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INCREASING ENERGY EFFICIENCY OF SOCIAL BUILDING

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Problem statement. The European Directive on the Energy Performance of Buildings insists that all residential buildings from the end of 2020 must meet the standard of a building with «zero» energy consumption or be "positive", all existing residential buildings need thermal modernization according to modern requirements.

The professors and students of PSABA participated in the International project "International Sustainable Engineering Practices", which was supported by the Visegrad Fund. The global aim of the InStep project was to improve the education of future planners in the field of nearly zero energy buildings. One of the tasks for the participants was to develop a reconstruction/ renovation project of the Center-shelter for women with children in Malacky (Slovakia).

Purpose of the study. The shelter was founded in 2006 in Malacky (Slovakia) and is designed to accommodate 40 people at a time. Mothers with children live in this shelter, who are in a difficult social situation for various reasons (unemployment, difficult financal situation, domestic violence, etc.). The aim of this work is to design measures to improve the energy efficiency of the building and to increase the quality of the indoor environment of a social institution for women with children in Malacky (Slovakia).

Main results. At the first stage a visual inspection of the building of the Center-shelter was carried out. The one-story shelter building is connected to a multi-storey residential building. The external wall consists of the profiled sheet, the silicate brick, the plaster, the total width is 330 mm, the heat transmission coefficient is U = 1,78 W/m^{2}K, significantly exceeds the standard value. The windows are made of plastic and aluminum profil, the heat transmission coefficient is U = 2 W/m^{2}K. The roof of this shelter is completed of roll material, U = 0,6 W/m^{2}K. The heat transmission coefficient of floors is U = 0,27W/m^{2}K.

In this study, the calculation of heat losses through the enclosing structures of the building were calculated monthly during the heating period according to the method ДБН В.2.6-31:2016 [2]. The data of climatic condition and the calculated temperatures were taken according to [3].

According to the calculation results, the largest heat losses occur through the external walls of the building − 60 %. Measures to increase the energy efficiency of the building were thermal insulation of enclosing structures and extension of the greenhouse to the Center building on the south or east side (the most rational orientation for the greenhouse) [4].

Table

Heat losses through Center's building envelope during the heating period

External envelope	Area (m^2)	The heat transmission coefficient U, W/m^2K	Inside temperature t_i, °C	Monthly heat losses, kWh							
				October	November	December	January	February	March	April	Total for the period, kWh
Walls	469,3	1,78	21	9 260,4	11 547	14 232	15 165	13 080	12 244	9 383	84 911,4
Windows	62,08	2	21	1 376,4	1 716	2 115	2 254	1 944	1 820	1 394	12 620,5
Flat roof	494,4	0,6	21	3 288,4	4 101	5 054	5 385	4 645	4 348	3 332	30 152,6
Floors	494,4	0,27	21	1 479,8	1 845	2 274	2 423	2090	1 956	1 499	13 568,7
Total heat losses during the heating period, kWh				**141 253,2**							

Fig. Architectural solution of the greenhouse attachment to the building of the shelter

The exterior walls of the shelter building are proposed to revet with ventilated systems and with mineral wool as an insulation. The windows and external doors must be replace with modern energy-efficient structures for reducing heat losses through translucent openings. The greenhouse frame is developped from light steel thin-walled structures. As a material of translucent coating in the greenhouse we use cellular polycarbonate, 16 mm thickness [5], the distination between the transverse frames is recommended 3 m, cover should be made on trusses of light-weight steel structures, the profil is C-section, 200 × 70 × 2.5 mm. Due to the relatively small weight of structures, such building is installed on reinforced concrete foundations.

The heat losses through the enclosing structures of shelter building combaned with greenhouse was calculated. This research includes a calcul of heat losses and solar gains monthly for the heating period. It was found that the heat gains are three times more than the heat losses. But at the same time, due to the peculiarity of climatic conditions, heat gains are distributed unevenly during the year period.

For the greenhouse function throughout the year, it is necessary to organize additional heating sources during the cold period or external protection means for translucent surfaces (external blinds). The heating accumulators can be offered as additional sources of heating: daily allowance for the autumn-spring transition period and seasonal for the coldest winter months.

Conclusion. To increase the building energy efficiency class and reduce heat losses through the building envelope, and to improve the quality of staying inside the building, it is necessary to take measures for the thermal insulation protection of the enclosing building envelope. The implementation of the proposed measures for improving the energy efficiency of the building and the construction of a greenhouse attached with shelter building make a great technical and socio-psychological contribution. The greenhouse structure can provide an additional source of heat during the cold season, and the solar energy stored in the greenhouse can be used as an additional source of heat during the cold season. The erecting of a greenhouse and the gardering in it will diversify the daily diet of the shelter residents with high-quality and healthy food and, possibly, will give additional profit from the sale of excess products. Also the construction of the greenhouse will allow organizing the leisure activities for the residents of the shelter when they are busy with gardering, which is very important not only for adults, but especially for children.

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