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THE IMPACT OF THE ENERGY EFFICIENCY OF THE BUILDING TO ITS MARKET VALUE

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ABSTRACT: In the presented considerations, attention was focused primarily on signaling selected problem issues related to energy efficiency of buildings and its relation to the market value of a building property. The thesis was put forward that the improvement of energy efficiency, through the implementation of the directions of technological development in the building industry and the use of renewable energy sources significantly affects the value of building property. In Poland, more and more importance is attached to environmental protection and energy savings through thermal modernization of buildings in order to improve thermal insulation of walls, modernization of ventilation system, regular inspections and repairs of central heating boilers, modernization of hot water preparation systems, introduction of alternative energy sources, or the use of modern technologies in the building industry.

KEY WORDS: energy efficiency, buildings, energy demand, energy consumption, market value of building property

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Introduction

In recent years, more and more attention has been paid to energy savings, which on the one hand results from the increase in demand for energy caused by the development of individual regions of the world, with the simultaneous depletion of non-renewable fuels and the search for sources to meet the growing energy needs, and on the other hand from the problems related to emissions to the atmosphere and their impact on climate change. These problems occur in many areas, and one of them is construction. For the purpose of these considerations, attention has been focused on housing.

Modern construction technologies more and more often take into account energy efficiency aspects. On the one hand, it is cost-intensive at the construction stage, but on the other hand, it brings a measurable profit in the process of exploitation and measurable effects related to

environmental protection. In the light of the problem under consideration, it is worth noting that the costs incurred to achieve the highest possible energy efficiency of residential buildings influence their market value.

Energy efficiency of a residential building in terms of energy demand

According to estimates, the demand for energy, along with the development of the world economy, is constantly increasing, and the rate of this growth is extremely fast. Analyses indicate that the largest energy consumption is in the residential sector. It is one of the following

emissions from the main energy consumers in the modern economies of developed countries and especially in the phase of operation of these facilities. Buildings account on average for about 41% of the total energy consumption in the European Union, which translates into the emission of about 842 million tons of CO_2 (Lis, Sekret, 2016).

The European Environment Agency in the European Union estimates that energy used for space heating accounts for 69% of total energy consumption in buildings (in Poland it is about 71%), 15% is used for hot water preparation, 11% for lighting and driving electric equipment and 5% for cooking (Lis, Sekret, 2016).

With reference to the above data, it should be stated that the biggest benefits would be the savings in the area of heating of buildings and here we should look for optimal solutions to this problem. Saving energy and thereby creating reserves of energy used during further development has introduced the necessity to consider the issues related to the so-called energy efficiency of buildings.

According to the Energy Efficiency Act of 20 May 2016 Energy efficiency is the ratio of the achieved amount of the utility effect of a given facility, technical equipment or installation, under typical conditions of use or operation, to the amount of energy consumed by that facility, technical equipment or installation, or as a result of a service rendered necessary to achieve that effect.

The energy efficiency value is therefore the ratio of the amount of energy used for heating prior to the modernization of a building to the amount of energy used after the modernization. It can therefore be concluded that energy efficiency determines how much energy can be saved by undertaking certain thermo-insulation measures, by increasing the efficiency of heating appliances or by simply reducing unnecessary consumption of electricity, gas and coal.

The energy efficiency of a building depends on many factors. Of course, the thermo-physical properties of the building material are most important. The key role is undoubtedly played by the roof and windows. Heating systems that can significantly reduce energy consumption are also very important. The best effects of measures to improve the energy efficiency of buildings are achieved by in a comprehensive approach – while sealing the building by improving thermal insulation and installing better heating equipment.

Measures to improve energy efficiency are not yet very popular, although they certainly guarantee real savings, even in the short term. When planning a thermomodernization, of course, it is worth taking a good look at the building itself first. A comprehensive solution is to conduct a full energy audit, combined with a thermal imaging camera. This allows you to determine exactly which way the heat escapes, which elements cause the greatest loss of energy, and which solutions will bring the best results.

Table 1. Energy standards of buildings in Poland since 1966

Year of construction of the building	Index of energy consumption for heating kWh/[m^2/year]
until 1966	240 – 350
1967 – 1985	240 – 280
1985 – 1992	160 – 200
1992 – 1997	120 – 160
from 1998	90 – 120
currently	50 – 80

Source: Kapuściński, Rodzoch, 2010.

An important issue in thermal upgrading is the age of the building, which is closely related to the technology used in residential construction and the current energy standards. According to Kapuściński and Rodzoch's (2010) analyses, unit heat demand of residential buildings in Poland changed with the period of their construction (table 1).

Unfortunately, in the case of about 90% of flats in Poland, the energy standard is lower than 240 kWh/(m^2/year). As can be seen, the area for the implementation of thermal upgrading processes in buildings, including their technical equipment, is very large.

Thermomodernization consists in introducing changes which aim at limiting heat loss and ensuring more economic and energy-efficient heating of interiors, as well as usable water. As already mentioned, the main reason for high consumption of heating energy is excessive heat loss from the house. It most often penetrates outside the building through inadequately insulated external walls and windows, roof and floor on the ground. For this reason, thermomodernization is most often performed:

- insulation of external walls of the building,
- replacement of windows and doors,
- roof or flat roof insulation,
- insulation of the ceiling above the unheated basement or insulation of the floor on the ground.

Thermomodernisation of a house also concerns its internal installations and consists, among other things, in:

- modernization or replacement of the heating system,
- starting to use RES (renewable energy sources) for heating purposes, e.g. through the installation of solar collectors or heat pumps,
- use of mechanical ventilation with heat recovery (recuperation),
- insulation of uncovered central heating and hot water pipes,
- Improvement of the hot water production system.

Investment outlays on this type of construction and energy technologies are quite significant. However, it is assumed that within a few years such investment should pay off, especially with financial support from the funds for the promotion of pro-environmental solutions. In the case of currently constructed buildings, the use of modern technologies aimed at obtaining low-energy buildings, which have an energy demand for heating in the range of 15-45 kWh/(m^2 a year) and passive buildings with a value of this ratio below 15 kWh/(m^2 a year), also generates high costs.

In conclusion, it can be expected that in the case of thermal upgrading of buildings as well as in the case of construction of new low-energy residential buildings, the costs incurred will translate into the market value of these building properties.

Low energy building properties and their market value

According to the Real Estate Management Act "the market value of a property is the estimated amount that can be obtained on the valuation date for a property in a sale transaction concluded on market terms between the buyer and the seller, who have a firm intention to enter into an agreement, act with discernment and prudence, and are not in a forced situation".

The market value of a property is affected by many different attributes, which are clearly classified in the literature. In the course of these considerations on the question of the impact of the energy efficiency of a building on its market value, the characteristics that affect its economic value, related not only to the cost of purchase or construction, but also to the costs of subsequent operation of the building, are particularly relevant.

A building property is a very specific good, whose market value is determined by certain features, such as:

- the surrounding area of the object,
- shape and size of the plot,
- the age of the building,
- quality of materials used in the construction of the facility,
- type of object and type of construction,
- quality of construction workmanship,
- operating conditions,
- design defects,
- the renovation economy carried out,
- security,
- microclimate,
- maintenance costs,
- demand and supply,
- energy intensity.

Among the factors influencing the market value of building properties, the technical condition of the building and its demand for energy for utility purposes, such as space heating and water heating, play an important role. These parameters naturally affect the costs associated with the use of the building.

Actions aimed at improving the technical characteristics of buildings, which result in a reduction in the demand for heat necessary for heating and hot water by eliminating heat losses, are the most important element of thermo-modernization measures.

The modernization of existing construction works should take into account the principles of sustainable development. The development of an integrated plan for the assessment, maintenance and management of the

works and the energy efficiency of the works are of particular importance in this respect and should take into account the following factors:
- reduction of energy consumption,
- use of renewable energy sources (solar collectors, heat pumps, domestic wind and hydroelectric power plants, biofuels),
- installation of modern measuring devices monitoring energy, gas and heat consumption in the facility,
- continuous analysis of the degree of consumption of energy carriers through the use of specialized IT tools.

The benefits of thermal upgrading include, first of all, a decrease in property maintenance costs, an increase in its value, as well as an improvement in the comfort of operation in a given facility. Generally, one can observe a desire to achieve results in terms of heat transfer coefficient through building envelope at a level lower than the limit values not provided for in the Act. This is advantageous due to the constantly changing legal regulations concerning the insulation requirements of buildings, and also economic profits, because with a small increase in investment costs it may cause a high decrease in the annual energy demand of the building.

Profits from thermomodernization procedures may turn out to be significant depending on the type of conducted procedures and the current condition of the building. The greatest benefits are usually obtained when insulating the buildings and modernizing the central heating system. However, it is beneficial to jointly modernize a wider range of building elements causing heat losses, which allows for synergy. The table 2 presents average changes in the scope of savings on heating of buildings in particular types of modernization.

Table 2. Estimated savings from thermal upgrading of the building

How to achieve savings	Reducing heat consumption
Thermal insulation of external building partitions (walls, roof, ceiling, cellar ceiling) – without windows	15-25%
Replacement of windows with airtight windows with a lower value of the permeation coefficient	10-15%
Introduction of improvements in the heat substation, including weather automatics and control equipment	5-15%
Comprehensive modernisation of the internal central heating system, including air-tightness of the system and insulation of pipes, hydraulic control and installation of thermostatic valves in all rooms	10-25%
Introduction of cost allocators	about 5%

Source: www.termomodernizacja.pl/strony/na-czym-polega-termomodernizacja [01-05-2019].

The thermal upgrading investments are aimed at achieving high energy efficiency based on energy savings. Thermomodernization of buildings is characterized by a relatively short payback period of 5-8 years. The rate of return on outlays in the analyzed investments ranges from 19-10%, which proves the following of their high economic efficiency. Usually, the value of savings from heating the property after a period of 10 years fully covers the amount of investment in this type of investment. It is estimated that this value is an approximate amount of the increase in the value of the property.

Conclusions

In the process of estimating the value of building properties, a number of attributes are taken into account. The set of features significantly affecting the value is not clearly defined, however, in the light of the applicable valuation standards, appraisers usually select a specific set of features matching it to the purpose of valuation and the type of property. In the case of residential properties, these are usually the location, the technical condition of the building, the area of the premises, the number of rooms, the location on the first floor or the communication accessibility. However, there are features that do not affect the value of such properties to a lesser extent, but are not taken into account in the valuation process, or are very rarely taken into account.

Taking into account the fact that residential buildings generate costs at the stage of purchase or construction, but also in their subsequent maintenance, the costs incurred for their thermal upgrading should be taken into account in the process of evaluation of their value, which in consequence will reduce the costs of building operation in later years. After such measures, buildings have a much lower heat demand in the form of primary energy, so that the investment is returned, which of course takes time. There is no doubt that the building after thermal upgrading has a higher market value.

Therefore, it should be postulated that property appraisers should develop a normative system for assessing the impact of the energy efficiency of a building on its market value.

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