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ENERGY EFFICIENCY BUILDINGS
ENERGY FOR HOT WATER

За теперішнього росту цін на енергію її кількість для приготування і розподілення гарячої води є обмежена. У роботі представлено деякі шляхи і засоби зниження енергозатрат для приготування і розподілення гарячої води для плоских будівель.

At the actual increase price energy is cut-down energy for preparation and distribution of hot water. In paper are presented any ways and means energy reduction near preparation and distribution of hot water for flat-building.

Introduction. The validity to akt of energy efficiency is from 2005 in a Slovakia. He specifies minimal energy requirements for new and reconstruct's the houses. Total energy used inside of the house are energy to heating, preparation of the hott water, climatization and lighting. Energy for preparation the hot water is element total's energy used inside the of house.

Systéms hot water. In paper are presented four alternative distribution systems of the hot water. The hot water is preparing in heat exchanger outdoor. Distribution systems the hot water delivery together the 16 three-room flats. The flat-building is 35 years old. Caloric and energy requirement are calculated for the three alternatives.

The first alternative

The flat-building is not restoration. Distribution system – the rising piping is thermally insulated of felty strap´s (size 3 mm). The heat conductivity of thermal insulation is $\lambda = 0,07$ W/(m.K). Horizontal piping is thermally insulated of mineral wave. Size of mineral wave is 20 mm. Heat conductivity of mineral wave is $\lambda = 0,037$ W/(m.K).

The second alternative

The flat-building is restoration. Distribution system – the rising and horizontal piping are thermally insulated of foamed polyethylene (size 6 mm). The heat conductivity of thermal insulation is $\lambda = 0,044$ W/(m.K).

The third alternative

The flat-building is restoration. Distribution system – the rising and horizontal piping are thermally insulated of foamed polyethylene. Size of thermal insulation is according to national annex. The heat losses of 1 meter pipe´s are less or equal 8 W/m.

Energy of delivered hot water. This method is characterised by the assumption that there is a linear relationship between the domestic hot water demand and the floor area of the building. If the domestic hot water requirement is directly related to floor area, the energy content of the hot water delivered to the user (Q_w) may be calculated by:

$$Q_w = C_{tap} * A \qquad \text{(MJ/day)} \qquad (1)$$

where:

C_{tap} - is a specific hot water demand per day based on a water delivery temperature of 60°C and cold water supply temperature of 10°C. Values for $C_{tap} = 20$ kWh/m^2 - are given in a National decree.

A - specified floor area, $A = 1\ 024$ m^2.

Calculation energy delivery of the hot water for the flat-building - according to plank surface is Q_w

= 20 480 kWh/rok.

Distribution Heat losses. This section provides calculation of the heat losses from the domestic hot water distribution system.

In the calculations, a distinction is made between heat losses of the circulation loop and heat losses of the individual distribution pipes to the user outlet. These heat losses are calculated separately and then totalled.

The total heat at loss ($Q_{w,d}$) due to the distribution system is calculated by adding the heat loss from eachsection as follows:

$$Q_{W,d} = \Sigma Q_{W,dind} + Q_{W,dcol} \qquad \text{(kWh/day)} \qquad (2)$$

where;

$Q_{W,dind}$ - heat loss from independent section i of the distribution system

$Q_{W,dcol}$ - heat loss from circulation loop

Heat energy loss from pipe.

The general determination of heat losses, of the pipe section - of hot water pipe distribution system without a circulatory loop is given by:

$$Q_{W,d,i} = \frac{1}{1000}.U_i.L_i.\left(\Theta_{W,d,i} - \Theta_{amb}\right).t_W \qquad \text{(kWh/day)} \qquad (3)$$

where:

$Q_{W,d,i}$ - heat losses of the pipe section (per day), (kWh/day)

U_i - linear thermal transmission coefficient, (W/mK)

L_i - length of pipe section (m)

$\Theta_{W,d,i}$ - average temperature of pipe section (°C) $\Theta_{W,d,i} = 52$ °C

Θ_{amb} - average ambient temperature (°C)

            $\Theta_{amb} = 15$ °C for horizontal pipes

            $\Theta_{amb} = 25$ °C for rising pipes

t_W - daily utilisation period at the corresponding temperature, (h/day)

The total heat emission from the domestic hot water distribution system is calculated as the sum of heat emissions from the individual pipe sections.

The energy consumption on operation distributive system is:

- The first alternative $Q_{W,d,1} = 18\ 621$ kWh/rok,
- The second alternative $Q_{W,d,2} = 14\ 428$ kWh/rok,
- The third alternative $Q_{W,d,3} = 7\ 506$ kWh/rok.

Energy requirement for the hot water systems. The heat generator for the hot water system shall provide the energy required for meeting the energy need for the hot water. The energy requirement on the heat generator is given by:

$$Q_{W,gen,out} = Q_W + Q_{W,dis,ls} + Q_{W,st,ls} + Q_{W,p,ls} \qquad \text{(kWh/day)} \qquad (4)$$

where:

$Q_{W,gen,out}$ - is the total generation output (kWh/day)

Q_W - is the hot water requirement (kWh/day)

$Q_{W,dis,ls}$ - is the thermal loss from hot water distribution system (kWh/day)

$Q_{W,st,ls}$ - is the thermal loss from the hot water storage vessel (kWh/day)

$Q_{W,p,ls}$ - is the thermal loss from primary pipes (kWh/day).

The energy requirement on system hot water for flat-building is :

-        The first alternative $Q_{W,gen,out,1} = 39\ 101$ kWh/year
-        The second alternative $Q_{W,gen,out,2} = 34\ 908$ kWh/year
-        The third alternative $Q_{W,gen,out,3} = 27\ 986$ kWh/year

Conclusion. Acquired results and calculation methods can be applied to propose an optimal hot water distribution system in a flat-building with various number of flats, as well as for various number of flat-buildings.
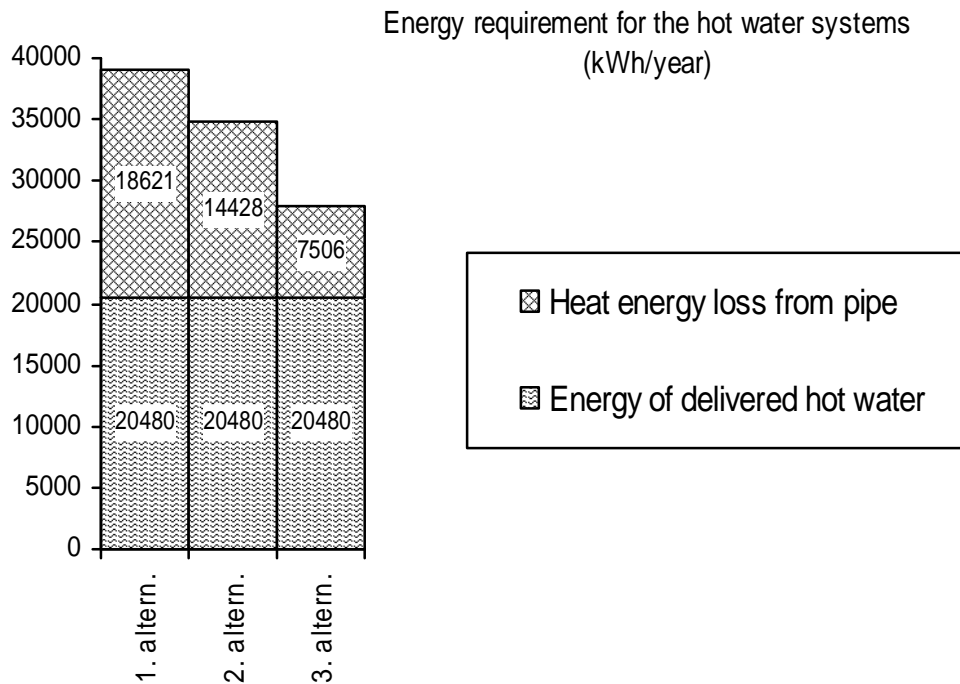

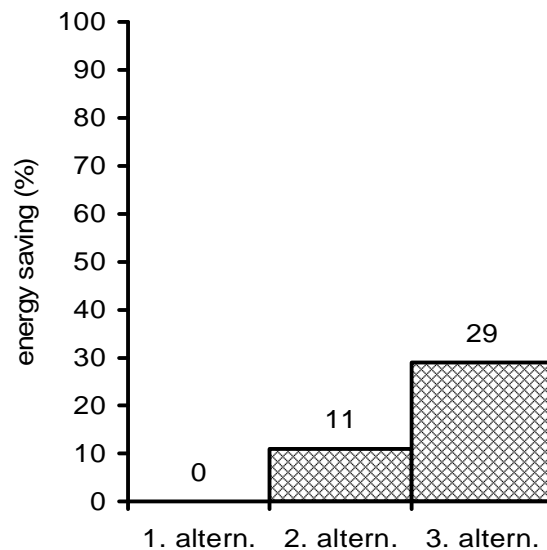*Figure 1: Energy requirement for the hot water systems*

Figure 2: General energy saving on operation distributive system (%)

1. STN EN 15316-3-1 Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 3-1: Domestic hot water systems, characterisation of needs (tapping requirements). 2. STN EN 15316-3-2 Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 3-2: Domestic hot water systems, distribution. 3. STN EN 15316-3-3 Heating systems in buildings − Method for calculation of system energy requirements and system efficiencies − Part 3-3: Domestic hot water systems, generation