calcula 0.81 18.48 as gains (calcula 3.41 235.83 gains (calcula 5.91 35.91 ad fans gains 3 3 g. evaporatio 03.28 -103.28 ating gains (* 6.76 84.56 | Mar 129.1 Ited in Ap 15.03 culated in Ap 229.73 ated in Ap 35.91 c (Table 5 3 on (negation of the color) -103.28 Table 5) 79.54 | Apr 129.1 opendix 11.38 Append 216.74 ppendix 35.91 5a) 3 tive valu | May 129.1 L, equat 8.51 dix L, eq 200.33 L, equat 35.91 3 es) (Tab | 129.1 ion L9 of 7.18 uation L 184.92 tion L15 35.91 3 ole 5) -103.28 | 129.1 r L9a), a 7.76 13 or L1 174.62 or L15a) 35.91 3 | 129.1 lso see 10.09 3a), also 172.2 , also se 35.91 3 | 129.1 Table 5 13.54 see Tal 178.3 ee Table 35.91 3 -103.28 | 129.1 17.19 ble 5 191.29 5 35.91 3 -103.28 | 20.06 207.7 35.91 3 -103.28 | 129.1 21.39 223.11 35.91 3 -103.28 | | (67) (68) (69) (70) (71) |

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | r | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---------------------------|---------------------------|---|------------|---|------------------|---|----------------|---|----------------|-----|--------------|------|
| Southeast 0.9x | 0.77 | x | 5.6 | x | 36.79 | x | 0.63 | х | 0.7 | = | 62.97 | (77) |
| Southeast 0.9x | 0.77 | x | 8.12 | x | 36.79 | x | 0.63 | x | 0.7 | = | 91.31 | (77) |
| Southeast 0.9x | 0.77 | x | 5.6 | x | 62.67 | x | 0.63 | x | 0.7 | = | 107.26 | (77) |
| Southeast 0.9x | 0.77 | x | 8.12 | x | 62.67 | x | 0.63 | x | 0.7 | = | 155.53 | (77) |
| Southeast 0.9x | 0.77 | x | 5.6 | x | 85.75 | x | 0.63 | x | 0.7 | = | 146.76 | (77) |
| Southeast 0.9x | 0.77 | x | 8.12 | x | 85.75 | x | 0.63 | x | 0.7 | = | 212.8 | (77) |
| Southeast 0.9x | 0.77 | x | 5.6 | x | 106.25 | x | 0.63 | x | 0.7 | = | 181.84 | (77) |
| Southeast 0.9x | 0.77 | x | 8.12 | x | 106.25 | x | 0.63 | x | 0.7 | = | 263.67 | (77) |
| Southeast 0.9x | 0.77 | x | 5.6 | x | 119.01 | x | 0.63 | x | 0.7 | = | 203.68 | (77) |
| Southeast 0.9x | 0.77 | x | 8.12 | x | 119.01 | x | 0.63 | x | 0.7 | = | 295.33 | (77) |
| Southeast 0.9x | 0.77 | X | 5.6 | x | 118.15 | x | 0.63 | X | 0.7 | = | 202.21 | (77) |
| Southeast 0.9x | 0.77 | x | 8.12 | x | 118.15 | x | 0.63 | x | 0.7 | = | 293.2 | (77) |
| Southeast 0.9x | 0.77 | x | 5.6 | x | 113.91 | x | 0.63 | x | 0.7 | = | 194.95 | (77) |
| Southeast 0.9x | 0.77 | x | 8.12 | x | 113.91 | x | 0.63 | x | 0.7 | = | 282.67 | (77) |
| Southeast 0.9x | 0.77 | x | 5.6 | x | 104.39 | x | 0.63 | х | 0.7 | = | 178.66 | (77) |
| Southeast 0.9x | 0.77 | x | 8.12 | x | 104.39 | x | 0.63 | х | 0.7 | = | 259.05 | (77) |
| Southeast 0.9x | 0.77 | x | 5.6 | x | 92.85 | x | 0.63 | х | 0.7 | = | 158.91 | (77) |
| Southeast 0.9x | 0.77 | x | 8.12 | x | 92.85 | x | 0.63 | х | 0.7 | = | 230.42 | (77) |
| Southeast 0.9x | 0.77 | x | 5.6 | x | 69.27 | x | 0.63 | х | 0.7 | = | 118.55 | (77) |
| Southeast 0.9x | 0.77 | x | 8.12 | x | 69.27 | x | 0.63 | х | 0.7 | = | 171.89 | (77) |
| Southeast 0.9x | 0.77 | x | 5.6 | x | 44.07 | x | 0.63 | х | 0.7 | = | 75.42 | (77) |
| Southeast 0.9x | 0.77 | x | 8.12 | x | 44.07 | x | 0.63 | х | 0.7 | = | 109.36 | (77) |
| Southeast 0.9x | 0.77 | x | 5.6 | x | 31.49 | x | 0.63 | x | 0.7 | = | 53.89 | (77) |
| Southeast 0.9x | 0.77 | x | 8.12 | x | 31.49 | x | 0.63 | x | 0.7 | = | 78.14 | (77) |
| Southwest _{0.9x} | 0.77 | x | 1.96 | x | 36.79 |] | 0.63 | x | 0.7 | = | 44.08 | (79) |
| Southwest _{0.9x} | 0.77 | x | 2.8 | x | 36.79 |] | 0.63 | x | 0.7 | = | 31.49 | (79) |
| Southwest _{0.9x} | 0.77 | x | 1.96 | x | 62.67 |] | 0.63 | x | 0.7 | = | 75.08 | (79) |
| Southwest _{0.9x} | 0.77 | x | 2.8 | x | 62.67 |] | 0.63 | x | 0.7 | = | 53.63 | (79) |
| Southwest _{0.9x} | 0.77 | x | 1.96 | x | 85.75 |] | 0.63 | x | 0.7 | = | 102.73 | (79) |
| Southwest _{0.9x} | 0.77 | x | 2.8 | x | 85.75 |] | 0.63 | x | 0.7 | = | 73.38 | (79) |
| Southwest _{0.9x} | 0.77 | x | 1.96 | x | 106.25 |] | 0.63 | x | 0.7 | = | 127.29 | (79) |
| Southwest _{0.9x} | 0.77 | x | 2.8 | x | 106.25 |] | 0.63 | x | 0.7 | = | 90.92 | (79) |
| Southwest _{0.9x} | 0.77 | x | 1.96 | x | 119.01 |] | 0.63 | x | 0.7 | = | 142.58 | (79) |
| Southwest _{0.9x} | 0.77 | x | 2.8 | x | 119.01 |] | 0.63 | x | 0.7 | = | 101.84 | (79) |
| Southwest _{0.9x} | 0.77 | x | 1.96 | x | 118.15 |] | 0.63 | х | 0.7 | = | 141.54 | (79) |
| Southwest _{0.9x} | 0.77 | X | 2.8 | x | 118.15 |] | 0.63 | х | 0.7 | = | 101.1 | (79) |
| Southwest _{0.9x} | 0.77 | X | 1.96 | x | 113.91 |] | 0.63 | х | 0.7 |] = | 136.46 | (79) |
| Southwest _{0.9x} | 0.77 | X | 2.8 | x | 113.91 |] | 0.63 | x | 0.7 |] = | 97.47 | (79) |
| Southwest _{0.9x} | 0.77 | X | 1.96 | x | 104.39 |] | 0.63 | x | 0.7 |] = | 125.06 | (79) |
| | | | | - | | - | | • | | - | | _ |

| Southwe | est _{0.9x} | 0.77 | X | 2.8 | 3 | x | 1(| 04.39 |] [| | 0.63 | x | 0.7 | = | 89.33 | (79) |
|---------|---------------------|-----------|---------------------|--------------------|-----------|---------------|---------------|-----------|--------|---------------|------------------|-----------|-------------|-----------|--------|------|
| Southwe | est _{0.9x} | 0.77 | X | 1.9 | 16 | x | 9 | 2.85 |] [| | 0.63 | x [| 0.7 | = | 111.24 | (79) |
| Southwe | est _{0.9x} | 0.77 | X | 2.8 | 3 | x | 9 | 2.85 | | | 0.63 | x | 0.7 | = | 79.45 | (79) |
| Southwe | est _{0.9x} | 0.77 | X | 1.9 | 16 | x | 6 | 9.27 |] [| | 0.63 | x | 0.7 | = | 82.98 | (79) |
| Southwe | est _{0.9x} | 0.77 | X | 2.8 | 3 | x | 6 | 9.27 |] [| | 0.63 | x [| 0.7 | = | 59.27 | (79) |
| Southwe | est _{0.9x} | 0.77 | X | 1.9 | 16 | x | 4 | 4.07 | | | 0.63 | x | 0.7 | = | 52.8 | (79) |
| Southwe | est _{0.9x} | 0.77 | X | 2.8 | 3 | x | 4 | 4.07 | | | 0.63 | x | 0.7 | = | 37.71 | (79) |
| Southwe | est _{0.9x} | 0.77 | x | 1.9 | 16 | x | 3 | 1.49 | | | 0.63 | x | 0.7 | = | 37.72 | (79) |
| Southwe | est _{0.9x} | 0.77 | X | 2.8 | 3 | x | 3 | 1.49 | | | 0.63 | x | 0.7 | = | 26.94 | (79) |
| | _ | | | | | | | | | | | | | | | |
| Solar g | ains in | watts, ca | alculated | for eac | n month | | | | (83)m | ı = Sı | um(74)m . | (82)m | | | | |
| (83)m= | 229.84 | 391.5 | 535.67 | 663.73 | 743.43 | 73 | 88.05 | 711.56 | 652 | 2.1 | 580.02 | 432.7 | 275.3 | 196.7 | | (83) |
| Total g | ains – i | nternal a | nd solar | (84)m = | (73)m - | + (8 | 33)m | , watts | | | | | - | | | |
| (84)m= | 635.56 | 795.11 | 924.7 | 1029.22 | 1084.95 | 10 | 56.49 | 1015.43 | 962. | .73 | 903.07 | 779.49 | 649.09 | 590.49 | | (84) |
| 7. Mea | an inter | nal temp | erature | (heating | season |) | | | | | | | | | | |
| | | | eating p | ` | | , | area f | from Tab | ole 9, | Th | 1 (°C) | | | | 21 | (85) |
| • | | • | ains for I | | | • | | | , | | , | | | | | |
| ſ | Jan | Feb | Mar | Apr | May | È | Jun | Jul | Αι | ug | Sep | Oct | Nov | Dec | | |
| (86)m= | 1 | 0.99 | 0.96 | 0.91 | 0.79 | 0 | 0.62 | 0.46 | 0.5 | 5 | 0.74 | 0.94 | 0.99 | 1 | | (86) |
| Mean | interna | l temner | ature in l | living ar | 22 T1 (fc | الم | w ste | ns 3 to 7 | in T | ahle | 9c) | | | | l | |
| (87)m= | 19.74 | 19.97 | 20.27 | 20.61 | 20.85 | $\overline{}$ | 0.96 | 20.99 | 20.9 | $\overline{}$ | 20.92 | 20.59 | 20.09 | 19.69 | | (87) |
| L | | | | | | l | | | l | | | | | | | , , |
| · r | 19.87 | 19.88 | eating p | erioas ir 19.89 | 19.89 | _ | eiiing 9.9 | 19.9 | 19. | \neg | 12 (°C) 19.89 | 19.89 | 19.89 | 19.88 | | (88) |
| (88)m= | 19.07 | 19.00 | 19.00 | 19.09 | 19.09 | <u>'</u> | 9.9 | 19.9 | 19. | .9 | 19.09 | 19.09 | 19.09 | 19.00 | | (00) |
| г | | tor for g | ains for r | | welling, | h2,ı | m (se | e Table | 9a) | | | | | | l | |
| (89)m= | 0.99 | 0.98 | 0.95 | 0.88 | 0.73 | 0 |).52 | 0.35 | 0.3 | 9 | 0.65 | 0.91 | 0.98 | 1 | | (89) |
| Mean | interna | l temper | ature in t | the rest | of dwelli | ng | T2 (f | ollow ste | ps 3 | to 7 | in Tabl | e 9c) | | | | |
| (90)m= | 18.21 | 18.55 | 18.98 | 19.45 | 19.75 | 19 | 9.88 | 19.89 | 19.8 | 89 | 19.84 | 19.44 | 18.73 | 18.15 | | (90) |
| | | | | | | | | | | | f | LA = Livi | ng area ÷ (| 4) = | 0.33 | (91) |
| Mean | interna | l temper | ature (fo | r the wh | ole dwe | lling | a) = fl | _A × T1 | + (1 - | – fL | A) × T2 | | | | | |
| (92)m= | 18.71 | 19.02 | 19.41 | 19.83 | 20.11 | _ | 0.23 | 20.26 | 20.2 | | 20.19 | 19.81 | 19.18 | 18.66 | | (92) |
| Apply | adjustn | nent to t | he mean | internal | temper | atu | re fro | m Table | 4e, \ | whe | re appro | priate | | ! | l | |
| (93)m= | 18.71 | 19.02 | 19.41 | 19.83 | 20.11 | 20 | 0.23 | 20.26 | 20.2 | 25 | 20.19 | 19.81 | 19.18 | 18.66 | | (93) |
| 8. Spa | ice hea | ting requ | uirement | | | | | | | | | | | | | |
| | | | | • | | ed | at ste | ep 11 of | Table | e 9b | , so tha | t Ti,m= | (76)m an | d re-calc | culate | |
| the uti | | | or gains u | | | 1 | _ | | T . | | | _ | T | I _ | | |
| | Jan | Feb | Mar | Apr | May | L | Jun | Jul | Αι | ug | Sep | Oct | Nov | Dec | | |
| г | 0.99 | tor for g | ains, hm | | 0.74 | _ | \ F.F. | 0.20 | 0.4 | ٦ | 0.67 | 0.01 | 1 0 00 | 0.00 | | (94) |
| (94)m= | | | 0.95 | 0.88 | | |).55 | 0.38 | 0.4 | -2 | 0.67 | 0.91 | 0.98 | 0.99 | | (34) |
| _ | 630.15 | 777.38 | , W = (94 875.97 | 902.32 | 807.53 | 58 | 33.81 | 388.3 | 407. | 33 | 607.4 | 708.56 | 636.82 | 586.77 | | (95) |
| ` ′ L | | | rnal tem | | | <u> </u> | | 000.0 | 1 +07. | .50 | 557.7 | , 55.55 | 1 000.02 | 000.77 | | (55) |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | | 4.6 | 16.6 | 16. | .4 | 14.1 | 10.6 | 7.1 | 4.2 | | (96) |
| L | | | an intern | | | | | | | | | | | <u> </u> | | |
| Г | | 1540.67 | | 1179.74 | 906.38 | |)2.27 | 390.81 | 411. | · | 653.31 | 992.95 | 1305.74 | 1568.84 | | (97) |
| L | | | | | | | | | Ь—— | ! | ! | | ļ. | <u> </u> | ı | |

| (98)m= 703.73 512.93 | ement ic | r each n | nonth, k\ | Wh/mont | th = 0.02 | 24 x [(97) | m – (95 |)m] x (4′ | 1)m | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------|--------------------------|----------|-----------|------------------------|-----------------------------|---------------------------------------------------|----------------------------|------------------------|------------------------------------------------|---------------------|
| (98)m= 703.73 512.93 | 394.32 | 199.74 | 73.54 | 0 | 0 | 0 | 0 | 211.59 | 481.62 | 730.66 | | |
| | | | | | | Tota | l per year | (kWh/year |) = Sum(9 | 8) _{15,912} = | 3308.14 | (98) |
| Space heating requi | rement in | kWh/m² | /year | | | | | | | | 38.03 | (99) |
| 9a. Energy requireme | nts – Ind | ividual h | eating sy | ystems i | ncluding | micro-C | HP) | | | | | |
| Space heating: | at from a | ooondor | /ournalo | montory | ovotom | | | | | Г | | (201) |
| Fraction of space he Fraction of space he | | | | memary | - | (202) = 1 - | - (201) = | | | L | 0 | (202) |
| Fraction of total heat | | - | ` , | | | (204) = (20 | , , | (203)] = | | L | 1 | (204) |
| Efficiency of main sp | _ | - | | | | (204) - (20 | 32) X [1 | (200)] = | | L | 93.4 | (206) |
| Efficiency of second | | • . | | a evetom | 0/- | | | | | L | 0 | (208) |
| , , , , , , , , , , , , , , , , , , , | 1 | | | | i . | Δ | 0 | 0-4 | Mari | | | ` ′ |
| Jan Feb Space heating requi | Mar rement (c | Apr | May d above | Jun | Jul | Aug | Sep | Oct | Nov | Dec | kWh/ye | ear |
| 703.73 512.93 | 394.32 | 199.74 | 73.54 | 0 | 0 | 0 | 0 | 211.59 | 481.62 | 730.66 | | |
| 211)m = {[(98)m x (2 | _ 04)] + (21 | L I0)m } x | 100 ÷ (2 | 206) | <u> </u> | | | | | | | (211) |
| 753.46 549.18 | 422.19 | 213.85 | 78.74 | 0 | 0 | 0 | 0 | 226.54 | 515.66 | 782.29 | | ` ' |
| - | ! | | | | | Tota | l (kWh/yea | ar) =Sum(2 | 211) _{15,1012} | | 3541.9 | (211) |
| Space heating fuel (| secondar | y), kWh/ | month | | | | | | | _ | | |
| = {[(98)m x (201)] + (2 | 1 | · | | ı | <u> </u> | | | | | | | |
| (215)m= 0 0 | 0 | 0 | 0 | 0 | 0 | 0 Tota | 0 | 0 ar) =Sum(2 | 0 | 0 | | 7(045) |
| Notes booting | | | | | | Tota | i (KVVII/yea | ai) =3uiii(2 | 13) _{15,1012} | | 0 | (215) |
| Water heating | | | | | | | | | | | | |
| Output from water he | ater (calc | ulated al | oove) | | | | | | | | | |
| Output from water he 206.79 182.31 | ater (calc 190.29 | ulated a | oove) 163.4 | 143.92 | 137.88 | 153.71 | 155.41 | 176.96 | 188.28 | 201.87 | | |
| 206.79 182.31 | 190.29 | | | 143.92 | 137.88 | 153.71 | 155.41 | 176.96 | 188.28 | 201.87 | 80.3 | (216) |
| 206.79 182.31 Efficiency of water he | 190.29 | | | 143.92 | 137.88 | 153.71 | 155.41 | 176.96 85.5 | 188.28 87.31 | 201.87 | 80.3 | (216) |
| 206.79 182.31 Efficiency of water he 217)m= 87.89 87.51 Fuel for water heating | 190.29 ater 86.84 | 168.78 85.48 onth | 163.4 | | | | | | | | 80.3 | |
| | 190.29 ater 86.84 | 168.78 85.48 onth | 163.4 | | | | | | | | 80.3 | |
| | 190.29 ater 86.84 , kWh/mo 0 ÷ (217) | 168.78 85.48 Onth | 163.4 83.18 | 80.3 | 80.3 | 80.3 | 80.3 | 85.5 | 87.31 | 88 | 80.3 | (217) |
| 206.79 182.31 Efficiency of water he 217)m= 87.89 87.51 Fuel for water heating (219)m = (64)m x 10 (219)m= 235.28 208.33 | 190.29 ater 86.84 , kWh/mo 0 ÷ (217) | 168.78 85.48 Onth | 163.4 83.18 | 80.3 | 80.3 | 80.3 | 80.3 | 85.5 206.97 19a) ₁₁₂ = | 87.31 | 229.39 | | (217) |
| 206.79 182.31 Efficiency of water he 217)m= 87.89 87.51 Fuel for water heating 219)m = (64)m x 10 219)m= 235.28 208.33 Annual totals | 190.29 ater 86.84 kWh/ma 0 ÷ (217) 219.11 | 85.48 onth m 197.45 | 83.18 196.44 | 80.3 | 80.3 | 80.3 | 80.3 | 85.5 206.97 19a) ₁₁₂ = | 87.31 | 229.39 | 2444.49 | (217 |
| | 190.29 ater 86.84 kWh/ma 0 ÷ (217) 219.11 ed, main | 85.48 onth m 197.45 | 83.18 196.44 | 80.3 | 80.3 | 80.3 | 80.3 | 85.5 206.97 19a) ₁₁₂ = | 87.31 | 229.39 | 2444.49 kWh/yea | (217 |
| 206.79 182.31 Efficiency of water he 217)m= 87.89 87.51 Fuel for water heating 219)m = (64)m x 10 219)m= 235.28 208.33 Annual totals Space heating fuel us Water heating fuel us | 190.29 ater 86.84 1, kWh/mo 0 ÷ (217) 219.11 ed, main | 85.48 onth m 197.45 | 163.4 83.18 196.44 | 80.3 | 80.3 | 80.3 | 80.3 | 85.5 206.97 19a) ₁₁₂ = | 87.31 | 229.39 | 2444.49 kWh/yea 3541.9 | (217 |
| 206.79 182.31 Efficiency of water he 217)m= 87.89 87.51 Fuel for water heating 219)m = (64)m x 10 219)m= 235.28 208.33 Annual totals Space heating fuel us Water heating fuel us | 190.29 ater 86.84 1, kWh/mo 0 ÷ (217) 219.11 ed, main ed fans and | 85.48 onth m 197.45 | 163.4 83.18 196.44 | 80.3 | 80.3 | 80.3 | 80.3 | 85.5 206.97 19a) ₁₁₂ = | 87.31 | 229.39 | 2444.49 kWh/yea 3541.9 | (217) |
| 206.79 182.31 Efficiency of water he 217)m= 87.89 87.51 Fuel for water heating 219)m = (64)m x 10 219)m= 235.28 208.33 Annual totals Space heating fuel us Water heating fuel us Electricity for pumps, | 190.29 ater 86.84 1, kWh/mo 0 ÷ (217) 219.11 ed, main ed fans and o: | 85.48 onth m 197.45 | 163.4 83.18 196.44 | 80.3 | 80.3 | 80.3 | 80.3 | 85.5 206.97 19a) ₁₁₂ = | 87.31 | 229.39 | 2444.49 kWh/yea 3541.9 | (217) (219) r (230) |
| Efficiency of water he (217)m= 87.89 87.51 Fuel for water heating (219)m = (64)m x 10 (219)m= 235.28 208.33 Annual totals Space heating fuel us Water heating fuel us Electricity for pumps, central heating pump boiler with a fan-ass | 190.29 ater 86.84 1, kWh/mc 0 ÷ (217) 219.11 ed, main ed fans and o: sted flue | 85.48 onth m 197.45 system electric | 163.4 83.18 196.44 | 80.3 | 80.3 | 80.3 191.42 Tota | 80.3 193.53 I = Sum(2 | 85.5 206.97 19a) ₁₁₂ = | 87.31 215.64 Wh/year | 229.39 | 2444.49 kWh/yea 3541.9 2444.49 | (217) (219) r (230) |
| Efficiency of water he (217)m= 87.89 87.51 Fuel for water heating (219)m = (64)m x 10 (219)m= 235.28 208.33 Annual totals Space heating fuel us Water heating fuel us Electricity for pumps, central heating pump | 190.29 ater 86.84 1, kWh/mc 0 ÷ (217) 219.11 ed, main ed fans and o: sted flue | 85.48 onth m 197.45 system electric | 163.4 83.18 196.44 | 80.3 | 80.3 | 80.3 191.42 Tota | 80.3 193.53 I = Sum(2 | 85.5 206.97 19a) ₁₁₂ = k\ | 87.31 215.64 Wh/year | 229.39 | 2444.49 kWh/yea 3541.9 | (217) |

Energy

kWh/year

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Emissions

kg CO2/year

Emission factor

kg CO2/kWh

| Space heating (main system 1) | (211) x | 0.216 | | 765.05 (261 | 1) |
|---------------------------------------------------|---------------------------------|-----------------|---|--------------|----|
| Space heating (secondary) | (215) x | 0.519 | : | 0 (263 | 3) |
| Water heating | (219) x | 0.216 | = | 528.01 (264 | 4) |
| Space and water heating | (261) + (262) + (263) + (264) = | | | 1293.06 (265 | 5) |
| Electricity for pumps, fans and electric keep-hot | (231) x | 0.519 = | = | 38.93 (267 | 7) |
| Electricity for lighting | (232) x | 0.519 | : | 190.73 (268 | 3) |
| Total CO2, kg/year | sum | of (265)(271) = | | 1522.71 (272 | 2) |

TER = 17.51 (273)

| | | | = | N 4 11 | | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|------------|--------------|-------------|------------|----------|-----------|---------------|----------|
| | | | User L | Details: | | | | | | |
| Assessor Name: | Neil Ingham | | | Strom | a Num | ber: | | STRO | 0002943 | |
| Software Name: | Stroma FSAP | 2012 | | Softwa | are Ve | rsion: | | Versio | n: 1.0.1.9 | |
| | | Р | roperty | Address | Flat 3 | | | | | |
| Address : | | ester Mews | , LOND(| ON, NW1 | 9JB | | | | | |
| Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.1.9 | | | | | | | | | | |
| Construct the con- | | | | | | | | 1,, , | | <u>-</u> |
| Ground floor | | | | 50.12 | (1a) x | 2 | 2.8 | (2a) = | 140.34 | (3a) |
| Total floor area TFA = (1 | a)+(1b)+(1c)+(1d) | +(1e)+(1r | ገ) 5 | 50.12 | (4) | | | | | |
| Dwelling volume | | | | | (3a)+(3b |)+(3c)+(3c | d)+(3e)+ | (3n) = | 140.34 | (5) |
| 2. Ventilation rate: | | | | -41 | | 4-4-1 | | | | |
| | | | ту | otner | | totai | | | m³ per nou | ır — |
| Number of chimneys | 0 | + 0 | _] + | 0 | _ = _ | 0 | X 4 | 40 = | 0 | (6a) |
| Number of open flues | 0 | + 0 | 7 + [| 0 | = | 0 | x 2 | 20 = | 0 | (6b) |
| Assessor Name: Stroma FSAP 2012 Software Name: Stroma FSAP 2012 Property Address: Flat 3, 16, Rochester Mews, LONDON, NW1 9JE 1. Overall dwelling dimensions: Area(m²) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 50.12 (4) Dwelling volume 3.a) 2. Ventilation rate: main | | | | Ī | 2 | x - | 10 = | 20 | (7a) | |
| Number of passive vents | 5 | | | | F | 0 | x · | 10 = | 0 | (7b) |
| Number of flueless gas f | ires | | | | F | 0 | x | 40 = | 0 | (7c) |
| The second of th | | | | | L | | | | | (. %) |
| | | | | | | | | Air ch | nanges per ho | our |
| Infiltration due to chimne | eys, flues and fans | = (6a)+(6b)+(7a) | 7a)+(7b)+(| (7c) = | | 20 | | ÷ (5) = | 0.14 | (8) |
| | | tended, procee | d to (17), | otherwise (| continue fr | om (9) to | (16) | | | _ |
| • | the dwelling (ns) | | | | | | | | - | (9) |
| | 0.05 (| . | 0.05.6 | | | | [(9) | -1]x0.1 = | | (10) |
| | | | | | • | uction | | | 0 | (11) |
| | | | The great | ici wali arc | a (anoi | | | | | |
| If suspended wooden | floor, enter 0.2 (un | sealed) or 0 | .1 (seale | ed), else | enter 0 | | | | 0 | (12) |
| If no draught lobby, er | nter 0.05, else ente | r 0 | | | | | | | 0 | (13) |
| • | s and doors draug | ht stripped | | | | | | | 0 | (14) |
| | | | | - | ` ' | - | | | 0 | (15) |
| | | | | | | | | | 0 | (16) |
| • | • | | • | • | • | etre of e | envelope | area | 5 | (17) |
| • | - | | | | | io hoina u | and | | 0.39 | (18) |
| | | st rias been doi | ie oi a ue | gree air pe | ппеаышу | is being u | seu | | 3 | (19) |
| | 5 | | | (20) = 1 - | [0.075 x (| 19)] = | | | | (20) |
| Infiltration rate incorpora | ting shelter factor | | | (21) = (18 |) x (20) = | | | | 0.3 | (21) |
| Infiltration rate modified | for monthly wind sp | peed | | | | | | | | ` |
| Jan Feb | Mar Apr M | lay Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| Monthly average wind si | <u> </u> | | • | | | • | • | • | • | |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) | | | | | | | | | | |
| | ı I | | | | | • | • | | 1 | |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) | | | | 1 | | | | | | |
| (∠∠a)m= 1.2/ 1.25 | 1.23 1.1 1.0 | U8 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 | J | |

| Adjusted infiltration rat | e (allowi | na for sh | nelter an | d wind s | speed) = | (21a) x | (22a)m | | | | | |
|--------------------------------------------------------|--------------|--------------|-------------|----------------|------------------|----------------|------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------|------------------|-----------------------------|
| 0.39 0.38 | 0.37 | 0.33 | 0.33 | 0.29 | 0.29 | 0.28 | 0.3 | 0.33 | 0.34 | 0.36 | | |
| Calculate effective air | - | rate for t | he appli | cable ca | se | | | | | | | |
| If mechanical ventila | | | | | | | | | | | 0 | (23a |
| If exhaust air heat pump | | | | | | | | o) = (23a) | | | 0 | (23b |
| If balanced with heat reco | • | • | · · | | , | | , | | | | 0 | (23c) |
| a) If balanced mech | | | | | - ` ` | | ŕ | , | ` | - ` ´ | ÷ 100] | |
| (24a)m = 0 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (24a |
| b) If balanced mech | | | | 1 | | ЛV) (24b | <u> </u> | 2b)m + (| 23b) | | 1 | |
| (24b)m = 0 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (24b |
| c) If whole house ex if (22b)m < 0.5 | | | • | • | | | | .5 × (23k | o) | | | |
| (24c)m= 0 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (24c |
| d) If natural ventilati | | | • | • | | | | 0.51 | | | ı | |
| if $(22b)m = 1$, th (24d)m = 0.58 = 0.57 | 0.57 | 0.56 | 0.55 | 0.54 | 0.54 | 0.5 + [(2 | 0.55 | 0.55 | 0.56 | 0.56 | l | (24d |
| ` ' | | <u> </u> | | <u> </u> | <u> </u> | <u> </u> | <u> </u> | 1 0.00 | 1 0.00 | 0.50 | I | (2 70 |
| Effective air change (25)m= 0.58 0.57 | 0.57 | 0.56 | 0.55 | 0.54 | 0.54 | 0.54 | 0.55 | 0.55 | 0.56 | 0.56 | 1 | (25) |
| (23)111= 0.36 0.37 | 0.57 | 0.50 | 0.55 | 0.54 | 0.54 | 0.54 | 0.55 | 0.55 | 0.30 | 0.30 | | (23) |
| 3. Heat losses and he | eat loss p | oaramete | er: | | | | | | | | | |
| ELEMENT Gros | T | Openin m | | Net Ar A ,n | | U-valı W/m2 | | A X U (W/ | | k-value kJ/m²·l | | A X k kJ/K |
| Windows Type 1 | | | | 6.09 | х1. | /[1/(1.4)+ | 0.04] = | 8.07 | | | | (27) |
| Windows Type 2 | | | | 6.44 | x1. | /[1/(1.4)+ | 0.04] = | 8.54 | | | | (27) |
| Walls Type1 57. | 12 | 12.5 | 3 | 44.59 |) x | 0.18 | | 8.03 | | | | (29) |
| Walls Type2 21.8 | 34 | 0 | | 21.84 | x x | 0.15 | च -i | 3.38 | | | 5 <u>–</u> | (29) |
| Total area of elements | s, m² | | | 78.96 | <u></u> | | | | | | | (31) |
| Party wall | | | | 13.44 | x x | 0 | ─ | 0 | | | | (32) |
| Party floor | | | | 50.12 | = | | | | | | 7 H | (32a |
| Party ceiling | | | | 50.12 | = | | | | | | $\exists \vdash$ | (32b |
| Internal wall ** | | | | 66.64 | _ | | | | L | | | (32c |
| * for windows and roof wind | ows use e | effective wi | ndow H-va | | | ı formula 1 | /[(1/Ll-valu | ıe)+0 041 a |] as aiven in | naragrant | | (320) |
| ** include the areas on both | | | | | a.c.a a.cg | | , _{[(1} , 0) rand | | g | paragrap. | . 0.2 | |
| Fabric heat loss, W/K | = S (A x | U) | | | | (26)(30) | + (32) = | | | | 28.02 | (33) |
| Heat capacity Cm = S | (A x k) | | | | | | ((28). | (30) + (3 | 2) + (32a). | (32e) = | 8698.70 | (34) |
| Thermal mass parame | eter (TMF | P = Cm ÷ | - TFA) ir | n kJ/m²K | | | Indica | ntive Value | : Medium | | 250 | (35) |
| For design assessments who can be used instead of a de | | | construct | ion are not | t known pr | ecisely the | e indicative | e values of | TMP in T | able 1f | | |
| Thermal bridges : S (L | x Y) cal | culated (| using Ap | pendix k | < | | | | | | 4.26 | (36) |
| if details of thermal bridging | are not kn | own (36) = | = 0.15 x (3 | 1) | | | | | | | | |
| Total fabric heat loss | | | | | | | (33) + | - (36) = | | | 32.28 | (37) |
| Ventilation heat loss c | alculated | monthly | | | | | | = 0.33 × (| (25)m x (5) |) | 1 | |
| Jan Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| (38)m= 26.64 26.5 | 26.37 | 25.75 | 25.63 | 25.09 | 25.09 | 24.99 | 25.3 | 25.63 | 25.87 | 26.11 | | (38) |
| Heat transfer coefficie | nt, W/K | | | | | | (39)m | ı = (37) + (| 38)m | | _ | |
| (39)m= 58.92 58.78 | 58.65 | 58.03 | 57.91 | 57.37 | 57.37 | 57.27 | 57.58 | 57.91 | 58.15 | 58.4 | | |
| Stroma FSAP 2012 Version | : 1.0.1.9 (S | SAP 9.92) | http://ww | w.stroma.d | com | | | Average = | Sum(39) ₁ | 12 /12= | 58.0 β | age 2 of (3 / 9) |

| Heat loss para | meter (l | -II P) \/// | m²K | | | | | (40)m | = (39)m ÷ | - (4) | | | |
|----------------------|--------------|--------------|-------------|----------------|-------------|------------------------|------------------------|--------------|-------------|-------------------------|----------|---------|-------|
| | | <u> </u> | | 1 16 | 1 14 | 1 14 | 1 14 | ` ′ | · | T | 1 17 | | |
| (10) | O me | | | | | | | | | | | | |
| Number of day | s in mo | nth (Tabl | le 1a) | | | | | | rorago | Sum(10) | | 0 | (\ -/ |
| (40)me | | | | | | | | | | | | | |
| (41)m= 31 | 28 | 31 | | | 30 | 31 | , | | 31 | 30 | 31 | | (41) |
| | | | | | | | | | | | | | |
| 4. Water heat | ing ene | rgy requi | rement: | | | | | | | | kWh/ye | ear: | |
| | | | | | | | | | | | | | |
| if TFA > 13.9 | 0, N = 1 | | [1 - exp | (-0.0003 | 349 x (TF | FA -13.9) |)2)] + 0.0 | 0013 x (¯ | ΓFA -13 | | 69 | | (42) |
| | | | | | | | | | | | .42 | | (43) |
| | • | | | | - | • | o achieve | a water us | se target o | of ^t | | | |
| | | | | | lot and co | | | 1 | Ī | | ı 1 | | |
| | | | | | | | | Sep | Oct | Nov | Dec | | |
| Hot water usage in | i litres pei | r day for ea | ecn montn | να,m = τa | ctor trom | able 1c x | (43) | | | | | | |
| (44)m= 81.87 | 78.89 | 75.91 | 72.93 | 69.96 | 66.98 | 66.98 | 69.96 | 72.93 | 75.91 | 78.89 | 81.87 | | _ |
| Energy content of | hot water | used - cal | culated m | onthly = 4 . | 190 x Vd,r | n x nm x D |)Tm / 3600 | | | | | 893.08 | (44) |
| | | | | | | | | | | 1 | | | |
| | | <u> </u> | | l | | l | | - | rotal = Su | ım(45) ₁₁₂ = | = | 1170.96 | (45) |
| If instantaneous wa | ater heati | ng at point | of use (no | hot water | storage), | enter 0 in | boxes (46 ₎ |) to (61) | | , , | ' | | |
| (46)m= 18.21 | 15.93 | 16.44 | 14.33 | 13.75 | 11.86 | 10.99 | 12.62 | 12.77 | 14.88 | 16.24 | 17.64 | | (46) |
| Water storage | loss: | | | | | | | | | | | | |
| Storage volume | e (litres) | includin | g any so | olar or W | /WHRS | storage | within sa | ame ves | sel | | 0 | | (47) |
| • | • | | | • | | | ` ' | | | | | | |
| | | hot wate | er (this in | icludes i | nstantar | neous co | mbi boil | ers) ente | er '0' in (| (47) | | | |
| • | | oolorod k | ooo foot | or io kno | | 2/dox4): | | | | | | | (40) |
| • | | | | JI IS KIIO | WII (KVVI | i/day). | | | | | | | |
| • | | | | | | | | | | | 0 | | , , |
| • • • | | _ | - | | or io not | | (48) x (49) |) = | | | 0 | | (50) |
| • | | | - | | | | | | | | 0 | | (51) |
| | - | | | _ (| ., 0, 0.0 | -57 | | | | | <u> </u> | | (0.) |
| • | _ | | | | | | | | | | 0 | | (52) |
| Temperature fa | actor fro | m Table | 2b | | | | | | | | 0 | | (53) |
| Energy lost from | m watei | storage | , kWh/ye | ear | | | (47) x (51) |) x (52) x (| 53) = | | 0 | | (54) |
| Enter (50) or (| 54) in (5 | 55) | | | | | | | | | 0 | | (55) |
| Water storage | loss cal | culated f | or each | month | | | ((56)m = (| 55) × (41)ı | m | | | | |
| (56)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (56) |
| If cylinder contains | dedicate | d solar sto | rage, (57)ı | m = (56)m | x [(50) – (| <u> </u> H11)] ÷ (5 | 0), else (5 | 7)m = (56) | m where (| H11) is fro | m Append | ix H | |
| (57)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (57) |
| Primary circuit | loss (ar | nual) fro | m Table | - 3 | | | | | | | 0 | | (58) |
| Primary circuit | • | • | | | 59)m = (| (58) ÷ 36 | 55 × (41) | m | | | | | * * |
| (modified by | | | | • | • | . , | , , | | r thermo | stat) | | | |
| (59)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (59) |
| | | | | | | | | | | | | | |

| Combi loss o | | | | <u> </u> | <u> </u> | - ` ` | <u> </u> | | | | | 1 | |
|--------------------------|----------------|------------|-------------|------------|-----------|-------------------|-----------|----------------|--------------|-------------------------|-------------|---------------|-----------|
| (61)m= 41.72 | 36.31 | 38.68 | 35.97 | 35.65 | 33.03 | 34.13 | 35.65 | 35.97 | 38.68 | 38.9 | 41.72 | | (61) |
| Total heat re | quired for | water h | eating ca | alculated | for eac | h month | (62)m | = 0.85 × | (45)m + | (46)m + | (57)m + | (59)m + (61)m | |
| (62)m= 163.1 | 2 142.49 | 148.25 | 131.49 | 127.31 | 112.13 | 107.42 | 119.75 | 121.08 | 137.87 | 147.17 | 159.29 | | (62) |
| Solar DHW inpu | it calculated | using App | endix G o | r Appendix | H (negat | ive quantity | y) (enter | '0' if no sola | r contribut | ion to wate | er heating) | | |
| (add addition | al lines if | FGHRS | and/or \ | WWHRS | applies | s, see Ap | pendix | (G) | , | , | , | 1 | |
| (63)m = 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (63) |
| Output from | water hea | ter | | | | _ | | | | | | | |
| (64)m= 163.1 | 2 142.49 | 148.25 | 131.49 | 127.31 | 112.13 | 107.42 | 119.75 | 121.08 | 137.87 | 147.17 | 159.29 | | , |
| | | | | | | | O | utput from w | ater heate | r (annual) ₁ | l12 | 1617.38 | (64) |
| Heat gains fr | om water | heating, | kWh/m | onth 0.2 | 5 ´ [0.85 | × (45)m | + (61) | m] + 0.8 | x [(46)m | + (57)m | + (59)m | [] | |
| (65)m= 50.8 | 44.38 | 46.1 | 40.75 | 39.39 | 34.56 | 32.9 | 36.88 | 37.29 | 42.65 | 45.73 | 49.52 | | (65) |
| include (57 | 7)m in cal | culation | of (65)m | only if c | ylinder i | s in the | dwellin | g or hot w | ater is f | om com | munity h | neating | |
| 5. Internal | gains (see | e Table 5 | and 5a |): | | | | | | | | | |
| Metabolic ga | ins (Table | e 5), Wat | ts | | | | | | | | | | |
| Jan | | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |] | |
| (66)m= 84.68 | 84.68 | 84.68 | 84.68 | 84.68 | 84.68 | 84.68 | 84.68 | 84.68 | 84.68 | 84.68 | 84.68 | 1 | (66) |
| Lighting gain | s (calcula | ted in Ap | pendix | L, equat | ion L9 o | r L9a), a | lso se | e Table 5 | • | • | • | • | |
| (67)m= 13.15 | 11.68 | 9.5 | 7.19 | 5.38 | 4.54 | 4.9 | 6.38 | 8.56 | 10.87 | 12.68 | 13.52 |] | (67) |
| Appliances g | ains (calc | ulated ir | Append | dix L, eq | uation L | .13 or L1 | 3a), al | so see Ta | ble 5 | | | | |
| (68)m= 147.5 | | 145.22 | 137 | 126.64 | 116.89 | 110.38 | 108.85 | | 120.92 | 131.29 | 141.03 |] | (68) |
| Cooking gair | ns (calcula | ted in A | ppendix | L, equat | ion L15 | or L15a |), also | see Table | 5 | ! | ! | J | |
| (69)m= 31.47 | _` | 31.47 | 31.47 | 31.47 | 31.47 | 31.47 | 31.47 | | 31.47 | 31.47 | 31.47 | 1 | (69) |
| Pumps and f | ans gains | (Table ! | 5а) | I | | ı | | | <u> </u> | <u> </u> | <u> </u> | J | |
| (70)m= 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |] | (70) |
| Losses e.g. | evaporatio | n (nega | tive valu | es) (Tab | le 5) | Į | | | | | | J | |
| (71)m= -67.74 | <u> </u> | -67.74 | -67.74 | -67.74 | -67.74 | -67.74 | -67.74 | -67.74 | -67.74 | -67.74 | -67.74 | 1 | (71) |
| Water heating | | | | | | | | | | | | J | |
| (72)m= 68.27 | `` | 61.97 | 56.6 | 52.94 | 48 | 44.22 | 49.57 | 51.79 | 57.33 | 63.51 | 66.56 | 1 | (72) |
| Total interna | _ | | | | | 1 | ļ | n + (69)m + | I | I | I | J | , |
| (73)m= 280.3 | _ | 268.09 | 252.2 | 236.36 | 220.83 | 210.91 | 216.2 | <u> </u> | 240.52 | 258.88 | 272.52 | 1 | (73) |
| 6. Solar gai | | 200.00 | 202.2 | 200.00 | 220.00 | 210.01 | 210.2 | 221110 | 2 10.02 | 200.00 | 272.02 | | (- / |
| Solar gains are | | using sola | r flux from | Table 6a | and assoc | iated equa | ations to | convert to th | ne applicat | ole orientat | tion. | | |
| Orientation: | Access F | actor | Area | | Flu | ıx | | g_ | | FF | | Gains | |
| | Table 6d | | m² | | Ta | ble 6a | | Table 6b | Т | able 6c | | (W) | |
| Southwest _{0.9} | 0.77 | X | 6.4 | 14 | x : | 36.79 | 1 [| 0.63 | х | 0.7 | = | 72.42 | (79) |
| Southwest _{0.9} | 0.77 | X | 6.4 | 14 | x (| 62.67 | i F | 0.63 | = | 0.7 | | 123.35 | (79) |
| Southwest _{0.9} | | x | | | | 85.75 | i F | 0.63 | - x | 0.7 | = = | 168.77 |] (79) |
| Southwest _{0.9} | <u> </u> | × | 6.4 | | | 06.25 | i F | 0.63 | - | 0.7 | | 209.12 | (79) |
| Southwest _{0.9} | | × | | == | = | 19.01 | i H | 0.63 | - x | 0.7 | = = | 234.23 |](79) |
| 3.07 | 0.17 | ^ | U., | r-r | ·' | 10.01 | J L | 0.00 | ^ L | 0.1 | | 204.20 | ٦٬٠٠٠, |

| F | | _ | | | r | | | 1 1 | | | | | | _ |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------|--------------------------------------|--------|----------------------------------------------|
| <u>L</u> | 0.77 | X | 6.4 | 14 | X | 1 | 18.15 | | 0.63 | X | 0.7 | = | 232.54 | (79) |
| Southwest _{0.9x} | 0.77 | X | 6.4 | 14 | x | 11 | 13.91 | | 0.63 | X | 0.7 | = | 224.19 | (79) |
| Southwest _{0.9x} | 0.77 | X | 6.4 | ļ 4 | x [| 10 | 04.39 | | 0.63 | X | 0.7 | = | 205.46 | (79) |
| Southwest _{0.9x} | 0.77 | X | 6.4 | 14 | x | 9 | 2.85 | | 0.63 | X | 0.7 | = | 182.75 | (79) |
| Southwest _{0.9x} | 0.77 | X | 6.4 | 14 | x | 6 | 9.27 | | 0.63 | X | 0.7 | = | 136.33 | (79) |
| Southwest _{0.9x} | 0.77 | X | 6.4 | 14 | x | 4 | 4.07 | | 0.63 | x | 0.7 | | 86.74 | (79) |
| Southwest _{0.9x} | 0.77 | X | 6.4 | 14 | x | 3 | 1.49 | | 0.63 | x | 0.7 | = | 61.97 | (79) |
| Northwest _{0.9x} | 0.77 | х | 6.0 |)9 | x | 1 | 1.28 | X | 0.63 | x | 0.7 | = | 21 | (81) |
| Northwest 0.9x | 0.77 | х | 6.0 |)9 | x | 2 | 2.97 | X | 0.63 | x | 0.7 | = | 42.75 | (81) |
| Northwest 0.9x | | | | | | | | | | | | | | |
| Northwest _{0.9x} | 0.77 | x | 6.0 |)9 | x | 6 | 7.96 | x | 0.63 | x | 0.7 | _ | 126.48 | (81) |
| Northwest _{0.9x} | 0.77 | x | 6.0 |)9 | x | 9 | 1.35 | x | 0.63 | x | 0.7 | = | 170.01 | (81) |
| Northwest _{0.9x} | 0.77 | x | 6.0 |)9 | × | 9 | 7.38 | x | 0.63 | x | 0.7 | = | 181.25 | (81) |
| Northwest _{0.9x} | 0.77 | x | 6.0 |)9 | x | 9 | 91.1 | x | 0.63 | x | 0.7 | | 169.56 | (81) |
| Northwest _{0.9x} | 0.77 | | | | | | | | | | | | | |
| Northwest 0.9x | 0.77 | x | 6.0 |)9 | x | 5 | 0.42 | x | 0.63 | x | 0.7 | <u> </u> | 93.84 | (81) |
| Northwest 0.9x | 0.77 | x | 6.0 |)9 | x | 2 | 8.07 | x | 0.63 | x | 0.7 | = | 52.24 | (81) |
| Northwest 0.9x | 0.77 | x | 6.0 |)9 | x | , | 14.2 | x | 0.63 | x | 0.7 | = | 26.42 | (81) |
| Northwest 0.9x | 0.77 | x | 6.0 |)9 | × | (| 9.21 | x | 0.63 | x | 0.7 | | 17.15 | (81) |
| • | | | | | - | | | | | _ | | | | _ |
| Solar gains in | watts, calc | ulated | for eac | h month | ì | | | (83)m | ı = Sum(74)m . | (82)m | | | | |
| (83)m= 93.42 | 166.1 2 | 45.79 | 335.6 | 404.24 | 41 | 13.79 | 393.75 | 340 | .63 276.59 | 188.5 | 7 113.16 | 79.12 | | (83) |
| Total gains – i | nternal and | d solar | (84)m = | = (73)m | + (8 | 33)m | , watts | | | | _ | | • | |
| (84)m= 373.79 | westo, se | | | | | | | | | | | | | |
| 7. Mean inter | Duthwest0 9, 0.77 | | | | | | | | | | | | | |
| Temperature | Southwesto, 9x | | | | | | | | | | | | | |
| Utilisation fac | uthwesto 9, 0.77 | | | | | | | | | | | | | |
| Jan | Feb | | iving are | ea, h1,m |) (SE | ee Ta | ble 9a) | ole 9, | Th1 (°C) | | | | 21 | (85) |
| | . 00 | Mar | | | Ť | | | | | Oct | Nov | Dec | 21 | (85) |
| (86)m= 0.99 | | - | Apr | May | Ì, | Jun | Jul | A | ug Sep | | + | | 21 | |
| ` ′ | 0.99 | 0.97 | Apr 0.9 | May 0.75 | 0 | Jun).56 | Jul 0.41 | A: | ug Sep 7 0.73 | | + | | 21 | |
| Mean interna | 0.99 | 0.97 ure in l | Apr 0.9 iving are | May 0.75 ea T1 (fo | ollov | Jun 0.56 w ste | Jul 0.41 ps 3 to 7 | 0.4 ' in T | ug Sep .7 0.73 | 0.94 | 0.99 | 1 | 21 | (86) |
| Mean interna (87)m= 19.86 | 0.99 Il temperatu 20.05 2 | 0.97 ure in 1 20.34 | Apr 0.9 iving are 20.67 | May 0.75 ea T1 (fo 20.9 | ollov | Jun 0.56 w ste 0.98 | Jul 0.41 ps 3 to 7 | 0.4 7 in T 20.9 | ug Sep .7 0.73 .7able 9c) .99 20.94 | 0.94 | 0.99 | 1 | 21 | (86) |
| Mean interna (87)m= 19.86 Temperature | 0.99 Il temperatu 20.05 2 during hea | 0.97 ure in l 20.34 ating p | Apr 0.9 iving are 20.67 eriods ir | May 0.75 ea T1 (for 20.9) rest of | ollov 20 | Jun 0.56 w ste 0.98 elling | Jul 0.41 ps 3 to 7 21 from Ta | 0.47 in T 20.9 | ug Sep 7 0.73 Table 9c) 99 20.94 9, Th2 (°C) | 20.63 | 0.99 | 19.82 | 21 | (86) |
| Mean interna (87)m= 19.86 Temperature (88)m= 19.94 | 0.99 Il temperatu 20.05 2 during hea | 0.97 ure in l 20.34 ating p | Apr 0.9 iving are 20.67 eriods ir 19.95 | May 0.75 ea T1 (for 20.9) n rest of 19.96 | ollov 20 dwo | Jun 0.56 w ste 0.98 elling 9.96 | Jul 0.41 ps 3 to 7 21 from Ta 19.96 | Au 0.47 in T 20.9 | ug Sep 7 0.73 Table 9c) 99 20.94 9, Th2 (°C) | 20.63 | 0.99 | 19.82 | 21 | (86) |
| Mean internation (87)m= 19.86 Temperature (88)m= 19.94 Utilisation factors | 0.99 Il temperatu 20.05 | 0.97 ure in 1 20.34 ating p 19.94 | Apr 0.9 iving are 20.67 eriods ir 19.95 est of d | May 0.75 ea T1 (for 20.9) rest of 19.96 welling, | 00 ollov 20 dwe | Jun 0.56 w ste 0.98 elling 9.96 m (se | Jul 0.41 ps 3 to 7 21 from Ta 19.96 ee Table | Ai 0.47 in T 20.93 able 9 19.9 | ug Sep 17 0.73 Table 9c) 199 20.94 19, Th2 (°C) 19.96 | 0.94 20.63 19.96 | 0.99 20.18 | 19.82 | 21 | (86) (87) (88) |
| Mean internation (87)m= 19.86 Temperature (88)m= 19.94 Utilisation fact (89)m= 0.99 | 0.99 Il temperatu 20.05 | 0.97 ure in 1 20.34 ating p 19.94 ns for r 0.95 | Apr 0.9 iving are 20.67 eriods ir 19.95 est of d | May 0.75 ea T1 (for 20.9) n rest of 19.96 welling, 0.69 | 0 ollow 20 dwo | Jun 0.56 w ste 0.98 elling 9.96 m (se 0.48 | Jul 0.41 ps 3 to 7 21 from Ta 19.96 ee Table 0.32 | Au 0.4 7 in T 20.3 able 9 19.3 9a) 0.3 | ug Sep 17 0.73 Table 9c) 99 20.94 9, Th2 (°C) 97 19.96 | 0.94 20.63 19.96 | 0.99 20.18 | 19.82 | 21 | (86) (87) (88) |
| Mean interna (87)m= 19.86 Temperature (88)m= 19.94 Utilisation fac (89)m= 0.99 Mean interna | 0.99 Il temperatu 20.05 during hea 19.94 ctor for gair 0.98 Il temperatu | 0.97 ure in 1 20.34 ating p 19.94 ns for r 0.95 ure in t | Apr 0.9 iving are 20.67 eriods in 19.95 est of d 0.87 | May 0.75 ea T1 (for 20.9) n rest of 19.96 welling, 0.69 of dwell | 00 ollov 20 dwo 19 h2,1 o | Jun 0.56 w ste 0.98 elling 9.96 m (se 0.48 | Jul 0.41 ps 3 to 7 21 from Ta 19.96 ee Table 0.32 ollow ste | Ai 0.4 7 in T 20.9 able 9 19.9 9a) 0.3 | ug Sep 7 0.73 Table 9c) 99 20.94 9, Th2 (°C) 97 19.96 17 0.64 to 7 in Table | 0.94 20.63 19.96 0.91 le 9c) | 0.99 20.18 19.95 0.98 | 1 19.82 19.95 | 21 | (86) (87) (88) (89) |
| Mean interna (87)m= 19.86 Temperature (88)m= 19.94 Utilisation fac (89)m= 0.99 Mean interna | 0.99 Il temperatu 20.05 during hea 19.94 ctor for gair 0.98 Il temperatu | 0.97 ure in 1 20.34 ating p 19.94 ns for r 0.95 ure in t | Apr 0.9 iving are 20.67 eriods in 19.95 est of d 0.87 | May 0.75 ea T1 (for 20.9) n rest of 19.96 welling, 0.69 of dwell | 00 ollov 20 dwo 19 h2,1 o | Jun 0.56 w ste 0.98 elling 9.96 m (se 0.48 | Jul 0.41 ps 3 to 7 21 from Ta 19.96 ee Table 0.32 ollow ste | Ai 0.4 7 in T 20.9 able 9 19.9 9a) 0.3 | ug Sep 7 0.73 Table 9c) 99 20.94 9, Th2 (°C) 97 19.96 17 0.64 to 7 in Table 96 19.92 | 0.94 20.63 19.96 0.91 le 9c) | 0.99 20.18 19.95 0.98 | 1 19.82 19.95 0.99 | | (86) (87) (88) (89) |
| Mean interna (87)m= 19.86 Temperature (88)m= 19.94 Utilisation fac (89)m= 0.99 Mean interna | 0.99 Il temperatu 20.05 during hea 19.94 ctor for gair 0.98 Il temperatu | 0.97 ure in 1 20.34 ating p 19.94 ns for r 0.95 ure in t | Apr 0.9 iving are 20.67 eriods in 19.95 est of d 0.87 | May 0.75 ea T1 (for 20.9) n rest of 19.96 welling, 0.69 of dwell | 00 ollov 20 dwo 19 h2,1 o | Jun 0.56 w ste 0.98 elling 9.96 m (se 0.48 | Jul 0.41 ps 3 to 7 21 from Ta 19.96 ee Table 0.32 ollow ste | Ai 0.4 7 in T 20.9 able 9 19.9 9a) 0.3 | ug Sep 7 0.73 Table 9c) 99 20.94 9, Th2 (°C) 97 19.96 17 0.64 to 7 in Table 96 19.92 | 0.94 20.63 19.96 0.91 le 9c) | 0.99 20.18 19.95 0.98 | 1 19.82 19.95 0.99 | | (86) (87) (88) (89) |
| Mean interna (87)m= 19.86 Temperature (88)m= 19.94 Utilisation fac (89)m= 0.99 Mean interna (90)m= 18.44 Mean interna | 0.99 Il temperatu 20.05 during hea 19.94 ctor for gair 0.98 Il temperatu 18.72 | 0.97 ure in 1 20.34 ating p 19.94 ns for r 0.95 ure in 1 19.13 | Apr 0.9 iving are 20.67 eriods ir 19.95 est of d 0.87 the rest 19.59 r the wh | May 0.75 ea T1 (for 20.9) n rest of 19.96 welling, 0.69 of dwell 19.86 | 0 0 0 20 | Jun 0.56 w ste 0.98 elling 9.96 m (se 0.48 T2 (fo 9.95 | Jul 0.41 ps 3 to 7 21 from Ta 19.96 ee Table 0.32 ollow ste 19.96 | Al 0.4 7 in T 20.9 19.9 9a) 0.3 19.9 + (1 | ug Sep 7 0.73 Table 9c) 99 20.94 9, Th2 (°C) 97 19.96 7 0.64 to 7 in Table 96 19.92 | 0.94 20.63 19.96 0.91 le 9c) 19.55 fLA = Liv | 0.99 20.18 19.95 0.98 18.91 ving area ÷ (4 | 1 19.82 19.95 0.99 18.39 | | (86) (87) (88) (89) (90) (91) |
| Mean interna (87)m= 19.86 Temperature (88)m= 19.94 Utilisation fac (89)m= 0.99 Mean interna (90)m= 18.44 Mean interna (92)m= 19.15 | 0.99 Il temperatu 20.05 | 0.97 ure in 1 20.34 ating p 19.94 ns for r 0.95 ure in 1 19.13 ure (fo | Apr 0.9 iving are 20.67 eriods ir 19.95 est of dr 0.87 the rest 19.59 r the wh | May 0.75 ea T1 (for 20.9) n rest of 19.96 welling, 0.69 of dwell 19.86 nole dwell 20.38 | 00000000000000000000000000000000000000 | Jun 0.56 w ste 0.98 elling 9.96 m (se 0.48 T2 (fo 9.95 g) = fl 0.47 | Jul 0.41 ps 3 to 7 21 from Ta 19.96 ee Table 0.32 ollow ste 19.96 _A × T1 20.48 | 9a) 0.3 19. 4 (1 20. | ug Sep 17 0.73 Table 9c) 99 20.94 0, Th2 (°C) 97 19.96 17 0.64 10 7 in Table 96 19.92 | 0.94 20.63 19.96 0.91 le 9c) 19.55 fLA = Liv | 0.99 20.18 19.95 0.98 18.91 ving area ÷ (4) | 1 19.82 19.95 0.99 18.39 | | (86) (87) (88) (89) (90) (91) |

| | | | · | | | | | | | 1 | 1 | ı | |
|----------------------------------|-------------------|---------------------|-------------|----------|-----------|----------|------------|-----------------------|------------|------------------------------|------------|----------------------------|------------|
| (93)m= 19.15 | 19.39 | 19.74 | 20.14 | 20.38 | 20.47 | 20.48 | 20.48 | 20.43 | 20.09 | 19.55 | 19.11 | | (93) |
| 8. Space hea | | | | | | | | | | | | | |
| Set Ti to the the utilisation | | | • | | ed at ste | ep 11 of | Table 9 | b, so tha | t Ti,m=(| 76)m an | d re-calc | culate | |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| Utilisation fac | L | | <u> </u> | I way | <u> </u> | - Oui | _ / tug | СОР | 000 | 1101 | 200 | | |
| (94)m= 0.99 | 0.98 | 0.95 | 0.87 | 0.72 | 0.52 | 0.37 | 0.42 | 0.68 | 0.92 | 0.98 | 0.99 | | (94) |
| Useful gains, | hmGm | , W = (94 | 4)m x (8 | 4)m | ļ | <u> </u> | | | | ! | 1 | l | |
| (95)m= 370.58 | 435.64 | 489.31 | 513.38 | 460.85 | 330.13 | 221.85 | 232.08 | 340.96 | 393.86 | 365.38 | 349.32 | | (95) |
| Monthly aver | age exte | rnal tem | perature | from Ta | able 8 | | | | | | • | | |
| (96)m= 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | | (96) |
| Heat loss rat | e for mea | an intern | al tempe | erature, | Lm , W = | =[(39)m | x [(93)m | – (96)m |] | - | | • | |
| (97)m= 875.03 | 851.76 | 776.38 | 652.06 | 502.83 | 336.77 | 222.77 | 233.77 | 364.42 | 549.57 | 723.72 | 870.62 | | (97) |
| Space heating | | 1 | r each n | nonth, k | Wh/mon | h = 0.02 | 24 x [(97 |)m – (95 |)m] x (4 | 1)m | , | | |
| (98)m= 375.31 | 279.63 | 213.58 | 99.85 | 31.23 | 0 | 0 | 0 | 0 | 115.85 | 258 | 387.84 | | _ |
| | | | | | | | Tota | l per year | (kWh/yeaı | r) = Sum(9 | 8)15,912 = | 1761.29 | (98) |
| Space heating | g require | ement in | kWh/m² | ²/year | | | | | | | | 35.14 | (99) |
| 9a. Energy red | quiremer | nts – Indi | ividual h | eating s | ystems i | ncluding | micro-C | CHP) | | | | | |
| Space heati | ng: | | | | | J | | , , | | | | | |
| Fraction of sp | pace hea | at from se | econdar | y/supple | mentary | system | | | | | | 0 | (201) |
| Fraction of sp | oace hea | at from m | nain syst | em(s) | | | (202) = 1 | - (201) = | | | | 1 | (202) |
| Fraction of to | tal heati | ng from | main sys | stem 1 | | | (204) = (2 | 02) × [1 – | (203)] = | | | 1 | (204) |
| Efficiency of | main spa | ace heat | ing syste | em 1 | | | | | | | | 93.4 | (206) |
| Efficiency of | • | | | | a svstem | າ. % | | | | | | 0 | (208) |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | kWh/yea | 」` ′ |
| Space heating | I | | <u> </u> | | L | - Oui | l rug | СОР | 000 | 1101 | 200 | i kvinyot | A 1 |
| 375.31 | 279.63 | 213.58 | 99.85 | 31.23 | 0 | 0 | 0 | 0 | 115.85 | 258 | 387.84 | | |
| (211)m = {[(98 | 3)m x (20 | | l (1) m } x | 100 ÷ (2 | (06) | | ! | | | | | | (211) |
| 401.83 | 299.39 | 228.67 | 106.9 | 33.44 | 0 | 0 | 0 | 0 | 124.04 | 276.23 | 415.25 | | (/ |
| | ! | <u> </u> | | <u> </u> | | | Tota | l (kWh/yea | ar) =Sum(2 | 1 211) _{15,1012} | <u> </u> | 1885.75 | (211) |
| Space heating | a fuel (s | econdar | v). kWh/ | month | | | | | | | | | _ |
| $= \{[(98)m \times (200)]\}$ | • | | • / · | | | | | | | | | | |
| (215)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | | | | ! | | | Tota | I (kWh/yea | ar) =Sum(2 | 215) _{15,101} | <u></u> | 0 | (215) |
| Water heating | 9 | | | | | | | | | | | | _ |
| Output from w | ater hea | ter (calc | ulated a | bove) | | | | | | | | • | |
| 163.12 | 142.49 | 148.25 | 131.49 | 127.31 | 112.13 | 107.42 | 119.75 | 121.08 | 137.87 | 147.17 | 159.29 | | _ |
| Efficiency of w | ater hea | iter | | | | | | | | | - | 80.3 | (216) |
| (217)m= 87.08 | 86.72 | 85.97 | 84.37 | 82.11 | 80.3 | 80.3 | 80.3 | 80.3 | 84.62 | 86.45 | 87.21 | | (217) |
| Fuel for water | • | | | | | | | | | | | | |
| (219)m = (64) (219)m = 187.32 | m x 100 164.31 |) ÷ (217) 172.45 | m 155.86 | 155.05 | 139.63 | 133.78 | 149.13 | 150.78 | 162.93 | 170.24 | 182.66 | | |
| (213)111= 107.32 | 104.31 | 172.45 | 133.80 | 133.05 | 139.03 | 133.78 | | 150.78 Il = Sum(2° | | 170.24 | 102.00 | 1024.45 | (240) |
| Annual totals | | | | | | | 1010 | – Juiii(Z | | Wh/yeaı | | 1924.15 | (219) |
| Space heating | | ed, main | system | 1 | | | | | ĸ | •••#yedi | | kWh/year 1885.75 | 7 |
| | | · | • | | | | | | | | | <u> </u> | J |

| | | | | | _ |
|---------------------------------------------------|---------------------------------|----------------------------|------|-------------------------|--------|
| Water heating fuel used | | | | 1924.15 | |
| Electricity for pumps, fans and electric keep-hot | | | | | |
| central heating pump: | | | 30 |] | (230c) |
| boiler with a fan-assisted flue | | | 45 |] | (230e) |
| Total electricity for the above, kWh/year | sum of (23 | 30a)(230g) = | | 75 | (231) |
| Electricity for lighting | | | | 232.3 | (232) |
| 12a. CO2 emissions – Individual heating system | s including micro-CHP | | | | |
| | Energy kWh/year | Emission fac kg CO2/kWh | ctor | Emissions kg CO2/yea | |
| Space heating (main system 1) | (211) x | 0.216 | = | 407.32 | (261) |
| Space heating (secondary) | (215) x | 0.519 | = | 0 | (263) |
| Water heating | (219) x | 0.216 | = | 415.62 | (264) |
| Space and water heating | (261) + (262) + (263) + (264) = | = | | 822.94 | (265) |
| Electricity for pumps, fans and electric keep-hot | (231) x | 0.519 | = | 38.93 | (267) |
| Electricity for lighting | (232) x | 0.519 | = | 120.56 | (268) |
| Total CO2, kg/year | SI | um of (265)(271) = | | 982.43 | (272) |
| | | | | | |

TER =

(273)

| | | | User [| Details: | | | | | | |
|---------------------------------------------------------|-----------------------|-------------------|---------------|---------------|---------------|------------|----------|------------|-----------------------|----------------|
| Assessor Name: | Neil Inghan | n | | Strom | a Num | ber: | | STRO | 002943 | |
| Software Name: | Stroma FS | | | Softwa | | | | Versio | n: 1.0.1.9 | |
| | | | Property | | | | | | | |
| Address : | Flat 4, 16, R | ochester Mev | · | | | | | | | |
| Overall dwelling dime | | | | - , | | | | | | |
| 5 | | | Are | a(m²) | | Av. He | eight(m) | | Volume(m ³ | 3) |
| Ground floor | | | | | (1a) x | _ | 2.8 | (2a) = | 141.71 | , (3a) |
| Total floor area TFA = (1 | a)+(1b)+(1c)+(| 1d)+(1e)+ | (1n) (1n) | 50.61 | (4) | | | _ | | |
| Dwelling volume | | | | | I (3a)+(3b |)+(3c)+(3c | d)+(3e)+ | (3n) = | 141.71 | (5) |
| 2. Ventilation rate: | | | | | | | | | | |
| 2. Ventuation rate. | main heating | second heatin | | other | | total | | | m³ per hou | ır |
| Number of chimneys | 0 | + 0 | 9 | 0 | = | 0 | x | 40 = | 0 | (6a) |
| Number of open flues | 0 | + 0 | | 0 | j = [| 0 | x | 20 = | 0 | (6b) |
| Number of intermittent fa | ans | | | | | 2 | x | 10 = | 20 | (7a) |
| Number of passive vents | 5 | | | | F | 0 | × | 10 = | 0 | (7b) |
| Number of flueless gas f | ires | | | | F | 0 | x | 40 = | 0 | (7c) |
| | | | | | L | | | | | |
| | | | | | | | | Air ch | anges per ho | our |
| Infiltration due to chimne | ys, flues and fa | ans = (6a) + (6b) | +(7a)+(7b)+ | (7c) = | | 20 | | ÷ (5) = | 0.14 | (8) |
| If a pressurisation test has t | been carried out or | is intended, prod | eed to (17), | otherwise (| continue fr | rom (9) to | (16) | | | |
| Number of storeys in t | he dwelling (ns |) | | | | | | | 0 | (9) |
| Additional infiltration | | | | | | | [(9 |)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0 | 0.25 for steel or | timber frame | or 0.35 fo | r masoni | ry consti | ruction | | | 0 | (11) |
| if both types of wall are p deducting areas of openi | | | g to the grea | ter wall are | ea (after | | | | | |
| If suspended wooden | floor, enter 0.2 | (unsealed) o | 0.1 (seale | ed), else | enter 0 | | | | 0 | (12) |
| If no draught lobby, en | nter 0.05, else e | enter 0 | | | | | | | 0 | (13) |
| Percentage of window | s and doors dra | aught stripped | t | | | | | | 0 | (14) |
| Window infiltration | | | | 0.25 - [0.2 | 2 x (14) ÷ 1 | 100] = | | | 0 | (15) |
| Infiltration rate | | | | (8) + (10) | + (11) + (1 | 12) + (13) | + (15) = | | 0 | (16) |
| Air permeability value, | q50, expresse | d in cubic me | tres per ho | our per s | quare m | etre of e | envelope | area | 5 | (17) |
| If based on air permeabi | lity value, then | (18) = [(17) ÷ 20 |]+(8), otherw | rise (18) = (| (16) | | | | 0.39 | (18) |
| Air permeability value applie | es if a pressurisatio | n test has been | done or a de | gree air pe | rmeability | is being u | ised | | | ` ′ |
| Number of sides sheltered | ed | | | | | | | | 3 | (19) |
| Shelter factor | | | | (20) = 1 - | [0.075 x (| 19)] = | | | 0.78 | (20) |
| Infiltration rate incorpora | ting shelter fac | tor | | (21) = (18 | s) x (20) = | | | | 0.3 | (21) |
| Infiltration rate modified | for monthly win | d speed | | | | | | | • | |
| Jan Feb | Mar Apr | May Ju | n Jul | Aug | Sep | Oct | Nov | Dec | | |
| Monthly average wind sp | peed from Table | e 7 | | | | | | | | |
| (22)m= 5.1 5 | 4.9 4.4 | 4.3 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 | | |
| \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ | 10) 1 | | | | | | | | | |
| Wind Factor (22a)m = (2 | :∠)m ÷ 4 | 1.00 0.00 | 0.05 | 1 0.00 | | | | _ | 1 | |

1.1

1.08

0.95

0.95

0.92

1.08

1.12

1.18

1.23

(22a)m=

1.27

1.25

| Adjusted infiltr | ation rate | e (allowi | ng for sl | nelter an | d wind s | speed) = | (21a) x | (22a)m | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------|-------------|------------|-------------|---------------|--------------|---------------------|-------------|-------------|-----------|--------|--------|
| b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | | | | | | | | | | | | | |
| | | • | rate for t | пе арріі | cable ca | ise | | | | | | 0 | (2: |
| If exhaust air h | eat pump (| using Appe | endix N, (2 | 3b) = (23a | a) × Fmv (e | equation (I | N5)) , othe | rwise (23b |) = (23a) | | | | |
| If balanced with | h heat reco | overy: effic | iency in % | allowing t | or in-use f | actor (fron | n Table 4h |) = | | | | 0 | (2: |
| a) If balance | ed mecha | anical ve | entilation | with he | at recov | ery (MVI | HR) (24a | a)m = (22) | 2b)m + (| 23b) × [| 1 – (23c) | ÷ 100] | |
| (24a)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |] | (24 |
| b) If balance | ed mecha | anical ve | entilation | without | heat red | covery (N | MV) (24b | o)m = (22 | 2b)m + (| 23b) | _ | - | |
| (24b)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |] | (24 |
| , | | | | • | | | | | 5 v (23h |) | | | |
| | | <u> </u> | · ` ` | <u> </u> | ŕ | · ` ` | ŕ | ŕ | · ` ` | ŕ | 0 |] | (24 |
| | ventilatio | n or wh | ole hous | e positi | ve input | ventilatio | | | | | | J | • |
| , | | | | • | • | | | | 0.5] | | | _ | |
| (24d)m= 0.57 | 0.57 | 0.57 | 0.56 | 0.55 | 0.54 | 0.54 | 0.54 | 0.55 | 0.55 | 0.56 | 0.56 | | (24 |
| Effective air | change | rate - er | nter (24a |) or (24l | o) or (24 | c) or (24 | d) in bo | x (25) | • | | , | • | |
| (25)m= 0.57 | 0.57 | 0.57 | 0.56 | 0.55 | 0.54 | 0.54 | 0.54 | 0.55 | 0.55 | 0.56 | 0.56 | | (25 |
| 3. Heat losse | s and he | eat loss p | paramet | er: | | | | | | | | | |
| ELEMENT | | _ | | = | | | | | | | | | |
| Windows Type | e 1 | | | | 8.73 | x1 | /[1/(1.4)+ | 0.04] = | 11.57 | | | | (27 |
| Windows Type | e 2 | | | | 1.96 | x1 | /[1/(1.4)+ | 0.04] = | 2.6 | | | | (27 |
| Walls Type1 | 56.5 | 56 | 12.6 | 5 | 43.9′ | ı x | 0.18 | = | 7.9 | | | | (29 |
| Walls Type2 | 19.8 | 38 | 0 | | 19.88 | 3 X | 0.15 | = | 3.08 | | | | (29 |
| Roof | 35.7 | 7 | 0 | | 35.7 | X | 0.13 | = | 4.64 | | | | (30 |
| Total area of e | elements | , m² | | | 112.1 | 4 | | | | | | | (3 |
| Party wall | | | | | 13.44 | 1 × | 0 | | 0 | | | | (32 |
| Party floor | | | | | 50.6 | 1 | | | | | | | (32 |
| Party ceiling | | | | | 14.9 | 1 | | | | Ī | | | (32 |
| Internal wall ** | ŧ | | | | 43.12 | 2 | | | | Ī | | | (32 |
| | | | | | | lated using | g formula 1 | /[(1/U-valu | ue)+0.04] a | as given in | paragrapl | h 3.2 | |
| Fabric heat los | | | | o ana par | | | (26)(30 |) + (32) = | | | | 32. | .4 (33 |
| Heat capacity | | • | , | | | | | ((28). | (30) + (32 | 2) + (32a). | (32e) = | 7613 | |
| Thermal mass | , | , | P = Cm - | - TFA) ir | n kJ/m²K | , <u>.</u> | | Indica | itive Value | : Medium | | 25 | |
| For design asses | | | | construct | ion are no | t known pi | recisely the | e indicative | e values of | TMP in Ta | able 1f | | |
| Thermal bridg | | | | using Ar | pendix l | K | | | | | | 5.0 | 08 (36 |
| if details of therm | | | | | - | | | | | | | | (0. |
| Total fabric he | at loss | | | | | | | (33) + | (36) = | | | 37.4 | 48 (37 |
| Ventilation hea | at loss ca | alculated | monthl | / | | | | - ` ` ` | = 0.33 × (| (25)m x (5) |) | 7 | |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |] | |

| | | | • | • | | | | | | | • | | |
|----------------------------------------------------------|-------------|-------------|-------------------|---------------|-------------|------------|-------------|-------------|------------------------|---------------------------------------|----------|---------|------|
| (38)m= 26.88 | 26.74 | 26.6 | 25.98 | 25.86 | 25.32 | 25.32 | 25.22 | 25.53 | 25.86 | 26.1 | 26.35 | | (38) |
| Heat transfer of | coefficie | nt, W/K | | | | | | (39)m | = (37) + (| 38)m | | | |
| (39)m= 64.35 | 64.21 | 64.08 | 63.46 | 63.34 | 62.79 | 62.79 | 62.69 | 63 | 63.34 | 63.57 | 63.82 | | _ |
| Heat loss para | meter (H | HLP), W/ | /m²K | | _ | | - | | Average = = (39)m ÷ | Sum(39)₁ · (4) | 12 /12= | 63.46 | (39) |
| (40)m= 1.27 | 1.27 | 1.27 | 1.25 | 1.25 | 1.24 | 1.24 | 1.24 | 1.24 | 1.25 | 1.26 | 1.26 | | _ |
| Number of day | e in mo | nth (Tah | lo 1a) | | | | | , | Average = | Sum(40) ₁ | 12 /12= | 1.25 | (40) |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| (41)m= 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | | (41) |
| (11) | | <u> </u> | | | | <u> </u> | | | <u> </u> | | | | ` ' |
| 4 Water beat | ing one | rav regui | iromont: | | | | | | | | kWh/ye | oar: | |
| 4. Water heat | ing ene | igy requi | nement. | | | | | | | | KVVII/y | zai. | |
| Assumed occu if TFA > 13.9 if TFA £ 13.9 | 9, N = 1 | | [1 - exp | (-0.0003 | 349 x (TF | FA -13.9 |)2)] + 0.0 | 0013 x (| ΓFA -13. | | .71 | | (42) |
| Annual averag | , | ater usad | ae in litre | es per da | av Vd.av | erage = | (25 x N) | + 36 | | 74 | l.77 | | (43) |
| Reduce the annua | al average | hot water | usage by | 5% if the c | lwelling is | designed | | | se target o | | | | (1-) |
| not more that 125 | litres per | person per | r day (all w r | ater use, i | hot and co | ld) T | | | | | | I | |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| Hot water usage ii | | | 1 | 1 | 1 | 1 | · <i>'</i> | | | 1 | <u> </u> | I | |
| (44)m= 82.24 | 79.25 | 76.26 | 73.27 | 70.28 | 67.29 | 67.29 | 70.28 | 73.27 | 76.26 | 79.25 | 82.24 | | 7 |
| Energy content of | hot water | used - cal | culated mo | onthly = 4. | 190 x Vd,r | m x nm x E | OTm / 3600 | | | m(44) ₁₁₂ = ables 1b, 1 | | 897.21 | (44) |
| (45)m= 121.97 | 106.67 | 110.08 | 95.97 | 92.08 | 79.46 | 73.63 | 84.49 | 85.5 | 99.64 | 108.77 | 118.12 | | _ |
| If instantaneous w | ator hooti | na at paint | of uso (no | hot water | r etorago) | ontor O in | haves (16 | | Γotal = Su | m(45) ₁₁₂ = | = | 1176.38 | (45) |
| | | | | | | | | | 44.05 | 1,000 | 17.70 | 1 | (46) |
| (46)m= 18.29 Water storage | 16 loss: | 16.51 | 14.4 | 13.81 | 11.92 | 11.04 | 12.67 | 12.83 | 14.95 | 16.32 | 17.72 | | (46) |
| Storage volum | |) includin | ng any so | olar or W | /WHRS | storage | within sa | ame ves | sel | | 0 | | (47) |
| If community h | eating a | and no ta | ınk in dw | elling, e | nter 110 | litres in | (47) | | | | | | , , |
| Otherwise if no | - | | | _ | | | ` ' | ers) ente | er '0' in (| 47) | | | |
| Water storage | | | | | | | | | | | | | |
| a) If manufact | | | | or is kno | wn (kWh | n/day): | | | | | 0 | | (48) |
| Temperature f | | | | | | | | | | | 0 | | (49) |
| Energy lost fro | | _ | - | | ar ia nat | | (48) x (49) |) = | | | 0 | | (50) |
| b) If manufactHot water stora | | | - | | | | | | | | 0 | | (51) |
| If community h | • | | | _ (| | -77 | | | | | | | () |
| Volume factor | from Ta | ble 2a | | | | | | | | | 0 | | (52) |
| Temperature f | actor fro | m Table | 2b | | | | | | | | 0 | | (53) |
| Energy lost fro | m water | storage | , kWh/ye | ear | | | (47) x (51) | x (52) x (| 53) = | | 0 | | (54) |
| Enter (50) or (| (54) in (5 | 55) | | | | | | | | | 0 | | (55) |
| Water storage | loss cal | culated f | for each | month | | | ((56)m = (| 55) × (41)ı | m | | | | |
| (56)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (56) |
| If cylinder contains | dedicate | d solar sto | rage, (57)ı | m = (56)m | x [(50) – (| H11)] ÷ (5 | 0), else (5 | 7)m = (56) | m where (| H11) is fro | m Append | ix H | |
| (57)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (57) |

| Primary circuit loss (annual) from Table 3 | | | 0 (| (58) |
|-------------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------|-----------------------|------|
| Primary circuit loss calculated for each month (59)m = (5 | 3) ÷ 365 × (41)m | | | |
| (modified by factor from Table H5 if there is solar wate | heating and a cylinde | r thermostat) | | |
| (59)m= 0 0 0 0 0 | 0 0 0 | 0 0 | 0 (| (59) |
| Combi loss calculated for each month (61)m = (60) ÷ 365 | × (41)m | | | |
| (61)m= 41.91 36.48 38.86 36.13 35.81 33.18 | 34.29 35.81 36.13 | 38.86 39.08 | 41.91 | (61) |
| Total heat required for water heating calculated for each | month (62)m = 0.85 × (| (45)m + (46)m + | (57)m + (59)m + (61)m | |
| | 07.92 120.31 121.64 | 138.51 147.85 | ` ' ' ' ' | (62) |
| Solar DHW input calculated using Appendix G or Appendix H (negative | quantity) (enter '0' if no sola | r contribution to wate | er heating) | |
| (add additional lines if FGHRS and/or WWHRS applies, | | | . | |
| (63)m= 0 0 0 0 0 0 | 0 0 0 | 0 0 | 0 (| (63) |
| Output from water heater | ļ ļ | ! | | |
| | 07.92 120.31 121.64 | 138.51 147.85 | 160.03 | |
| | Output from w | ater heater (annual) _{1.} | 12 1624.86 (| (64) |
| Heat gains from water heating, kWh/month 0.25 ´ [0.85 × | (45)m + (61)ml + 0.8 x | x [(46)m + (57)m | + (59)m 1 | |
| | 33.06 37.05 37.46 | 42.85 45.94 | | (65) |
| include (57)m in calculation of (65)m only if cylinder is | n the dwelling or hot w | vater is from com | munity heating | |
| 5. Internal gains (see Table 5 and 5a): | in the aweiling of flot w | rater is from com | manity floating | |
| | | | | |
| Metabolic gains (Table 5), Watts | Jul Aug Sep | Oct Nov | Dec | |
| Jan Feb Mar Apr May Jun | Jul Aug Sep 85.4 85.4 85.4 | 85.4 85.4 | | (66) |
| ` ' | <u> </u> | 03.4 03.4 | 03.4 | ,00) |
| Lighting gains (calculated in Appendix L, equation L9 or l | ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' | 10.06 12.70 | 12.64 | (67) |
| (67)m= 13.27 11.78 9.58 7.26 5.42 4.58 | 4.95 6.43 8.63 | 10.96 12.79 | 13.64 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 | | | | (00) |
| | 11.33 109.79 113.68 | 121.97 132.42 | 142.25 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 o | | | | |
| | 31.54 31.54 31.54 | 31.54 31.54 | 31.54 | (69) |
| Pumps and fans gains (Table 5a) | | | | |
| (70)m= 3 3 3 3 3 3 | 3 3 3 | 3 3 | 3 (| (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | |
| (71)m= -68.32 -68.32 -68.32 -68.32 -68.32 -68.32 | 68.32 -68.32 -68.32 | -68.32 -68.32 | -68.32 | (71) |
| Water heating gains (Table 5) | | | | |
| (72)m= 68.59 66.35 62.25 56.86 53.19 48.22 | 44.43 49.8 52.03 | 57.59 63.8 | 66.87 | (72) |
| Total internal gains = (66)m | + (67)m + (68)m + (69)m + | (70)m + (71)m + (72) | m | |
| (73)m= 282.3 280.12 269.93 253.93 237.96 222.32 | 212.33 217.64 225.97 | 242.14 260.64 | 274.38 | (73) |
| 6. Solar gains: | | | | |
| Solar gains are calculated using solar flux from Table 6a and associate | ed equations to convert to the | ne applicable orientat | ion. | |
| Orientation: Access Factor Area Flux | g_ - | FF | Gains | |
| Table 6d m ² Table | e 6a Table 6b | Table 6c | (W) | |
| Southeast 0.9x 0.77 x 8.73 x 36. | 79 × 0.63 | x 0.7 | = 98.17 (| (77) |
| Southeast 0.9x 0.77 x 8.73 x 62. | 87 × 0.63 | x 0.7 | = 167.21 | (77) |

| | | | | | _ | | , | | | - | | | | _ |
|---------------------------|--------------------|------------|-----------|------------|-----------|------------|----------|-------------|-------------------|-------|---------------|----------|--------|------|
| Southeast 0.9x | 0.77 | X | 8.7 | 73 | x | 85.75 | X | 0.63 | | X | 0.7 | = | 228.79 | (77) |
| Southeast 0.9x | 0.77 | х | 8.7 | ' 3 | X | 106.25 | X | 0.63 | | X | 0.7 | = | 283.48 | (77) |
| Southeast _{0.9x} | 0.77 | X | 8.7 | ' 3 | X | 119.01 | X | 0.63 | | X | 0.7 | = | 317.52 | (77) |
| Southeast 0.9x | 0.77 | X | 8.7 | ' 3 | X | 118.15 | X | 0.63 | | x | 0.7 | = | 315.22 | (77) |
| Southeast 0.9x | 0.77 | X | 8.7 | ' 3 | X | 113.91 | X | 0.63 | | x | 0.7 | = | 303.91 | (77) |
| Southeast 0.9x | 0.77 | X | 8.7 | ' 3 | X | 104.39 | X | 0.63 | | x | 0.7 | = | 278.51 | (77) |
| Southeast 0.9x | 0.77 | X | 8.7 | ' 3 | x | 92.85 | X | 0.63 | | x | 0.7 | = | 247.73 | (77) |
| Southeast 0.9x | 0.77 | X | 8.7 | ' 3 | x | 69.27 | X | 0.63 | | x [| 0.7 | = | 184.81 | (77) |
| Southeast 0.9x | 0.77 | Х | 8.7 | 73 | x | 44.07 | X | 0.63 | | x | 0.7 | = | 117.58 | (77) |
| Southeast 0.9x | 0.77 | Х | 8.7 | 73 | x | 31.49 | X | 0.63 | | x | 0.7 | = | 84.01 | (77) |
| Southwest _{0.9x} | 0.77 | x | 1.9 | 96 | x | 36.79 | Ī | 0.63 | | x | 0.7 | | 44.08 | (79) |
| Southwest _{0.9x} | 0.77 | X | 1.9 | 96 | x | 62.67 | Ī | 0.63 | | x | 0.7 | _ = | 75.08 | (79) |
| Southwest _{0.9x} | 0.77 | X | 1.9 | 96 | x | 85.75 | Ī | 0.63 | | x | 0.7 | = | 102.73 | (79) |
| Southwest _{0.9x} | 0.77 | Х | 1.9 | 96 | X | 106.25 | ĺ | 0.63 | | x | 0.7 | = | 127.29 | (79) |
| Southwest _{0.9x} | 0.77 | Х | 1.9 | 96 | X | 119.01 | ĺ | 0.63 | | x | 0.7 | = | 142.58 | (79) |
| Southwest _{0.9x} | 0.77 | X | 1.9 | 96 | X | 118.15 | j . | 0.63 | | × | 0.7 | | 141.54 | (79) |
| Southwest _{0.9x} | 0.77 | х | 1.9 | 96 | X | 113.91 | j | 0.63 | | × | 0.7 | = | 136.46 | (79) |
| Southwest _{0.9x} | 0.77 | х | 1.9 | 96 | X | 104.39 | ĺ | 0.63 | | x [| 0.7 | | 125.06 | (79) |
| Southwest _{0.9x} | 0.77 | x | 1.9 | 96 | x | 92.85 | ĺ | 0.63 | | × | 0.7 | _ = | 111.24 | (79) |
| Southwest _{0.9x} | 0.77 | X | 1.9 | 96 | x | 69.27 | ĺ | 0.63 | | × | 0.7 | _ = | 82.98 | (79) |
| Southwest _{0.9x} | 0.77 | X | 1.9 | 96 | x | 44.07 | ĺ | 0.63 | | × | 0.7 | _ = | 52.8 | (79) |
| Southwest _{0.9x} | 0.77 | X | 1.9 | 96 | x | 31.49 | i | 0.63 | | × | 0.7 | | 37.72 | (79) |
| ' | | | | | | | _ | | | | | | | |
| Solar gains in | watts, ca | alculated | for eac | h month | | | (83)m | n = Sum(74) |)m(8 | 2)m | | | | |
| (83)m= 142.25 | 242.3 | 331.52 | 410.77 | 460.1 | 456.77 | 440.37 | 403 | .57 358. | 97 26 | 67.79 | 170.38 | 121.73 | | (83) |
| Total gains – | internal a | nd solar | (84)m = | = (73)m - | + (83)m | n , watts | | | | | | | _ | |
| (84)m= 424.54 | 522.42 | 601.45 | 664.7 | 698.06 | 679.09 | 652.71 | 621 | .21 584. | 93 50 | 9.93 | 431.02 | 396.11 | | (84) |
| 7. Mean inte | rnal temp | erature | (heating | season |) | | | | | | | | | |
| Temperature | | | , | | | from Tal | ble 9 | , Th1 (°C |) | | | | 21 | (85) |
| Utilisation fac | ctor for g | ains for I | iving are | ea, h1,m | (see T | able 9a) | | | | | | | | |
| Jan | Feb | Mar | Apr | May | Jun | Jul | A | ug Se | ер | Oct | Nov | Dec | | |
| (86)m= 0.99 | 0.98 | 0.95 | 0.88 | 0.75 | 0.57 | 0.42 | 0.4 | 16 0.69 | 9 0 |).91 | 0.98 | 0.99 | | (86) |
| Mean interna | al temper | ature in | living an | ea T1 (fo | ollow st | ens 3 to 3 | 7 in T | able 9c) | | | -! | | _ | |
| (87)m= 19.81 | 20.05 | 20.35 | 20.66 | 20.88 | 20.97 | 21 | 20. | | 04 20 | 0.65 | 20.16 | 19.77 | 1 | (87) |
| ` ' | ا به مانسانه ما ام | | | | مالا مسلم | | | | | | | <u> </u> | | |
| Temperature (88)m= 19.86 | 19.87 | 19.87 | 19.88 | 19.88 | 19.89 | 19.89 | 19. | | - | 9.88 | 19.88 | 19.87 | 1 | (88) |
| | | | | <u> </u> | | | <u> </u> | 19.0 | ~ ¹³ | J.00 | 13.00 | 19.07 | J | (30) |
| Utilisation fac | T - | | | | | 1 | T - | | | | | ı | 7 | (00) |
| (89)m= 0.99 | 0.97 | 0.93 | 0.84 | 0.68 | 0.48 | 0.32 | 0.3 | 35 0.6 | 0 |).88 | 0.98 | 0.99 | | (89) |
| Mean interna | al temper | ature in | the rest | of dwelli | ng T2 (| follow ste | eps 3 | to 7 in T | able 9 | (c) | _ | | - | |
| (90)m= 18.32 | 18.66 | 19.08 | 19.51 | 19.77 | 19.87 | 19.89 | 19. | 89 19.8 | | 19.5 | 18.83 | 18.25 | | (90) |
| | | | | | | | | | fLA : | = Liv | ing area ÷ (4 | 4) = | 0.63 | (91) |
| | | | | | | | | | | | | | | |

| N A ' - (1 | | -1 /6- | | | | | . /4 (1 | ۸\ <u>T</u> ۵ | | | | | |
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| Mean internal (92)m= 19.26 | tempera 19.54 | ature (fo 19.88 | 20.24 | ole dwel | ling) = fi 20.57 | LA × 11 20.58 | + (1 – fL 20.58 | .A) × 12 | 20.22 | 19.67 | 19.21 | | (92) |
| ` ' | | | | | | | | | | 19.07 | 19.21 | | (32) |
| Apply adjustm (93)m= 19.26 | 19.54 | 19.88 | 20.24 | 20.47 | 20.57 | 20.58 | 20.58 | 20.53 | 20.22 | 19.67 | 19.21 | | (93) |
| 8. Space heat | | | | 20.47 | 20.01 | 20.50 | 20.00 | 20.00 | 20.22 | 13.07 | 10.21 | | (00) |
| Set Ti to the m | nean int | ernal ter | nperatur | | ed at sto | ep 11 of | Table 9l | o, so tha | t Ti,m=(| 76)m an | d re-calc | ulate | |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| Utilisation fact | | | | iviay | Odii | <u> </u> | | СОР | 001 | 1101 | 200 | | |
| (94)m= 0.99 | 0.97 | 0.93 | 0.86 | 0.72 | 0.54 | 0.38 | 0.42 | 0.65 | 0.89 | 0.97 | 0.99 | | (94) |
| Useful gains, l | hmGm , | W = (94 | 4)m x (84 | 4)m | | | | | | | | | |
| (95)m= 419.19 | 506.69 | 561.63 | 568.52 | 502.18 | 364.19 | 248.55 | 259.67 | 380.15 | 453.48 | 419.68 | 392.31 | | (95) |
| Monthly avera | ige exte | rnal tem | perature | from Ta | able 8 | • | | | | | | | |
| (96)m= 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | | (96) |
| Heat loss rate | for mea | an intern | al tempe | erature, l | Lm , W = | =[(39)m | x [(93)m | – (96)m |] | | | | |
| (97)m= 962.65 | 939.86 | 857.38 | 719.53 | 555.41 | 374.62 | 250.2 | 262.26 | 405.28 | 609.59 | 799.07 | 957.72 | | (97) |
| Space heating | | | | | | | |)m – (95 | | · | | | |
| (98)m= 404.33 | 291.09 | 220.04 | 108.73 | 39.6 | 0 | 0 | 0 | 0 | 116.15 | 273.16 | 420.67 | | _ |
| | | | | | | | Tota | l per year | (kWh/year |) = Sum(9 | 8) _{15,912} = | 1873.76 | (98) |
| Space heating | g require | ement in | kWh/m² | /year | | | | | | | | 37.02 | (99) |
| 9a. Energy req | uiremen | ıts – Indi | vidual h | eating sy | ystems i | ncluding | micro-C | HP) | | | | | |
| Space heatin | g: | | | | | | | | | | | | |
| Fraction of spa | ace hea | t from se | econdary | y/supple | mentary | system | | | | | | 0 | (201) |
| Fraction of spa | aca haa | | | | | | | | | | | | |
| | ace nea | t from m | nain syst | em(s) | | | (202) = 1 | - (201) = | | | | 1 | (202) |
| Fraction of total | | | • | , , | | | (202) = 1 (204) = (2 | | (203)] = | | | 1 | (202) |
| · | al heatir | ng from i | main sys | stem 1 | | | | | (203)] = | | | | ╡ |
| Fraction of total | al heatir nain spa | ng from i | main sysing syste | stem 1 em 1 | g systen | | | | (203)] = | | | 1 | (204) |
| Fraction of total | al heatir nain spa | ng from i | main sysing syste | stem 1 em 1 | g system Jun | | (204) = (2 | | (203)] = | Nov | Dec | 1 93.4 | (204) (206) (208) |
| Fraction of total | al heatir nain spa econda Feb | ng from i ace heati ry/supple Mar | main sys ing syste ementar Apr | stem 1 em 1 y heating May | Jun | າ, % | | 02) × [1 – | . /- | Nov | Dec | 93.4 0 | (204) (206) (208) |
| Fraction of total Efficiency of m Efficiency of s | al heatir nain spa econda Feb | ng from i ace heati ry/supple Mar | main sys ing syste ementar Apr | stem 1 em 1 y heating May | Jun | າ, % | (204) = (2 | 02) × [1 – | . /- | Nov 273.16 | Dec 420.67 | 93.4 0 | (204) (206) (208) |
| Fraction of total Efficiency of m Efficiency of s Jan Space heating | al heatir nain spa econdar Feb g require 291.09 | ng from in ace heating ry/supplement (c 220.04 | main systementary Apr Alculated 108.73 | em 1 y heating May d above) | Jun) 0 | n, % Jul | (204) = (2 | 02) × [1 – | Oct | | | 93.4 0 | (204) (206) (208) |
| Efficiency of m Efficiency of s Jan Space heating | al heatir nain spa econdar Feb g require 291.09 | ng from in ace heating ry/supplement (c 220.04 | main systementary Apr Alculated 108.73 | em 1 y heating May d above) | Jun) 0 | n, % Jul | (204) = (2 | 02) × [1 – | Oct | | | 93.4 0 | (204) (206) (208) ar |
| Fraction of total Efficiency of modern Efficiency of s Jan Space heating 404.33 (211)m = {[(98)] | al heatir nain spa econdar Feb g require 291.09 m x (20 | ng from ince heating mar Mar ement (c 220.04 | main systementary Apr Alculated 108.73 | etem 1 em 1 y heating May d above) 39.6 | Jun 0 0 | n, % Jul o | (204) = (2 Aug 0 | 02) × [1 - Sep 0 | Oct 116.15 | 273.16 292.46 | 420.67 450.39 | 93.4 0 | (204) (206) (208) ar |
| Fraction of total Efficiency of modern Efficiency of s Jan Space heating 404.33 (211)m = {[(98)] | al heatin nain spa econdar Feb g require 291.09 m x (20 311.66 | mg from a rece heating mar lement (c 220.04 4)] + (21 235.59 | main systementary Apr alculated 108.73 0)m } x | stem 1 em 1 y heating May d above) 39.6 100 ÷ (2 | Jun 0 0 | n, % Jul o | (204) = (2 Aug 0 | 02) × [1 - Sep 0 | Oct 116.15 | 273.16 292.46 | 420.67 450.39 | 1 93.4 0 kWh/ye | (204) (206) (208) ar |
| Fraction of total Efficiency of m Efficiency of s Jan Space heating 404.33 (211)m = {[(98) | reduire 291.09 m x (20 311.66 | Mar ement (c 220.04 4)] + (21 235.59 | main systementary Apr Alculated 108.73 0)m } x 116.41 | month | Jun 0 0 | n, % Jul o | (204) = (2 Aug 0 | 02) × [1 - Sep 0 | Oct 116.15 | 273.16 292.46 | 420.67 450.39 | 1 93.4 0 kWh/ye | (204) (206) (208) ar |
| Fraction of total Efficiency of m Efficiency of s Jan Space heating 404.33 (211)m = {[(98) 432.9} Space heating | reduire 291.09 m x (20 311.66 | Mar ement (c 220.04 4)] + (21 235.59 | main systementary Apr Alculated 108.73 0)m } x 116.41 | month | Jun 0 0 | n, % Jul o | (204) = (2 Aug 0 Tota | 02) × [1 – Sep 0 I (kWh/yea | Oct 116.15 124.36 ar) =Sum(2) | 273.16 292.46 211) _{15,1012} | 420.67 450.39 | 1 93.4 0 kWh/ye | (204) (206) (208) ar |
| Fraction of total Efficiency of modern Efficiency of substitution Space heating 404.33 (211)m = {[(98) 432.9 Space heating = {[(98)m x (20) 1 | al heatin nain spa econdar Feb g require 291.09 m x (20 311.66 | mg from a lace heating mar Mar ement (c 220.04 4)] + (21 235.59 econdary | main systementary Apr alculated 108.73 0)m } x 116.41 y), kWh/ | month 208) | Jun 0 06) | n, % Jul 0 | (204) = (2 Aug 0 Tota | 02) × [1 – Sep 0 I (kWh/yea | Oct 116.15 124.36 ar) =Sum(2 | 273.16 292.46 211) _{15,1012} | 420.67 450.39 | 1 93.4 0 kWh/ye | (204) (206) (208) ar |
| Fraction of total Efficiency of modern Efficiency of substitution Space heating 404.33 (211)m = {[(98) 432.9 Space heating = {[(98)m x (20) 1 | reduire 291.09 m x (20 311.66 g fuel (se 1)] + (21 0 | mg from a lace heating mar Mar ement (c 220.04 4)] + (21 235.59 econdary | main systementary Apr alculated 108.73 0)m } x 116.41 y), kWh/ | month 208) | Jun 0 06) | n, % Jul 0 | (204) = (2 Aug 0 Tota | 02) × [1 – Sep 0 I (kWh/yea | Oct 116.15 124.36 ar) =Sum(2) | 273.16 292.46 211) _{15,1012} | 420.67 450.39 | 1 93.4 0 kWh/ye | (204) (206) (208) ar (211) |
| Fraction of total Efficiency of moderate Efficiency of substituting Efficiency of substituting Incomplete Inco | al heatinnain sparecondaring Feb grequire 291.09 m x (20 311.66 green fuel (settle 1)] + (21 0 | mg from a lace heating supplement (constant) with the suppleme | main systementary Apr alculated 108.73 0)m } x 116.41 y), kWh/ x 100 ÷ (x 0 | month 208) | Jun 0 06) 0 | o 0 | (204) = (2 Aug 0 Tota 0 Tota | 02) × [1 – Sep 0 1 (kWh/yea | Oct 116.15 124.36 ar) =Sum(2 | 273.16 292.46 211) _{15,1012} 0 215) _{15,1012} | 420.67 | 1 93.4 0 kWh/ye | (204) (206) (208) ar (211) |
| Fraction of total Efficiency of modern Efficiency of substitution Space heating 404.33 (211)m = {[(98) | reduire 291.09 m x (20 311.66 lb] + (21 0 lb) atter hear 143.15 | Mar ement (c 220.04 4)] + (21 235.59 econdary 14) m } x 0 ter (calce | main systementary Apr alculated 108.73 0)m } x 116.41 y), kWh/x 100 ÷ (x | stem 1 em 1 y heating May d above) 39.6 100 ÷ (2 42.4 month 208) 0 | Jun 0 06) | n, % Jul 0 | (204) = (2 Aug 0 Tota | 02) × [1 – Sep 0 I (kWh/yea | Oct 116.15 124.36 ar) =Sum(2) | 273.16 292.46 211) _{15,1012} | 420.67 450.39 | 1 93.4 0 kWh/ye 2006.17 | (204) (206) (208) ar (211) (211) |
| Fraction of total Efficiency of modern Efficiency of some serious of the Efficiency of some serious of the Efficiency of some serious of the Efficiency of t | reduire 291.09 m x (20 311.66 g fuel (se 1)] + (21 0 atter hear 143.15 atter hear 143.15 | Mar ement (c 220.04 4)] + (21 235.59 econdary 14) m } x 0 | main systementary Apr alculated 108.73 0)m } x 116.41 y), kWh/(100 ÷ (2) 0 ulated alculated alc | month 208) oove) 127.9 | Jun 0 06) 0 | o 0 107.92 | (204) = (2 Aug 0 Tota 120.31 | 02) × [1 – Sep 0 0 I (kWh/yea 121.64 | Oct 116.15 124.36 ar) =Sum(2 0 ar) =Sum(2 | 273.16 292.46 211) _{15,1012} 0 215) _{15,1012} | 420.67 450.39 = 0 = | 1 93.4 0 kWh/ye | (204) (206) (208) ar (211) (211) |
| Fraction of total Efficiency of moderate Efficiency of substituting Efficiency of substituting Efficiency of substituting Efficiency of substituting Efficiency of water heating Output from water heating Efficiency of water Efficiency of substituting Efficiency of substitutin | al heatin sparecondar Feb grequire 291.09 m x (20 311.66 green full (sq. 1)] + (21 0 g | mg from ince heating ry/supplement (company) 220.04 4)] + (21 235.59 econdary 14) m } x 0 ter (calculater (calculater 86.03) | main systementary Apr alculated 108.73 0)m } x 116.41 y), kWh/ x 100 ÷ (x 0 | month 208) | Jun 0 06) 0 | o 0 | (204) = (2 Aug 0 Tota 0 Tota | 02) × [1 – Sep 0 1 (kWh/yea | Oct 116.15 124.36 ar) =Sum(2 | 273.16 292.46 211) _{15,1012} 0 215) _{15,1012} | 420.67 | 1 93.4 0 kWh/ye 2006.17 | (204) (206) (208) ar (211) (211) |
| Fraction of total Efficiency of moderate Efficiency of moderate Efficiency of substitution of the Efficiency of substitution of the Efficiency of water heating Output from water heating efficiency of water from water fro | al heatin sparecondar Feb grequire 291.09 m x (20 311.66 grequire 0 grequire 143.15 ater heat 86.8 neating, | mg from ince heating ry/supplement (comment (com | main systementary Apr alculated 108.73 0)m } x 116.41 y), kWh/ x 100 ÷ (x 0 ulated alculated a | month 208) oove) 127.9 | Jun 0 06) 0 | o 0 107.92 | (204) = (2 Aug 0 Tota 120.31 | 02) × [1 – Sep 0 0 I (kWh/yea 121.64 | Oct 116.15 124.36 ar) =Sum(2 0 ar) =Sum(2 | 273.16 292.46 211) _{15,1012} 0 215) _{15,1012} | 420.67 450.39 = 0 = | 1 93.4 0 kWh/ye 2006.17 | (204) (206) (208) ar (211) (211) |
| Fraction of total Efficiency of moderate Efficiency of substituting Efficiency of substituting Efficiency of substituting Efficiency of substituting Efficiency of water heating Output from water heating Efficiency of water Efficiency of substituting Efficiency of substitutin | al heatin sparecondar Feb grequire 291.09 m x (20 311.66 grequire 0 grequire 143.15 ater heat 86.8 neating, | mg from ince heating ry/supplement (comment (com | main systementary Apr alculated 108.73 0)m } x 116.41 y), kWh/ x 100 ÷ (x 0 ulated alculated a | month 208) oove) 127.9 | Jun 0 06) 0 | o 0 107.92 | (204) = (2 Aug 0 Tota 120.31 | 02) × [1 – Sep 0 0 I (kWh/yea 121.64 | Oct 116.15 124.36 ar) =Sum(2 0 ar) =Sum(2 | 273.16 292.46 211) _{15,1012} 0 215) _{15,1012} | 420.67 450.39 = 0 = | 1 93.4 0 kWh/ye 2006.17 | (204) (206) (208) ar (211) (211) |
| Fraction of total Efficiency of more Efficiency of more Efficiency of some Jan Space heating 404.33 (211)m = {[(98) | reduired spanning spa | mg from ince heating ry/supplement (continue 220.04 doi: 10.00 doi | main systementary Apr alculated 108.73 0)m } x 116.41 y), kWh/(x 100 ÷ (x 100 in the continuous con | month 208) 0 0 0 0 0 0 0 0 0 0 0 0 0 | Jun 0 0 06) 0 112.64 | o 0 0 107.92 80.3 | (204) = (2 Aug 0 Tota 120.31 80.3 | 02) × [1 – Sep 0 0 I (kWh/yea 121.64 80.3 | Oct 116.15 124.36 124.36 0 ar) =Sum(2 138.51 84.61 | 273.16 292.46 211) _{15,1012} 0 215) _{15,1012} 147.85 | 420.67 450.39 = 0 = 160.03 | 1 93.4 0 kWh/ye 2006.17 | (204) (206) (208) ar (211) (211) |

| Annual totals | | 1/\/\/h /\/.oo# | kWh/year |
|---------------------------------------------------|---------------------------------|-------------------------------|---------------------------------|
| Space heating fuel used, main system 1 | | kWh/year | 2006.17 |
| Water heating fuel used | | | 1930.79 |
| Electricity for pumps, fans and electric keep-hot | | | |
| central heating pump: | | 30 | (230c) |
| boiler with a fan-assisted flue | | 45 | (230e) |
| Total electricity for the above, kWh/year | sum of (230a | a)(230g) = | 75 (231) |
| Electricity for lighting | | | 234.31 (232) |
| 12a. CO2 emissions – Individual heating systems | s including micro-CHP | | |
| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |
| Space heating (main system 1) | (211) x | 0.216 = | 433.33 (261) |
| Space heating (secondary) | (215) x | 0.519 = | 0 (263) |
| Water heating | (219) x | 0.216 = | 417.05 (264) |
| Space and water heating | (261) + (262) + (263) + (264) = | | 850.38 (265) |
| Electricity for pumps, fans and electric keep-hot | (231) x | 0.519 = | 38.93 (267) |
| Electricity for lighting | (232) x | 0.519 = | 121.6 (268) |
| Total CO2, kg/year | sum | of (265)(271) = | 1010.91 (272) |
| | | | |

TER =

(273)

19.97

| | | | User D | Notoile: | | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|--------------------------|-------------|-----------------------|-------------|------------|-----------------------|--------------|------------------------|--------------|
| Assessor Name: Software Name: | Neil Ingham Stroma FSAP 20 | | | Strom Softwa | are Vei | | | | 0002943 on: 1.0.1.9 | |
| Address : | Flat 5, 16, Rochest | | | Address | | | | | | |
| Overall dwelling dime | | | , 201121 | J. 1, 1111 | 002 | | | | | |
| Ground floor | | | | a(m²) 70.74 | (1a) x | | ight(m) 2.8 | (2a) = | Volume(m 3 | (3a) |
| Total floor area TFA = (1 | la)+(1b)+(1c)+(1d)+(1 | e)+(1r | n) <u>7</u> | 70.74 | (4) | | | | | |
| Dwelling volume | | | | | (3a)+(3b) |)+(3c)+(3c | d)+(3e)+ | .(3n) = | 198.07 | (5) |
| 2. Ventilation rate: | | | | -41 | | 4-4-1 | | | | - |
| Number of chimneys Number of open flues | | secondar heating 0 | ry + | 0 0 |] = [| 0 0 | | 40 = 20 = | 0 0 | (6a) (6b) |
| Number of intermittent fa | ans | | | | | 3 | X ' | 10 = | 30 | (7a) |
| Number of passive vents | S | | | | Γ | 0 | x | 10 = | 0 | (7b) |
| Number of flueless gas f | fires | | | | Ī | 0 | X 4 | 40 = | 0 | (7c) |
| | | | | | | | | Air ch | nanges per ho | our |
| Infiltration due to chimne | eys, flues and fans = (| 6a)+(6b)+(7 | 7a)+(7b)+(| (7c) = | Γ | 30 | | ÷ (5) = | 0.15 | (8) |
| If a pressurisation test has | been carried out or is intend | ded, procee | d to (17), | otherwise o | continue fr | om (9) to | (16) | | | |
| Number of storeys in t | the dwelling (ns) | | | | | | | | 0 | (9) |
| Additional infiltration | | | | | | | [(9) | -1]x0.1 = | 0 | (10) |
| deducting areas of open | oresent, use the value corre ings); if equal user 0.35 | sponding to | the great | ter wall are | a (after | uction | | | 0 | (11) |
| If suspended wooden | • | alea) or U | .1 (seale | ea), eise | enter U | | | | 0 | (12) |
| If no draught lobby, er Percentage of window | | stripped | | | | | | | 0 | (13) |
| Window infiltration | s and doors draught s | sirippeu | | 0.25 - [0.2 | x (14) ÷ 1 | 001 = | | | 0 | (14) |
| Infiltration rate | | | | (8) + (10) | | | + (15) = | | 0 | (16) |
| Air permeability value | , q50, expressed in cu | bic metre | es per ho | | | | | area | 5 | (17) |
| If based on air permeabi | • • | | • | • | • | | • | | 0.4 | (18) |
| Air permeability value appli | es if a pressurisation test ha | as been dor | ne or a de | gree air pe | rmeability | is being u | sed | | | |
| Number of sides shelter | ed | | | (22) | | | | | 3 | (19) |
| Shelter factor | | | | (20) = 1 - | | [9)] = | | | 0.78 | (20) |
| Infiltration rate incorpora | - | | | (21) = (18 |) x (20) = | | | | 0.31 | (21) |
| Infiltration rate modified | | 1 | | T . | | | T | | 1 | |
| Jan Feb | Mar Apr May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| Monthly average wind sp | 1 | T 00 | | 1 | | 1.0 | 1.5 | 1 | 1 | |
| (22)m= 5.1 5 | 4.9 4.4 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 | J | |
| Wind Factor $(22a)m = (2a)m =$ | 22)m ÷ 4 | | | | | | | | _ | |
| (22a)m= 1.27 1.25 | 1.23 1.1 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 | | |

| Adjusted infilti | ration rat | e (allowi | ng for sh | nelter an | d wind s | peed) = | (21a) x | (22a)m | | | | | |
|--------------------------------------|----------------------------|------------|-------------|-------------|----------------|---------------------|-------------------|-------------|----------------------|--------------------------------------------------|--------------------|---------------|------------------------------|
| 0.4 | 0.39 | 0.38 | 0.34 | 0.33 | 0.3 | 0.3 | 0.29 | 0.31 | 0.33 | 0.35 | 0.37 | | |
| Calculate effe | | • | rate for t | he appli | cable ca | se | | | • | • | | | |
| If mechanic | | | andiv N. 70 | 2h) _ (22c |) Em. (a | auation (N | JEN otho | ruino (22h |) - (22a) | | | 0 | (238 |
| If exhaust air h | | | | | | | | |) = (23a) | | | 0 | (23k |
| If balanced wit | | - | • | _ | | | | | > / | | | 0 | (230 |
| a) If balance | 1 | | | | | - ` ` - | | <u> </u> | | - | - ` ´ | i ÷ 100] I | (0.4) |
| (24a)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (248 |
| b) If balance | 1 | | | | | | | <u> </u> | r ´ ` | r ´ | | 1 | (0.41 |
| 24b)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (24) |
| c) If whole h | nouse ex m < 0.5 > | | | | • | | | | .5 × (23b | o) | | _ | |
| 24c)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (24 |
| d) If natural if (22b) | ventilation ventilation | | | • | • | | | | 0.5] | - | | | |
| 24d)m= 0.58 | 0.58 | 0.57 | 0.56 | 0.56 | 0.54 | 0.54 | 0.54 | 0.55 | 0.56 | 0.56 | 0.57 | | (240 |
| Effective air | r change | rate - er | nter (24a |) or (24b | o) or (24 | c) or (24 | d) in box | (25) | • | • | • | • | |
| 25)m= 0.58 | 0.58 | 0.57 | 0.56 | 0.56 | 0.54 | 0.54 | 0.54 | 0.55 | 0.56 | 0.56 | 0.57 |] | (25) |
| 2. Heat lead | | at loss r | o romot | 0.51 | | | | | • | • | • | 1 | |
| 3. Heat losse ELEMENT | Gros area | SS | Openin m | gs | Net Ar A ,r | | U-valı W/m2 | | A X U (W/I | | k-value kJ/m²·l | | A X k <j k<="" td=""></j> |
| Vindows Type | | ` , | | | 4.36 | | /[1/(1.4)+ | 0.04] = | 5.78 | $\stackrel{\prime}{\Box}$ | | | (27) |
| Vindows Type | | | | | 5.64 | x1. | /[1/(1.4)+ | 0.041 = | 7.48 | = | | | (27) |
| Windows Type | | | | | 7.69 | _ | · /[1/(1.4)+ | | 10.2 | \dashv | | | (27) |
| Valls Type1 | | 10 | 17.6 | | | = | | —, ¦ | | ╡╶ | | | (29) |
| Valls Type1 | 81.4 | | | <u>"</u> | 63.79 | = | 0.18 | _ | 11.48 | 륵 ¦ | | - | == |
| | 32.4 | | 0 | _ | 32.48 | = | 0.15 | _ = | 5.03 | 믁 ¦ | | ┥ | (29) |
| Roof | 70.7 | | 0 | | 70.74 | _ | 0.13 | = | 9.2 | | | | (30) |
| otal area of | eiements | , m² | | | 184.7 | <u>'</u> | | | | - | | | (31) |
| Party floor | | | | | 70.74 | | | | | اِ | | _ | (32 |
| nternal wall * | | | | | 73.92 | | | | | L | | | (32 |
| for windows and * include the are | | | | | | ated using | formula 1 | /[(1/U-valu | ıe)+0.04] a | as given in | paragraph | 1 3.2 | |
| Fabric heat lo | | | | is and pan | uuons | | (26)(30) | + (32) = | | | | 40.16 | (33) |
| Heat capacity | • | • | 0) | | | | (==):::(==) | | (30) + (32 | 2) + (32a) | (32e) = | 49.16 | == |
| Thermal mass | | , | P – Cm – | _ TΕΔ\ ir | k I/m²K | | | | tive Value | , , , | (020) = | 9907.74 | (34) |
| or design asses | • | • | | • | | | ecisely the | | | | able 1f | 250 | (35) |
| an be used inste | | | | CONSTRUCT | ion are not | . Kilowii pi | colocity tire | maroative | valace of | 11011 111 11 | abic ii | | |
| Thermal bridg | jes : S (L | x Y) cal | culated (| using Ap | pendix ł | < | | | | | | 5.08 | (36) |
| f details of therm | al bridging | are not kn | own (36) = | = 0.15 x (3 | 1) | | | | | | | | |
| Total fabric he | eat loss | | | | | | | (33) + | (36) = | | | 54.24 | (37) |
| entilation he | at loss ca | alculated | monthly | / | | | | (38)m | = 0.33 × (| (25)m x (5) |) | 1 | |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| 38)m= 37.83 | 37.63 | 37.43 | 36.51 | 36.34 | 35.54 | 35.54 | 35.39 | 35.85 | 36.34 | 36.69 | 37.05 | | (38) |
| Heat transfer | coefficie | nt, W/K | | | | | | (39)m | = (37) + (3 | 38)m | | | |
| 39)m= 92.07 | 91.87 | 91.68 | 90.75 | 90.58 | 89.78 | 89.78 | 89.63 | 90.09 | 90.58 | 90.93 | 91.3 | | |
| | | | | | | | | | | | | | |

| Heat loss para | meter (l | HLP). W/ | m²K | | | | | (40)m | = (39)m ÷ | - (4) | | | |
|-------------------------------------------------|---------------|------------------|-----------------|----------------|------------------|------------------|------------------|-----------------|-----------------|---------------------------------------|---------------|---------|------|
| (40)m= 1.3 | 1.3 | 1.3 | 1.28 | 1.28 | 1.27 | 1.27 | 1.27 | 1.27 | 1.28 | 1.29 | 1.29 | | |
| () | | | | | | <u> </u> | | | | Sum(40) ₁ . | | 1.28 | (40) |
| Number of day | s in mo | nth (Tabl | le 1a) | | | | | | 3 | (), | | | ` |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| (41)m= 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | | (41) |
| | | | | | | l | <u> </u> | <u> </u> | <u> </u> | <u> </u> | | | |
| | | | | | | | | | | | 1200 | | |
| 4. Water heat | ing ene | rgy requi | rement: | | | | | | | | kWh/ye | ear: | |
| Assumed occur if TFA > 13.9 if TFA £ 13.9 | 9, N = 1 | | [1 - exp | (-0.0003 | 349 x (TF | FA -13.9 |)2)] + 0.0 | 0013 x (¯ | TFA -13. | | 26 | | (42) |
| Annual averag | ıl average | hot water | usage by | 5% if the a | lwelling is | designed t | | | se target o | | .97 | | (43) |
| not more that 125 | nires per | r in per | uay (ali w | | ioi anu co | | | | | | | | |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| Hot water usage ir | n litres pe | r day for ea | ch month | Vd,m = fa | ctor from | Table 1c x | (43) | _ | | | | | |
| (44)m= 96.77 | 93.25 | 89.73 | 86.21 | 82.69 | 79.17 | 79.17 | 82.69 | 86.21 | 89.73 | 93.25 | 96.77 | | |
| Energy content of | hot water | used - cal | culated m | onthly = 4 . | 190 x Vd,r | n x nm x E |)Tm / 3600 | | | m(44) ₁₁₂ = ables 1b, 1 | | 1055.64 | (44) |
| (45)m= 143.5 | 125.51 | 129.51 | 112.91 | 108.34 | 93.49 | 86.63 | 99.41 | 100.6 | 117.24 | 127.98 | 138.97 | | |
| ` ' | | <u> </u> | | | | l | <u> </u> | | I Total = Su | M(45) ₁₁₂ = | <u> </u> | 1384.11 | (45) |
| If instantaneous w | ater heati | ng at point | of use (no | hot water | storage), | enter 0 in | boxes (46 | | | (- / | | | |
| (46)m= 21.53 | 18.83 | 19.43 | 16.94 | 16.25 | 14.02 | 13 | 14.91 | 15.09 | 17.59 | 19.2 | 20.85 | | (46) |
| Water storage | loss: | <u> </u> | | | | l | <u> </u> | <u> </u> | 1 | 1 | <u> </u> | | |
| Storage volum | e (litres) |) includin | g any so | olar or W | /WHRS | storage | within sa | ame ves | sel | | 0 | | (47) |
| If community h | eating a | and no ta | nk in dw | velling, e | nter 110 | litres in | (47) | | | | | | |
| Otherwise if no | stored | hot wate | er (this in | icludes i | nstantar | neous co | mbi boil | ers) ente | er '0' in (| 47) | | | |
| Water storage | | | | | | | | | | | | | |
| a) If manufact | urer's d | eclared l | oss facto | or is kno | wn (kWł | n/day): | | | | | 0 | | (48) |
| Temperature fa | actor fro | m Table | 2b | | | | | | | | 0 | | (49) |
| Energy lost fro | m watei | storage | , kWh/ye | ear | | | (48) x (49) |) = | | | 0 | | (50) |
| b) If manufact | | | - | | | | | | | | | | |
| Hot water stora | - | | | e 2 (kWl | h/litre/da | ay) | | | | | 0 | | (51) |
| If community h | • | | on 4.3 | | | | | | | | | | (50) |
| Temperature fa | | | 2h | | | | | | | — | 0 | | (52) |
| • | | | | | | | () | > . | > | | 0 | | (53) |
| Energy lost fro | | • | , KVVh/ye | ear | | | (47) x (51) |) x (52) x (| 53) = | | 0 | | (54) |
| Enter (50) or (| | , | | | | | //> | | | | 0 | | (55) |
| Water storage | loss cal | culated f | or each | month | | | ((56)m = (| 55) × (41)ı | m | _ | | | |
| (56)m= 0 If cylinder contains | 0 dedicate | 0 d solar sto | 0 rage. (57) | 0 m = (56)m | 0 x [(50) – (| 0 H11)] ÷ (5) | 0 0), else (5 | 0 7)m = (56) | 0 m where (| 0 H11) is fro | 0 m Append | ix H | (56) |
| (57)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (57) |
| | 1 / | | T .l.l. | | | l | <u> </u> | <u> </u> | <u> </u> | <u> </u> | 0 | | (58) |
| Primary circuit | • | • | | | 50\ ~ | (EQ) + 20 | SE > (44) | m | | | 0 | | (30) |
| Primary circuit (modified by | | | | • | • | . , | , , | | r thermo | stat) | | | |
| (59)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n | | (59) |
| (35)111= 0 | U | L | U | U | U | <u> </u> | | | | | 0 | | (55) |

| Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$ | | | | | | | | | | | | | |
|---------------------------------------------------------------------------|-------------|------------|----------------|-----------|-----------|-------------|------------------|----------------|-------------|--------------|-------------|---------------|----------------------------|
| | | | | <u> </u> | <u> </u> | · ` ` | _ | | | Т | | 1 | |
| (61)m= 49.31 | 42.92 | 45.73 | 42.51 | 42.14 | 39.04 | 40.35 | 42.14 | | 45.73 | 45.99 | 49.31 | | (61) |
| Total heat req | uired for | | | | | 1 | ` | | (45)m + | (46)m + | (57)m + | (59)m + (61)m | |
| (62)m= 192.81 | 168.43 | 175.24 | 155.43 | 150.48 | 132.54 | 126.98 | 141.5 | 5 143.12 | 162.97 | 173.96 | 188.29 | | (62) |
| Solar DHW input | | | | | | | | | r contribu | tion to wate | er heating) | | |
| (add additiona | l lines if | FGHRS | and/or \ | WWHRS | applies | , see Ap | pendi | (G) | | | | 1 | |
| (63)m= 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | (63) |
| Output from w | ater heat | ter | | | | | | | | | | | |
| (64)m= 192.81 | 168.43 | 175.24 | 155.43 | 150.48 | 132.54 | 126.98 | 141.5 | 5 143.12 | 162.97 | 173.96 | 188.29 | | , |
| | | | | | | | 0 | utput from w | ater heate | r (annual) | 12 | 1911.79 | (64) |
| Heat gains fro | m water | heating, | kWh/m | onth 0.2 | 5 ´ [0.85 | × (45)m | + (61 |)m] + 0.8 x | k [(46)m | + (57)m | + (59)m |] | |
| (65)m= 60.04 | 52.46 | 54.49 | 48.17 | 46.56 | 40.85 | 38.89 | 43.59 | 44.08 | 50.41 | 54.05 | 58.54 | | (65) |
| include (57) | m in calc | ulation o | of (65)m | only if c | ylinder i | s in the | dwellir | g or hot w | ater is f | rom com | munity h | neating | |
| 5. Internal ga | ains (see | Table 5 | and 5a |): | | | | | | | | | |
| Metabolic gain | s (Table | 5). Wat | ts | | | | | | | | | | |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Au | g Sep | Oct | Nov | Dec |] | |
| (66)m= 113.2 | 113.2 | 113.2 | 113.2 | 113.2 | 113.2 | 113.2 | 113.2 | 2 113.2 | 113.2 | 113.2 | 113.2 | | (66) |
| Lighting gains | (calculat | ted in Ap | pendix | L, equat | ion L9 o | r L9a), a | lso se | e Table 5 | | 1 | | 1 | |
| (67)m= 17.74 | 15.76 | 12.82 | 9.7 | 7.25 | 6.12 | 6.62 | 8.6 | 11.54 | 14.66 | 17.11 | 18.24 |] | (67) |
| Appliances ga | ins (calc | ulated in | Append | dix L. ea | uation L | 13 or L1 | 3a). al | so see Ta | ble 5 | 1 | ! | ı | |
| (68)m= 199.02 | | 195.88 | 184.8 | 170.82 | 157.67 | 148.89 | 146.8 | | 163.11 | 177.09 | 190.24 | 1 | (68) |
| Cooking gains | (calcula | ted in A | opendix | L. eguat | ion L15 | or L15a | L), also | see Table | 5 | ! | | ı | |
| (69)m= 34.32 | 34.32 | 34.32 | 34.32 | 34.32 | 34.32 | 34.32 | 34.32 | | 34.32 | 34.32 | 34.32 |] | (69) |
| Pumps and fai | ne naine | (Tahle F | [[a] | <u> </u> | | | <u> </u> | | <u> </u> | <u> </u> | | I | |
| (70)m= 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | (70) |
| Losses e.g. ev | | | | ļ | ļ | | | | | | | l | (- / |
| (71)m= -90.56 | -90.56 | -90.56 | -90.56 | -90.56 | -90.56 | -90.56 | -90.5 | 6 -90.56 | -90.56 | -90.56 | -90.56 | 1 | (71) |
| | | | -90.50 | -90.00 | -90.50 | -90.50 | -90.5 | 90.30 | -90.50 | -90.50 | -90.50 | l | (, ,) |
| Water heating (72)m= 80.7 | 78.07 | 73.25 | 66.91 | 62.58 | 56.73 | 52.27 | 58.59 | 61.22 | 67.76 | 75.07 | 78.68 | 1 | (72) |
| | ļ! | | 00.91 | 02.36 | | l | | Ļ | | | | | (12) |
| Total internal | | | 004.07 | 000.04 | | | | m + (69)m + | • | • | | 1 | (72) |
| (73)m= 357.42 | 354.87 | 341.9 | 321.37 | 300.61 | 280.49 | 267.74 | 273.9 | 7 284.75 | 305.49 | 329.23 | 347.11 | | (73) |
| 6. Solar gains Solar gains are of | | ucina colo | r flux from | Table 6a | and accor | siated equa | utions to | convert to th | o applica | olo orientat | tion | | |
| Orientation: A | | • | Area | | Flu | • | ilions to | | іс арріісаі | FF | iioii. | Gains | |
| | Table 6d | actor | m ² | | | ble 6a | | g_ Table 6b | Т | able 6c | | (W) | |
| Southeast 0.9x | 0.77 | x | 7.6 | 20 | x ; | 36.79 |] _x [| 0.63 | x [| 0.7 | | 86.47 | (77) |
| Southeast 0.9x | | _ | | | - | | ┆ ╞ | | ≓ | | = | | ╡ |
| Southeast 0.9x | 0.77 | x | 7.6 | | | 52.67 |] × | 0.63 | × | 0.7 | _ = | 147.29 |](77)] ₍₇₇₎ |
| Southeast 0.9x | 0.77 | x | 7.6 | | | 35.75 |] × <u> </u> | 0.63 | | 0.7 | = | 201.53 |](77)] ₍₇₇₎ |
| <u>L</u> | 0.77 | X | 7.6 | | = | 06.25 |] | 0.63 | × | 0.7 | = | 249.71 | (77) |
| Southeast 0.9x | 0.77 | X | 7.6 | 69 | X 1 | 19.01 | X | 0.63 | X | 0.7 | = | 279.69 | (77) |

| Southeast 0.9x 0.77 x 7.69 x 118.15 x 0.63 x 0.7 | 277.67 (77) |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Southoost of Control C | 267.71 (77) |
| Couthoost of | 245.33 (77) |
| Couthoost of | 218.22 (77) |
| Southoost of Control C | 162.79 (77) |
| Courthogat a a | 103.57 (77) |
| Couthoods o | = 74 (77) |
| Couthwests a | 63.42 (79) |
| Couthwest a | 108.03 (79) |
| Couthwests a | = 147.81 (79) |
| Couthwest a | 183.14 (79) |
| Couthwester | 205.13 (79) |
| Cauthurate | 203.65 (79) |
| Couthweate a Couth | 196.34 (79) |
| Couthwests a | 179.93 (79) |
| Couthwest - | 160.04 (79) |
| Couthwest a | 119.39 (79) |
| Couthweater | 75.96 (79) |
| Couthwest - | 54.27 (79) |
| Northwest a a | 15.03 (81) |
| Northwest a a | 30.6 (81) |
| Northwest | 55.14 (81) |
| Northwest e.e. | 90.55 (81) |
| Northwest a a | 121.72 (81) |
| Northwest | 129.76 (81) |
| Northwest a c | 121.39 (81) |
| Northwest | 96.77 (81) |
| Northwest | 67.18 (81) |
| Northwest a a | 37.4 (81) |
| Neathwest as | 18.92 (81) |
| Northwest | 12.28 (81) |
| 4.30 \ 9.21 \ \ 0.03 \ \ 0.7 | 12.20 |
| Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m | |
| (83)m= 164.93 285.92 404.48 523.4 606.54 611.08 585.44 522.04 445.45 319.58 198.45 140.5 | 5 (83) |
| Total gains – internal and solar (84)m = (73)m + (83)m , watts | |
| (84)m= 522.35 640.79 746.38 844.77 907.15 891.57 853.18 796.01 730.2 625.07 527.68 487.6 | 7 (84) |
| 7. Mean internal temperature (heating season) | |
| Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 (85) |
| Utilisation factor for gains for living area, h1,m (see Table 9a) | L |
| Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov De | |
| (86)m= 1 0.99 0.97 0.91 0.79 0.61 0.46 0.51 0.75 0.94 0.99 1 | (86) |
| Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) | _ |
| | (87) |
| (87)m= 19.69 19.91 20.21 20.57 20.84 20.96 20.99 20.99 20.9 20.54 20.04 19.64 | (01) |

| · r | | | | | | | from Ta | 1 | h2 (°C) | | | | ı | |
|-------------|----------|-----------|----------------|------------|--------------------|------------|-----------------------|------------|-------------------|--------------|------------------------------|------------------------|--------------|----------|
| (88)m= | 19.84 | 19.84 | 19.84 | 19.85 | 19.86 | 19.86 | 19.86 | 19.87 | 19.86 | 19.86 | 19.85 | 19.85 | | (88) |
| Utilisa | tion fac | tor for g | ains for | rest of d | welling, | h2,m (se | e Table | 9a) | | | | | | |
| (89)m= | 0.99 | 0.98 | 0.96 | 0.88 | 0.73 | 0.52 | 0.34 | 0.39 | 0.66 | 0.92 | 0.99 | 1 | | (89) |
| Mean | internal | temper | ature in | the rest | of dwelli | ing T2 (f | ollow ste | eps 3 to | 7 in Tabl | e 9c) | | | | |
| (90)m= | 18.11 | 18.44 | 18.88 | 19.38 | 19.71 | 19.84 | 19.86 | 19.86 | 19.79 | 19.35 | 18.64 | 18.06 | | (90) |
| • | | | | | | | | | f | LA = Livin | g area ÷ (4 | 1) = | 0.47 | (91) |
| Mean | internal | l temner | ature (fo | or the wh | ole dwe | lling) – f | LA × T1 | + (1 – fl | Δ) v T2 | | | ! | | |
| (92)m= | 18.85 | 19.12 | 19.5 | 19.94 | 20.24 | 20.36 | 20.39 | 20.39 | 20.31 | 19.91 | 19.29 | 18.8 | | (92) |
| L | | | | | | | m Table | ļ | | ļ | | | | |
| (93)m= | 18.85 | 19.12 | 19.5 | 19.94 | 20.24 | 20.36 | 20.39 | 20.39 | 20.31 | 19.91 | 19.29 | 18.8 | | (93) |
| 8. Spa | ace hea | ting requ | uirement | | | | | | | | | | | |
| | | | | | re obtair | ned at st | ep 11 of | Table 9l | o, so tha | t Ti,m=(| 76)m an | d re-calc | culate | |
| | | | or gains | • | | | | | | , , | | | • | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| Utilisa | | | ains, hm | i e | | | | | | | | | ı | |
| (94)m= | 0.99 | 0.98 | 0.95 | 0.88 | 0.75 | 0.56 | 0.4 | 0.44 | 0.7 | 0.92 | 0.98 | 0.99 | | (94) |
| г | | | W = (94) | <u> </u> | <u> </u> | ı | | ı | | ı | | | ı | |
| (95)m= | 517.96 | 627.91 | 710.93 | 746.69 | 680.91 | 499.37 | 337.35 | 352.55 | 510.55 | 575.19 | 518.45 | 484.59 | | (95) |
| г | | | rnal tem | r | 1 | | T | | 1 | | ı | | İ | (20) |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | | (96) |
| | | | | | | 1 | =[(39)m : | | | | 4400.0 | 4000.0 | 1 | (07) |
| L | | | 1191.99 | | L | 517.57 | 340.22 | 357.38 | 559.58 | 843.21 | 1108.6 | 1332.8 | | (97) |
| | 611.1 | 456.06 | 357.91 | 183.59 | 68.59 | vvn/mon | $\frac{th = 0.02}{0}$ | 24 X [(97] |)m – (95 0 | 199.41 | 424.91 | 631.07 | | |
| (98)m= | 011.1 | 430.00 | 357.91 | 163.59 | 00.39 | | | <u> </u> | <u> </u> | <u> </u> | <u> </u> | | 0000.04 | 7(00) |
| _ | | | | | | | | Tota | l per year | (KWII/yeai |) = Sum(9 | O) _{15,912} = | 2932.64 | (98) |
| Space | heating | g require | ement in | kWh/m² | ² /year | | | | | | | | 41.46 | (99) |
| 9a. Ene | ergy red | uiremer | nts – Indi | ividual h | eating s | ystems i | ncluding | micro-C | CHP) | | | | | |
| - | heatin | • | | | | | | | | | | 1 | | _ |
| Fraction | on of sp | ace hea | at from so | econdar | y/supple | mentary | system | | | | | | 0 | (201) |
| Fraction | on of sp | ace hea | at from m | nain syst | em(s) | | | (202) = 1 | - (201) = | | | | 1 | (202) |
| Fraction | on of to | tal heati | ng from | main sys | stem 1 | | | (204) = (2 | 02) × [1 – | (203)] = | | | 1 | (204) |
| Efficie | ncy of r | main spa | ace heat | ing syste | em 1 | | | | | | | | 93.4 | (206) |
| Efficie | ncy of s | seconda | ry/supple | ementar | y heatin | g systen | ո, % | | | | | | 0 | (208) |
| Г | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | kWh/ye | ⊇ar |
| Space | | | ement (c | | <u> </u> | | | 7 tug | ССР | | 1101 | Doo | (KVVIII y C | , ai |
|] | 611.1 | 456.06 | 357.91 | 183.59 | 68.59 | 0 | 0 | 0 | 0 | 199.41 | 424.91 | 631.07 | | |
| ۱ (211)m | _ {[(98 | m x (20 | (4)] + (21 | I(1) m } x | 100 ± (2 | 206) | 1 | | | | | | | (211) |
| (211) | 654.29 | 488.29 | 383.2 | 196.56 | 73.43 | 0 | 0 | 0 | 0 | 213.5 | 454.94 | 675.66 | | (211) |
| L | | | | | | | | | l (kWh/yea | | | | 3139.87 | (211) |
| Space | heatin | a fual (e | econdar | v) k\//b/ | month | | | | | , | 7 15, 10 12 | | 0.00.0. | ` ′ |
| • | | • , | 14) m } x | • • | | | | | | | | | | |
| (215)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | | | ! | ! | Į | | ! | Tota | l I (kWh/yea | ar) =Sum(2 | 1 215) _{15,1012} | = | 0 | (215) |
| | | | | | | | | | | | ., | | | _ |

| Water heating | | | | | | | | |
|------------------------------------------------------------|---------------------------|-------------|------------|-----------------------|-------------------------|--------|-------------------------|----------|
| Output from water heater (calculated above) 192.81 | 32.54 126.98 | 141.55 | 143.12 | 162.97 | 173.96 | 188.29 | 1 | |
| Efficiency of water heater | l | | | | | | 80.3 | (216) |
| (217)m= 87.75 87.43 86.81 85.47 83.21 8 | 80.3 80.3 | 80.3 | 80.3 | 85.56 | 87.21 | 87.86 | | (217) |
| Fuel for water heating, kWh/month | • | | | | | | • | |
| $(219)m = (64)m \times 100 \div (217)m$ (219)m = 219.72 | 65.05 158.13 | 176.28 | 178.23 | 190.47 | 199.47 | 214.3 |] | |
| | ! | Tota | = Sum(2 | 19a) ₁₁₂ = | | | 2258.84 | (219) |
| Annual totals | | | | k\ | Wh/year | • | kWh/year | - - |
| Space heating fuel used, main system 1 | | | | | | | 3139.87 | <u> </u> |
| Water heating fuel used | | | | | | | 2258.84 | |
| Electricity for pumps, fans and electric keep-hot | | | | | | | | |
| central heating pump: | | | | | | 30 |] | (230c) |
| boiler with a fan-assisted flue | | | | | | 45 |] | (230e) |
| Total electricity for the above, kWh/year | | sum | of (230a). | (230g) = | | | 75 | (231) |
| Electricity for lighting | | | | | | | 313.34 | (232) |
| 12a. CO2 emissions – Individual heating systems | s including mi | icro-CHP | | | | | | |
| | Energy kWh/year | | | Emiss kg CO | ion fac 2/kWh | tor | Emissions kg CO2/yea | ır |
| Space heating (main system 1) | (211) x | | | 0.2 | 16 | = | 678.21 | (261) |
| Space heating (secondary) | (215) x | | | 0.5 | 19 | = | 0 | (263) |
| Water heating | (219) x | | | 0.2 | 16 | = | 487.91 | (264) |
| Space and water heating | (261) + (262) | + (263) + (| 264) = | | | | 1166.12 | (265) |
| Electricity for pumps, fans and electric keep-hot | (231) x | | | 0.5 | 19 | = | 38.93 | (267) |
| Electricity for lighting | (232) x | | | 0.5 | 19 | = | 162.62 | (268) |
| Total CO2, kg/year | | | sum o | f (265)(2 | 271) = | | 1367.67 | (272) |

TER =

(273)

19.33

BRUKL Output Document



Compliance with England Building Regulations Part L 2013

Project name

16 Rochester Mews

As designed

Date: Tue Oct 07 10:51:51 2014

Administrative information

Building Details

Address: Workshop Premises, 16 Rochester Mews,

LONDON, NW1 9JB

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.d.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.2.0

BRUKL compliance check version: v5.2.d.2

Owner Details

Name: Palmhurst Group Telephone number:

Address: , ,

Certifier details

Name: Neil Ingham

Telephone number: 07736 771584

Address: 7 Rosemary Way, Cleethorpes, DN35 0SR

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

The building does not comply with England Building Regulations Part L 2013

| CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum | 14 |
|----------------------------------------------------------------------------------------------------|---------------------|
| Target CO₂ emission rate (TER), kgCO₂/m².annum | 14 |
| Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum | 15.6 |
| Are emissions from the building less than or equal to the target? | BER > TER |
| Are as built details the same as used in the BER calculations? | Separate submission |

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

| Element | U _{a-Limit} | Ua-Calc | Ui-Calc | Surface where the maximum value occurs* |
|------------------------------------------|----------------------|---------|---------|-----------------------------------------|
| Wall** | 0.35 | 0.27 | 0.27 | Workshop - Zone 1_W_6 |
| Floor | 0.25 | 0.2 | 0.2 | Workshop - Zone 1_S_3 |
| Roof | 0.25 | 0.16 | 0.16 | Workshop - Zone 1_R_5 |
| Windows***, roof windows, and rooflights | 2.2 | 1.25 | 1.25 | Workshop - Zone 1_G_7 |
| Personnel doors | 2.2 | 1.5 | 1.5 | Workshop - Zone 1_D_11 |
| Vehicle access & similar large doors | 1.5 | - | - | "No external vehicle access doors" |
| High usage entrance doors | 3.5 | - | - | "No external high usage entrance doors" |

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]

U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air Permeability | Worst acceptable standard | This building |
|--------------------|---------------------------|---------------|
| m³/(h.m²) at 50 Pa | 10 | 5 |

^{*} There might be more than one surface where the maximum U-value occurs.

^{**} Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

^{***} Display windows and similar glazing are excluded from the U-value check.

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

| Whole building lighting automatic monitoring & targeting with alarms for out-of-range values | NO |
|----------------------------------------------------------------------------------------------|------|
| Whole building electric power factor achieved by power factor correction | <0.9 |

1- Gas heating

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(I/s)] | HR efficiency |
|----------------|----------------------|-----------------------|----------------------|----------------|---------------|
| This system | 0.8 | - | 0.65 | - | - |
| Standard value | 0.86 | N/A | 0.55 | N/A | N/A |
| Automatic moni | toring & targeting w | ith alarms for out-of | -range values for th | is HVAC syster | n NO |

1- PoU

| | Water heating efficiency | Storage loss factor [kWh/litre per day] |
|----------------|--------------------------|-----------------------------------------|
| This building | 1 | - |
| Standard value | 1 | N/A |

Local mechanical ventilation, exhaust, and terminal units

| ID | System type in Non-domestic Building Services Compliance Guide |
|----|---------------------------------------------------------------------------------------------------------|
| Α | Local supply or extract ventilation units serving a single area |
| В | Zonal supply system where the fan is remote from the zone |
| С | Zonal extract system where the fan is remote from the zone |
| D | Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery |
| E | Local supply and extract ventilation system serving a single area with heating and heat recovery |
| F | Other local ventilation units |
| G | Fan-assisted terminal VAV unit |
| Н | Fan coil units |
| 1 | Zonal extract system where the fan is remote from the zone with grease filter |

| Zone name | SFP [W/(I/s)] | | | | fficiency | | | | | | |
|-------------------|---------------|-----|-----|-----|-----------|-----|-----|-----|---|---------------|----------|
| ID of system type | Α | В | С | D | E | F | G | Н | 1 | HR efficiency | |
| Standard value | 0.3 | 1.1 | 0.5 | 1.9 | 1.6 | 0.5 | 1.1 | 0.5 | 1 | Zone | Standard |
| Workshop - Zone 1 | 0.6 | - | - | - | - | - | - | - | - | - | N/A |

| General lighting and display lighting | Lumino | us effic | acy [lm/W] | |
|---------------------------------------|-----------|----------|--------------|----------------------|
| Zone name | Luminaire | Lamp | Display lamp | General lighting [W] |
| Standard value | 60 | 60 | 22 | |
| Workshop - Zone 1 | 76 | - | - | 1295 |

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

| Zone | Solar gain limit exceeded? (%) | Internal blinds used? |
|-------------------|--------------------------------|-----------------------|
| Workshop - Zone 1 | YES (+53.6%) | NO |

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

| Were alternative energy systems considered and analysed as part of the design process? | NO |
|----------------------------------------------------------------------------------------|----|
| Is evidence of such assessment available as a separate submission? | NO |
| Are any such measures included in the proposed design? | NO |

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

| | Actual | Notional |
|-----------------------------|--------|----------|
| Area [m²] | 213.9 | 213.9 |
| External area [m²] | 447.4 | 447.4 |
| Weather | LON | LON |
| Infiltration [m³/hm²@ 50Pa] | 5 | 7 |
| Average conductance [W/K] | 184 | 150.88 |
| Average U-value [W/m²K] | 0.41 | 0.34 |
| Alpha value* [%] | 15.42 | 55.42 |

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

A1/A2 Retail/Financial and Professional services

A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways

100 **B1 Offices and Workshop businesses**

B2 to B7 General Industrial and Special Industrial Groups

B8 Storage or Distribution

C1 Hotels

C2 Residential Inst.: Hospitals and Care Homes

C2 Residential Inst.: Residential schools

C2 Residential Inst.: Universities and colleges

C2A Secure Residential Inst.

Residential spaces

D1 Non-residential Inst.: Community/Day Centre

D1 Non-residential Inst.: Libraries, Museums, and Galleries

D1 Non-residential Inst.: Education

D1 Non-residential Inst.: Primary Health Care Building D1 Non-residential Inst.: Crown and County Courts

D2 General Assembly and Leisure, Night Clubs and Theatres

Others: Passenger terminals Others: Emergency services

Others: Miscellaneous 24hr activities

Others: Car Parks 24 hrs Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

| | Actual | Notional |
|------------|--------|----------|
| Heating | 16.31 | 21.14 |
| Cooling | 0 | 0 |
| Auxiliary | 3.19 | 2.13 |
| Lighting | 18.38 | 15.31 |
| Hot water | 1.65 | 1.91 |
| Equipment* | 17.75 | 17.75 |
| TOTAL** | 39.53 | 40.49 |

^{*} Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

| | Actual | Notional |
|-----------------------|--------|----------|
| Photovoltaic systems | 0 | 0 |
| Wind turbines | 0 | 0 |
| CHP generators | 0 | 0 |
| Solar thermal systems | 0 | 0 |

Energy & CO, Emissions Summary

| | Actual | Notional |
|----------------------------------|--------|----------|
| Heating + cooling demand [MJ/m²] | 177.93 | 84.34 |
| Primary energy* [kWh/m²] | 91.19 | 80.1 |
| Total emissions [kg/m²] | 15.6 | 14 |

^{*} Primary energy is net of any electrical energy displaced by CHP generators, if applicable

| H | HVAC Systems Performance | | | | | | | | | |
|-----|----------------------------------------------------------------------------------------------|----------------|-------------------|--------------------|---|-------------------|---------------|---------------|------------------|------------------|
| Sys | stem Type | Heat dem MJ/m2 | Cool dem MJ/m2 | Heat con kWh/m2 | | Aux con kWh/m2 | Heat SSEEF | Cool SSEER | Heat gen SEFF | Cool gen SEER |
| [ST | [ST] Flued radiant heater, [HS] Unitary radiant heater, [HFT] Natural Gas, [CFT] Natural Gas | | | | | | | | | |
| | Actual | 37.6 | 140.3 | 16.3 | 0 | 3.2 | 0.64 | 0 | 0.8 | 0 |
| | Notional | 65.4 | 18.9 | 21.1 | 0 | 2.1 | 0.82 | 0 | | Andrews |

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption

Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)

Cool SSEER = Cooling system seasonal energy efficiency ratio

Heat gen SSEFF = Heating generator seasonal efficiency

Cool gen SSEER = Cooling generator seasonal energy efficiency ratio

ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

| Element | U _{i-Typ} | U _{i-Min} | Surface where the minimum value occurs* |
|------------------------------------------------------------------|--------------------|--------------------|--------------------------------------------------------------------|
| Wall | 0.23 | 0.27 | Workshop - Zone 1_W_6 |
| Floor | 0.2 | 0.2 | Workshop - Zone 1_S_3 |
| Roof | 0.15 | 0.16 | Workshop - Zone 1_R_5 |
| Windows, roof windows, and rooflights | 1.5 | 1.25 | Workshop - Zone 1_G_7 |
| Personnel doors | 1.5 | 1.5 | Workshop - Zone 1_D_11 |
| Vehicle access & similar large doors | 1.5 | - | "No external vehicle access doors" |
| High usage entrance doors | 1.5 | - | "No external high usage entrance doors" |
| U _{I-Typ} = Typical individual element U-values [W/(m²h | ()] | | U _{i-Min} = Minimum individual element U-values [W/(m²K)] |
| | | | |

 $[\]ensuremath{^{\star}}$ There might be more than one surface where the minimum U-value occurs.

| Air Permeability | Typical value | This building | |
|--------------------|---------------|---------------|--|
| m³/(h.m²) at 50 Pa | 5 | 5 | |