

## Specific energy demand for heating (monthly method)

Energy balance calculation with PHPP Version 10.4 EN

PHPP

"Stūriši" / Climate: LV0003b-Zilāni / TFA: 565 m<sup>2</sup> / Heating: 125,9 kWh/(m<sup>2</sup>a) / Overheating: 42 % / PER: 207,3 kWh/(m<sup>2</sup>a)

Interior temperature: 18,5 °C

Building type: 5-Multi-family house I Apartment building

Treated floor area A<sub>TFA</sub>: 565,3 m<sup>2</sup>

Spec. Capacity: 132 Wh/(m<sup>2</sup>K)

The sum of the heating periods calculated through the monthly method is presented on this worksheet.

### Transmission heat losses Q<sub>T</sub>

| Building assembly                         | Temperature zone | Area m <sup>2</sup> | U-value W/(m <sup>2</sup> K) | Temperature reduction factor | G <sub>t</sub> kWh/a | kWh/a        | Per m <sup>2</sup> of TFA |
|---|------------------|---------------------|------------------------------|------------------------------|----------------------|--------------|---------------------------|
| External wall - ambient                   | A                | 522,6               | 1,173                        | 1,00                         | 90                   | 55416        | 98,03                     |
| External wall ground/basement             | B                |                     |                              | 1,00                         |                      |              |                           |
| Roof / ceiling - ambient                  | A                | 253,0               | 0,171                        | 1,00                         | 90                   | 3919         | 6,93                      |
| Floor slab / basement ceiling             | B                | 253,0               | 0,463                        | 1,00                         | 21                   | 2505         | 4,43                      |
| Partition wall (pagraba siena)            | X                | 16,2                | 1,383                        | 0,50                         | 90                   | 1013         | 1,79                      |
|   | A                |                     |                              | 1,00                         |                      |              |                           |
|   | A                |                     |                              | 1,00                         |                      |              |                           |
| Windows                                   | A                | 96,2                | 1,397                        | 1,00                         | 90                   | 12136        | 21,47                     |
| Exterior door                             | A                | 2,5                 | 1,800                        | 1,00                         | 90                   | 410          | 0,73                      |
| Thermal bridges ambient (length/m)        | A                |                     |                              | 1,00                         |                      |              | 0,00                      |
| Perimeter thermal bridges (length/m)      | P                | 69,7                | 0,400                        | 1,00                         | 21                   | 597          | 1,06                      |
| Thermal bridges ground (length/m)         | B                | 69,7                | 0,400                        | 1,00                         | 21                   | 597          | 1,06                      |
| Sum of all areas of the building envelope |                  | 1143,4              |                              |                              |                      | <b>76592</b> | <b>135,5</b>              |

### Ventilation heat losses Q<sub>V</sub>

|   |                     |   |  |   |   |   |   |   |              |                             |
|---|---------------------|---|--|---|---|---|---|---|--------------|-----------------------------|
| Reference volume for the ventilation system, V <sub>V</sub> (A <sub>TFA</sub> *h) | 565 m <sup>2</sup>  | * | 2,50 m                                     | = | 1413 m <sup>3</sup>                         |   |   |   |              |                             |
| Effective air change rate Ambient n <sub>V,e</sub>                                | 0,288 1/h           | * | (1 - 0% SHX) * (1 - 0,00 η <sub>HR</sub> ) | + | 0,014 n <sub>V,Res</sub> 1/h                | = | 0,302 n <sub>V,equi, fraction</sub> 1/h |   |              |                             |
| Effective air change rate Ground n <sub>V,g</sub>                                 | 0,288               | * | (1 - 0% SHX) * (1 - 0,00 η <sub>HR</sub> ) |   |   | = | 0,000                                   |   |              |                             |
| Ventilation losses ambient Q <sub>V</sub>   | 1413 m <sup>3</sup> | * | 0,302 n <sub>V,equi, fraction</sub> 1/h    | * | 0,33 C <sub>Air</sub> Wh/(m <sup>3</sup> K) | * | 90 G <sub>t</sub> kWh/a                 | = | 12737 kWh/a  | 22,5 kWh/(m <sup>2</sup> a) |
| Ventilation losses ground Q <sub>V,g</sub>  | 1413                | * | 0,000                                      | * | 0,33  | * | 14                                      | = | 0 kWh/a      | 0,0 kWh/(m <sup>2</sup> a)  |
| Total ventilation heat losses Q <sub>V</sub>                                      |                     |   |  |   |   |   |   | = | <b>12737</b> | <b>22,5</b>                 |

### Total heat losses Q<sub>L</sub>

$$\left( \frac{76592}{\text{Q}_T} + \frac{12737}{\text{Q}_V} \right) * 1,0 = 89329 \text{ kWh/a} \quad \text{Reduction factor night/weekend lowering}$$

**158,0 kWh/(m<sup>2</sup>a)**

### Available solar heat gains Q<sub>S</sub>

| Orientation of the area                         | Reduction factor see 'Windows' worksheet | g-value (perp. radiation) | Area m <sup>2</sup> | Global radiation kWh/(m <sup>2</sup> a) | kWh/a       |             |
|---|--|---------------------------|---------------------|---|-------------|-------------|
| North   | 0,40                                     | 0,22                      | 11,7                | 78                                      | 81          |             |
| East  | 0,40                                     | 0,53                      | 38,7                | 166                                     | 1348        |             |
| South   | 0,47                                     | 0,64                      | 11,7                | 267                                     | 948         |             |
| West  | 0,39                                     | 0,49                      | 34,0                | 161                                     | 1058        |             |
| Horizontal                                      | 0,00                                     | 0,00                      | 0,0                 | 266                                     | 0           |             |
| Sum opaque areas                                |  |                           |                     |   | 2968        |             |
| Total available solar heat gains Q <sub>S</sub> |  |                           |                     |   | <b>6404</b> | <b>11,3</b> |

### Internal heat gains Q<sub>I</sub>

$$0,024 \text{ kh/d} * 212 \text{ d/a} * 4,1 \text{ W/m}^2 * 565,3 \text{ m}^2 = 11793 \text{ kWh/a} \quad \text{kWh/(m}^2\text{a)}$$

**20,9**

### Utilisation factor heat gains η<sub>G</sub>

$$\text{Free heat } Q_F = Q_S + Q_I = 18196 \text{ kWh/a} \quad \text{kWh/(m}^2\text{a)}$$

$$\text{Ratio free heat to losses } Q_F / Q_L = 0,20$$

$$\text{Utilisation factor heat gains } \eta_G = 100\%$$

### Total heat gains Q<sub>G</sub>

$$\eta_G * Q_F = 18176 \text{ kWh/a} \quad \text{kWh/(m}^2\text{a)}$$

**32,2**

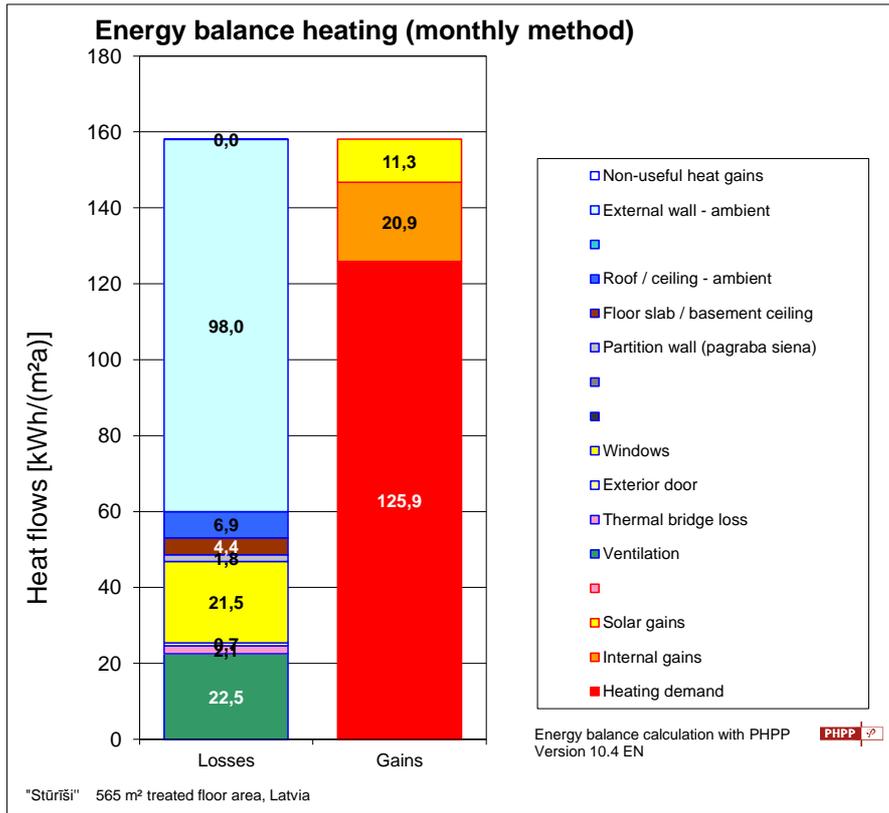
### Annual heating demand Q<sub>H</sub>

$$Q_L - Q_G = 71153 \text{ kWh/a} \quad \text{kWh/(m}^2\text{a)}$$

**125,9**

### Limit value

- Requirement met? **-**



## Specific energy for heating (monthly method)

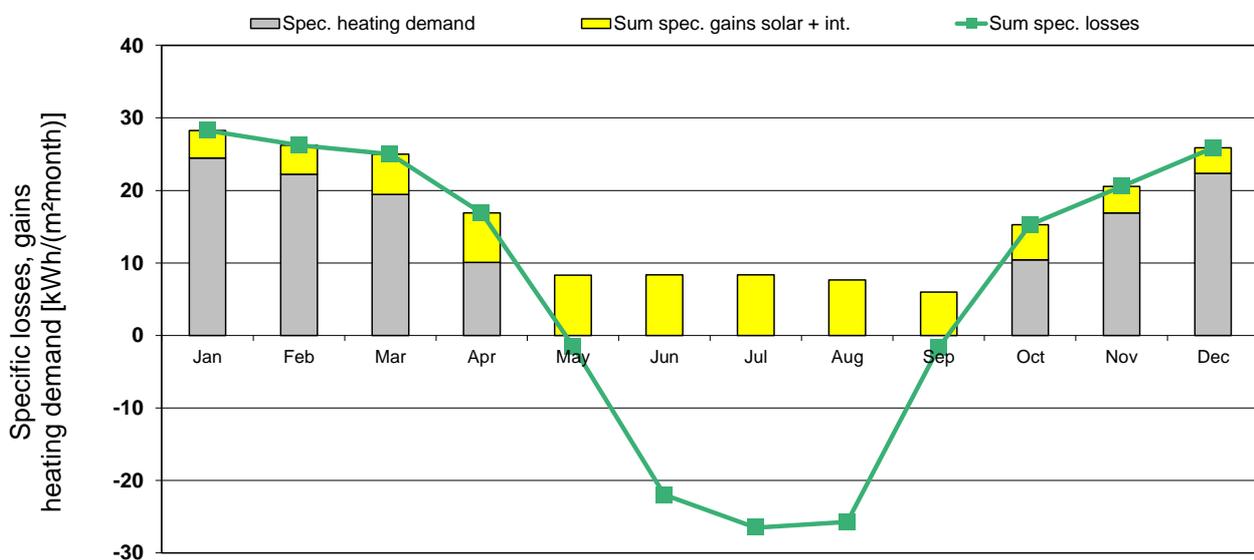
Energy balance calculation with PHPP Version 10.4 EN

"Stūriši" / Climate: LV0003b-Zilāni / TFA: 565 m<sup>2</sup> / Heating: 125,9 kWh/(m<sup>2</sup>a) / Overheating: 42 % / PER: 207,3 kWh/(m<sup>2</sup>a)

PHPP

Interior temperature: 18,5 °C  
Building type: 5-Multi-family house I Apartment building  
Treated floor area A<sub>TFA</sub>: 565 m<sup>2</sup>

|                                 | Jan   | Feb   | Mar   | Apr  | May   | Jun    | Jul    | Aug    | Sep   | Oct  | Nov   | Dec   | Year  |                    |
|---------------------------------|-------|-------|-------|------|-------|--------|--------|--------|-------|------|-------|-------|-------|--------------------|
| Heating degree hours - exterior | 16,5  | 14,9  | 13,6  | 8,5  | -2,6  | -14,7  | -17,1  | -16,1  | -1,3  | 9,1  | 12,4  | 15,4  | 38    | kKh                |
| Heating degree hours - ground   | 2,0   | 4,1   | 7,2   | 8,7  | 9,7   | 8,7    | 7,0    | 4,4    | 1,8   | 0,0  | -0,6  | 0,1   | 53    | kKh                |
| Losses - exterior               | 15622 | 14110 | 12902 | 8025 | -2502 | -13936 | -16201 | -15301 | -1268 | 8641 | 11718 | 14613 | 36421 | kWh                |
| Losses - ground                 | 343   | 714   | 1236  | 1508 | 1672  | 1496   | 1214   | 765    | 310   | -2   | -111  | 11    | 9155  | kWh                |
| Sum spec. losses                | 28,2  | 26,2  | 25,0  | 16,9 | -1,5  | -22,0  | -26,5  | -25,7  | -1,7  | 15,3 | 20,5  | 25,9  | 80,6  | kWh/m <sup>2</sup> |
| Solar gains - North             | 4     | 8     | 19    | 29   | 41    | 49     | 46     | 35     | 22    | 12   | 5     | 3     | 275   | kWh                |
| Solar gains - East              | 83    | 150   | 303   | 476  | 681   | 696    | 669    | 558    | 364   | 207  | 76    | 53    | 4316  | kWh                |
| Solar gains - South             | 78    | 123   | 200   | 256  | 288   | 263    | 273    | 283    | 229   | 164  | 73    | 53    | 2283  | kWh                |
| Solar gains - West              | 57    | 108   | 238   | 386  | 535   | 567    | 563    | 480    | 295   | 167  | 63    | 39    | 3500  | kWh                |
| Solar gains - Horiz.            | 0     | 0     | 0     | 0    | 0     | 0      | 0      | 0      | 0     | 0    | 0     | 0     | 0     | kWh                |
| Solar gains - Opaque            | 176   | 323   | 667   | 1042 | 1433  | 1482   | 1456   | 1248   | 809   | 466  | 180   | 114   | 9396  | kWh                |
| Internal heat gains             | 1724  | 1558  | 1724  | 1669 | 1724  | 1669   | 1724   | 1724   | 1669  | 1724 | 1669  | 1724  | 20303 | kWh                |
| Sum spec. gains solar + int.    | 3,8   | 4,0   | 5,6   | 6,8  | 8,3   | 8,4    | 8,4    | 7,7    | 6,0   | 4,8  | 3,7   | 3,5   | 70,9  | kWh/m <sup>2</sup> |
| Utilisation factor              | 100%  | 100%  | 100%  | 100% | 100%  | 100%   | 100%   | 100%   | 100%  | 100% | 100%  | 100%  | -64%  |                    |
| Annual heating demand           | 13842 | 12553 | 10987 | 5690 | 0     | 0      | 0      | 0      | 0     | 5902 | 9541  | 12639 | 71153 | kWh                |
| Spec. heating demand            | 24,5  | 22,2  | 19,4  | 10,1 | 0,0   | 0,0    | 0,0    | 0,0    | 0,0   | 10,4 | 16,9  | 22,4  | 125,9 | kWh/m <sup>2</sup> |



"Stūriši" 565 m<sup>2</sup> treated floor area, Latvia

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### Annual heating demand: Comparison

|                |                  |             |  |
|----------------|------------------|-------------|--|
| Monthly method | (Heating)        | 71153 kWh/a | 125,9 kWh/(m <sup>2</sup> a) reference to treated floor area according to PHPP |
| Annual method  | (Annual heating) | 74984 kWh/a | 132,6 kWh/(m <sup>2</sup> a) reference to treated floor area according to PHPP |

| Month                | 1     | 2     | 3    | Month | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    | Annual total |
|----------------------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------|
| Days                 | 31    | 28    | 31   | Month | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    | 365          |
| Ambient Temp.        | -3,9  | -3,9  | 0,0  | 4     | 6,6   | 23,1  | 41,5  | 44,1  | 42,8  | 21,2  | 6,1   | 1,1   | -2,5  | 14,8         |
| Radiation - North    | 4,0   | 8,1   | 18,3 | 4     | 28,2  | 40,0  | 46,8  | 44,1  | 34,1  | 21,6  | 11,8  | 4,8   | 2,8   | 265          |
| Radiation - East     | 10,2  | 18,5  | 37,2 | 4     | 58,5  | 83,7  | 85,5  | 82,2  | 68,5  | 44,7  | 25,4  | 9,3   | 6,5   | 530          |
| Radiation - South    | 22,0  | 34,7  | 56,4 | 4     | 72,3  | 81,2  | 74,1  | 77,1  | 79,7  | 64,5  | 46,2  | 20,7  | 14,9  | 644          |
| Radiation - West     | 8,7   | 16,5  | 36,3 | 4     | 58,8  | 81,5  | 86,4  | 85,8  | 73,2  | 45,0  | 25,4  | 9,6   | 5,9   | 533          |
| Horizontal radiation | 11,5  | 25,5  | 62,6 | 4     | 107,7 | 155,3 | 161,1 | 158,1 | 131,8 | 78,6  | 39,4  | 13,8  | 6,0   | 951          |
| Tsky                 | -4,0  | -4,0  | -0,1 | 4     | 6,6   | 12,1  | 15,7  | 18,1  | 16,9  | 11,9  | 6,1   | 1,4   | -2,1  | 6,6          |
| Ground Temp          | 15,84 | 12,35 | 8,89 | 4     | 6,38  | 5,50  | 6,48  | 9,06  | 12,55 | 16,01 | 18,51 | 19,40 | 18,42 | 12,5         |