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THERMAL PERFORMANCE IMPROVED THROUGH BIM DESIGN

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Problem statement. Nowadays, the problems of energy efficiency of existing buildings. are quite relevant and they require modern solutions. The use of information modeling technologies allows solving this problem with lower labor costs, thorough monitoring building costs, as well as comparisons of findings before and after insulation.

The purpose of the study. Information modeling technologies can contribute changes into the design of buildings. The software makes possible to conduct analytical calculations of the building and work on improving energy efficiency indicators. The analysis helps accurately calculate how much money is necessary to spend on insulation, which designs are more expedient to use and how much electricity and heating consumption will decrease. The correct choice of structures and materials makes it possible to reduce the cost of heating the building and increase the energy efficiency class. With alternative energy sources, it is possible to provide high indexes of the building and reduce the emissions of harmful gases to the environment. Also, the use of solar panels allows the building to be more autonomous.

Results of the research. During the study, two models of the building, before and after insulation are analyzed. The model of this building was provided by the public enterprise "Buildit Ukraine" within the international competition among the students "VDC Roasting". The virtual object information interacts with a large amount of available reference material that is entered into the system, and with additional services, namely Autodesk Insight (cloud software for the analysis of energy efficiency of buildings) allows you to get the results and explore the potential for improving the energy efficiency of the project. Insight reflects numerical results, as well as an interactive view of a model that allows you to visualize heating loads, refrigeration loads and potential of photovoltaic surfaces in the model.

The building that has been analyzed, trapezoidally in terms, is a three-storey building with an underground parking. The dimensions of the building in the axes are 56,7×18 (13) m, the height of the building − 15 m. Stairs and elevator are provided to connect the floors.

To improve the energy efficiency of the building with a fixed budget of 300 000 USD, it was decided to change the structure of the walls, slabs over parking, replace existing windows and doors to windows and doors with improved parameters.

Also, solar panels were installed for making the building autonomous and saving money for electricity.

The structure of the walls after insulation has the following indicators:

	Функция	Материал	Толщина	Огибания	Материал несущих конструкций
1	Отделка 2 [5]	Ceramic Tile_White	15.0	☑	■
2	Термическая/воздушная прос	_Air_Gap	50.0	☑	☐
3	Термическая/воздушная прос	Mineral Wool	200.0	☑	☐
4	**Граница сердцевины**	**Слои выше огибания**	**0.0**		
5	Структура [1]	Ceramic Brick	380.0	☐	☑
6	**Граница сердцевины**	**Слои ниже огибания**	**0.0**		
7	Отделка 2 [5]	Plaster	10.0	☑	☐

Fig. 1. Wall structure after insulation

Heat transfer coefficients of windows and doors after replacement:
- windows − 0,8333 W / (m^2 K),
- Doors − 0,8333 W / (m^2 K).

To insulate the slabs over parking, the plates from mineral wool of 150-mm thickness followed by plastering as a finishing layer were used

After the analysis of the insulated building in Autodesk Insight the following indicators were obtained.

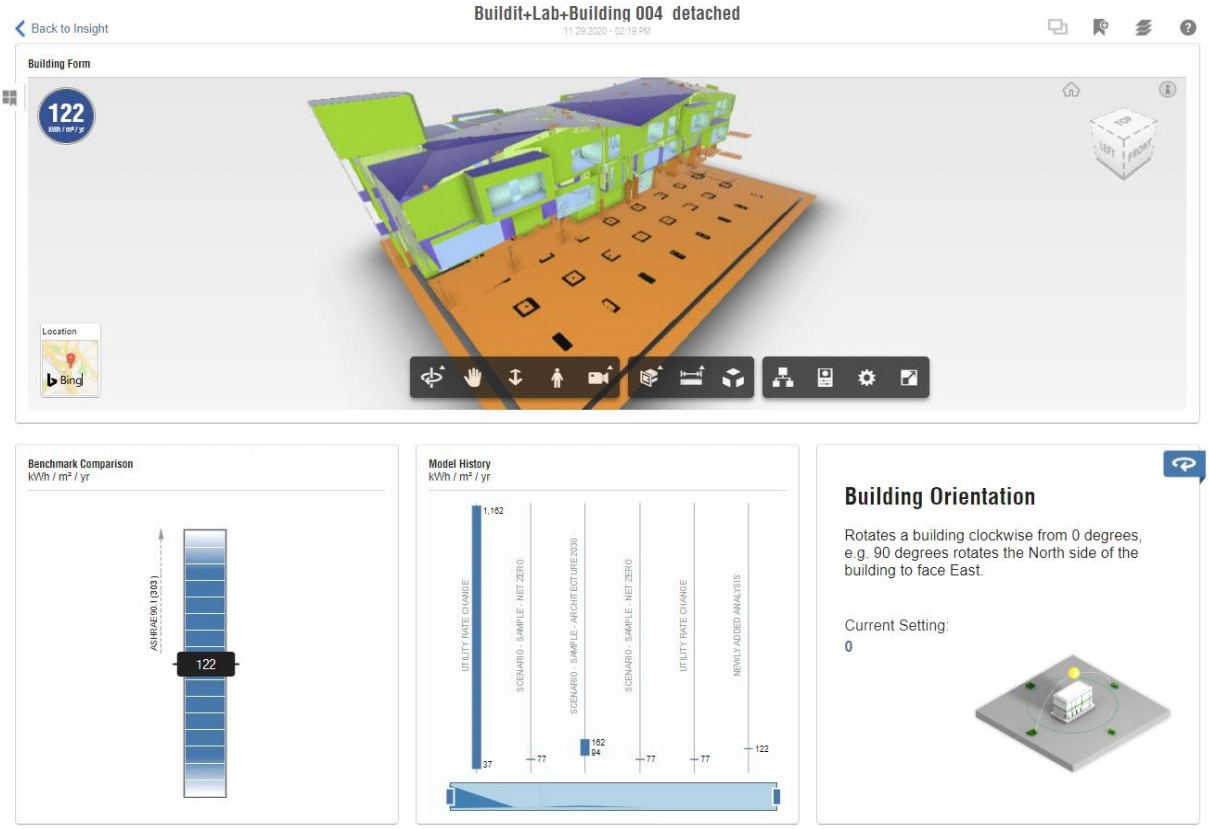

Fig. 2. Analysis data from Autodesk Insight (after insulation)

Also, a table of total cost of materials used to increase energy efficiency and their calculated value.

№	Name	Count	Price EUR
1	Windows	182	112 020
2	Doors	6	3 794
3	Insulated walls	995 m^2	94 508
4	Insulated floor	920 m^2	3 165,967
Total			213 487,967

Conclusions. The development of information modeling of buildings has demonstrated a new powerful source of efficiency of choosing rational architectural and technological solutions that ensure minimization of energy consumption and emissions of CO_2 at a given estimated limitation.

The results of the analysis of building energy efficiency showed that after the insulation, energy consumption decreased by 57 %.

The insulation of the building was calculated according to the allocated 300 000 USD budget.

References

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