

THE ROLE OF PROPERTY MANAGEMENT IN PROMOTING ENERGY-EFFICIENT SOLUTIONS FOR RENTALS

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Abstract

Real estate management plays a key role in promoting energy efficient solutions when renting out properties. The purpose of the study is to analyze the impact of management companies on the introduction of energy-efficient technologies to increase the competitiveness of facilities and reduce operating costs. The methodology is based on the analysis of data on the application of modern energy-efficient solutions, including lighting, heating and automation systems in buildings in the Czech Republic. The results showed that the use of such technologies helps to reduce utility costs by 20-40% and increases the attractiveness of facilities for tenants. In conclusion, property management aimed at energy efficiency ensures the achievement of sustainable development and economic benefits for owners and tenants. These measures increase the market value of the properties and extend the lease terms, which strengthens the position in the real estate rental market.

Keywords Real estate management, energy efficiency, rent, operating costs, sustainable development.

INTRODUCTION

In today's world, energy efficiency issues are becoming increasingly relevant, particularly in the context of sustainable development and the need to reduce negative environmental impacts. With rising energy prices and increasing environmental regulations by governments, energy-efficient solutions are gaining significant importance for both private and commercial real estate properties. Property management is becoming a key mechanism in implementing these solutions in practice, directly influencing the operational performance of buildings and conditions for tenants.

The relevance of this topic is driven by the fact that effective property management not only reduces utility costs but also increases the market value of properties, making them more attractive to

tenants focused on sustainability and reducing their carbon footprint. In such circumstances, renting properties with high energy efficiency standards becomes a preferred strategy for companies seeking to minimize operating expenses and comply with environmental regulations. This is particularly important in countries like the Czech Republic, where government policies actively support the development of energy-efficient technologies and encourage their use in commercial and residential real estate.

The aim of this study is to analyze the impact of property management companies on the implementation of energy-efficient technologies to enhance the competitiveness of properties and reduce operating costs.

MATERIALS AND METHODS

The Czech Republic does not possess extensive reserves of fossil fuels (Table 1). Globally, in terms of proven oil and natural gas reserves, the country ranks 85th and 93rd, respectively. As of 2024, coal

accounts for 99.8% of the country's proven reserves in tons of oil equivalent, natural gas for 0.1%, and oil for 0.1%. The most significant resource for the country is coal, with reserves estimated at 35.2 million barrels in 2021 [1].

Table 1. Fossil energy resources of the Czech Republic [1]

Resource/ Explanation	Crude Oil*	Natural Gas*	Coal*	Shale Gas	Tight Oil	Coalbed Methane
Value	15 (0.001%)	0.14 (0.002%)	3,962 (0.34%)	-	-	1.8 - 7.8
Unit	million barrels	Tcf	million short tons	-	-	billion cubic meters

***Figures in parentheses indicate the country's share in global reserves.**

The key indicators reflecting the volumes of these resources are shown in Table 2. The technical potential of hydropower that can be efficiently utilized in the country is estimated at 3,978 GWh per year, approximately seven times lower than the corresponding figure in Austria. The level of global horizontal irradiation across most regions of the Czech Republic ranges from 3.0 to 3.1 kWh/m² per day, while in the regions of Southern and Northern Moravia, this value can exceed 3.1 kWh/m² per day, which is comparable to figures recorded in Denmark, southern Sweden, and Belgium [1].

Table 2. Renewable energy resources of the Czech Republic [1].

Resource/Expl anation	Solar Potential (GHI)*	Wind Potential (50 m)*	Biomass Potential (agricultural area)	Biomass Potential (forest area)	Municipal Solid Waste
Value	3.0-3.1	5.5-6.5	45.7	34.7	570
Unit	kWh/m ² /day	m/s	% of land area	% of land area	kg per capita

***For the majority of the country's territory**

****Technically exploitable potential**

The distribution of wind potential in the Czech Republic is characterized by the following indicators: in most areas, wind speeds range from 5.5 to 6.5 meters per second, although in the eastern regions and the territory of Northern Moravia, this figure can exceed 7 meters per second at a height of 50 meters. These data indicate the prospects for the development of wind

energy in the country's energy sector, providing an opportunity to compete with other local renewable technologies such as bioenergy. According to the BP Statistical Review of World Energy 2023, the energy balance of the Czech Republic shows that the total primary energy consumption in 2021 amounted to 1.68 exajoules. Of this volume, 32.1% came from coal, 24.4% from oil, 19.6% from natural gas, 16.7% from nuclear energy, 5.9% from

other renewable sources, and 1.2% from hydropower [2].

In the electricity sector, the Czech Republic continues to use fossil fuels and nuclear energy, although there has been a general decline in the share of fossil fuels in the electricity generation structure. Due to the lack of significant oil and natural gas reserves, the Czech Republic holds a minor position in global rankings in terms of production and consumption of these resources. However, in terms of coal reserves and usage, the country holds a more stable position. The Czech Republic ranks 50th out of 170 countries in terms of the share of electricity generated from renewable sources, excluding hydropower [3].

The territorial map of key infrastructure facilities

in the fossil fuel and electricity production sectors in the Czech Republic is shown in Figure 1. Coal remains the main component of the country's energy resources, accounting for 99.8% of the total volume, while natural gas and oil each account for 0.1%. The most significant coal mine is Nastup Tusimice & Bilina, with an output of approximately 21 million tons per year. Among oil fields, Dambořice leads with a production capacity of 4,700 barrels per day. Oil storage is carried out at the largest storage facility in Nelahozeves (Mero ČR terminal), with a capacity of 1,550,000 cubic meters. The country operates three oil refineries, of which the Litvínov refinery is the largest, with a capacity of 120,000 barrels per day. Oil transportation is carried out through a pipeline network with a total length of 536 and 94 km.

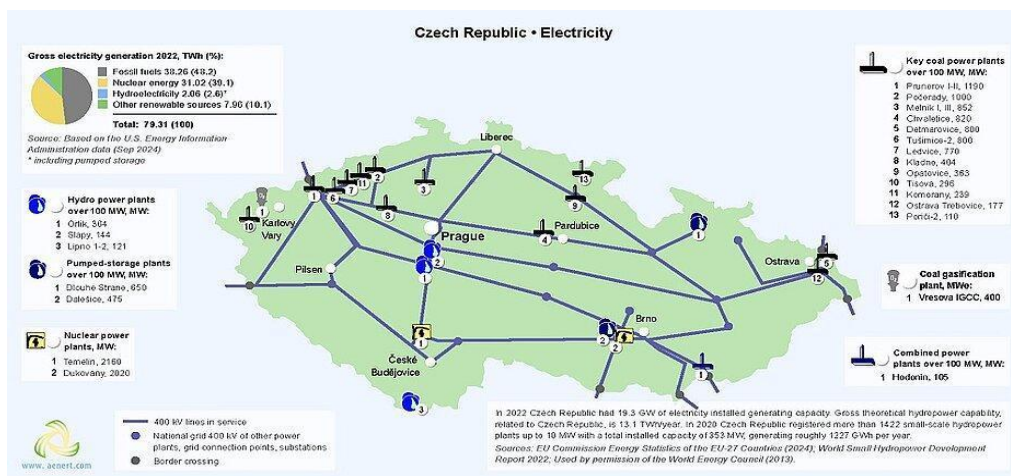
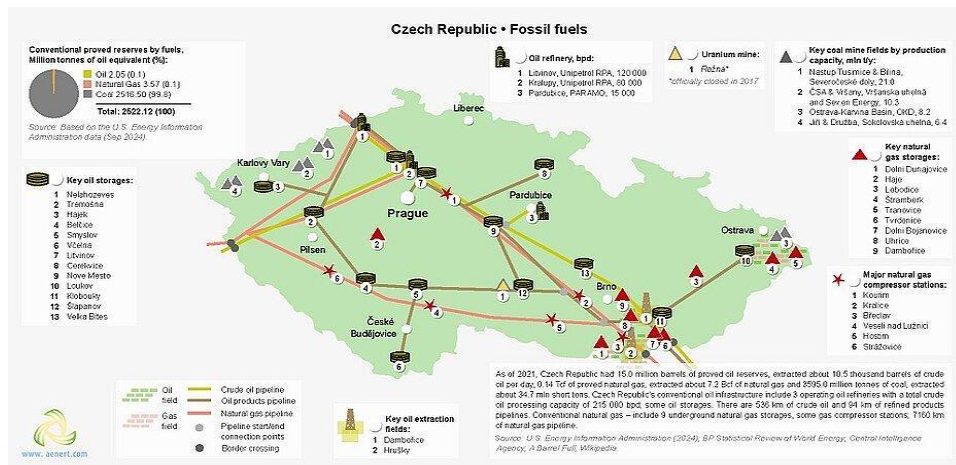


Fig.1. Electricity generation and renewable energy sources in the Czech Republic [3].

Among the most significant power plants in the country are the coal-fired Prunéřov I-II complex with an installed capacity of 1190 MW, the Temelín nuclear power plant with a capacity of 2160 MW, and the Hodonín combined power plant with a capacity of 105 MW. As previously mentioned, in 2023, electricity production from renewable sources (excluding hydropower) reached 8.99 TWh. In areas with favorable wind conditions, there are 11 large wind farms, each with a capacity of over 7 MWh. The total installed capacity of wind power in the Czech Republic is 278 MW, with the largest wind farm being Margonin, which has a capacity of 42 MW [27]. In regions with high levels of solar radiation (up to 3.1 kWh/m²), numerous solar power plants are located. The largest photovoltaic power station is Ralsko Ra-1, with a capacity of 38.3 MW.

Housing and energy poverty have a significant impact on various aspects of life and have become a focus for many governments in Europe. To address this issue, subsidy programs aimed at improving energy efficiency and household energy security are being implemented, such as support for solar energy, insulation, and modernization of heating systems. The Czech government plans to increase the installed capacity of hydropower plants to 1,127 MW, wind farms to 970 MW, and solar stations to 3,975 MW by 2030. The country also operates biomass processing plants and facilities for the production of biodiesel, bioethanol, pellets, and other types of biofuels.

The transition to renewable energy sources (RES) requires the development of systems that account for technological, territorial, and managerial features, as well as the involvement of various stakeholders, such as energy producers and consumers. One of the most important forms of such innovations has been the creation of energy

communities, which are cooperatives of citizens and organizations aimed at establishing more sustainable energy systems. At the same time, different models and levels of participation in these projects demonstrate that the community can act as both an active energy producer and consumer.

The European Union actively promotes the concept of energy communities, which is reflected in legislative initiatives such as the Renewable Energy Directive (RED II) and the Internal Electricity Market Directive (IEMD) (Directive, 2018; Directive, 2019). These documents create conditions for the involvement of citizens in the energy sector and contribute to the decentralization of energy management (Tosun et al., 2019) [5].

The European Bank for Reconstruction and Development (EBRD) supports the enhancement of energy efficiency in the housing sector of the Czech Republic by providing a loan of €110 million to Heimstaden Bostad, which manages the largest private rental housing portfolio in the country [6].

In collaboration with commercial banks, the EBRD directs funds toward the comprehensive environmental renovation of Heimstaden Bostad's residential properties, covering approximately 42,500 housing units, according to the bank's statement. The primary objective of this "green" loan, aimed at sustainable development, is the modernization of buildings, including the implementation of thermal insulation materials and the transition to low-carbon energy sources, such as renewable energy and heat pumps.

It is anticipated that such environmental investments will enable the company to achieve its goal of reducing greenhouse gas emissions by 42% by 2030, using 2020 as the baseline year. Since the

majority of emission reductions are expected to come from the Czech portfolio, the EBRD's financing will be a crucial factor in achieving this goal.

The study by Sokolovsky and colleagues [7] highlights the link between inadequate housing conditions and inefficient heating systems, which increase the risk of illness. Their survey of 1,735 respondents from two mid-sized cities in Poland's coal region revealed that residents living in unfavorable housing conditions are more likely to suffer from musculoskeletal and cardiovascular diseases. Respiratory problems were also noted among those using coal or wood stoves instead of central heating [8,9]. Similar conclusions were drawn by Jessel and colleagues, who pointed to the negative impact of energy instability on health, particularly in conditions of poverty and climate change. Kopp and co-authors argue that energy poverty is often accompanied by a lack of water resources, which leads to associated health problems. Water instability, undeniably, represents another related challenge.

To ensure the accuracy of the data, a statistical evaluation of price proposals is conducted; offers with detected errors are excluded from the analysis. Additionally, listings with unrealistic prices are removed from the sample to account for the difference between the stated price and actual market values [10].

Thus, it can be concluded that the Czech Republic is actively developing the renewable energy sector, including solar and wind power plants. Programs aimed at improving energy efficiency and introducing innovative technologies, such as energy communities, demonstrate the country's commitment to energy independence and sustainable development. Support from international organizations like the EBRD contributes to environmental investments focused on reducing emissions and modernizing the

housing stock, which is also linked to improving the health and living conditions of the population.

RESULTS AND DISCUSSION

There are several specific examples of successful projects in the Czech Republic and Europe related to the implementation of energy-efficient solutions in real estate management:

1. Futurama Business Park Office Building in Prague. One of the office buildings in the "Futurama" business park in Prague introduced advanced energy management systems, including:

- Smart lighting systems that adjust light intensity based on natural daylight and the presence of people.
- Energy-efficient heating and cooling systems using heat pumps.

As a result, energy-efficient technologies helped reduce heating and lighting costs by more than 25%. The project also received the BREEAM environmental certification, which increased the building's attractiveness to tenants seeking sustainable business practices [11].

2. Building Modernization under the "Zelená úsporám" Program. This program was developed by the Czech government to support the modernization of residential and commercial buildings to improve their energy efficiency. One example is the modernization of a multi-story residential building in Brno:

- Solar panels were installed for water heating and electricity generation.
- Old windows were replaced with energy-efficient double-glazed windows.
- Modern thermal insulation materials were applied to the walls and roof of the building.

These measures reduced heating costs by 40% and allowed the investments to pay off in less than five years. The program subsidized up to 30% of the

modernization costs, making the project financially attractive [12].

3. "The Park" Project in Prague. The office complex "The Park" is a large-scale project that includes the use of advanced technologies for energy-efficient management:

- Automated ventilation and air conditioning systems with high energy efficiency.
- A centralized Building Management System (BMS) that optimizes energy consumption based on time of day, outdoor temperature, and other factors.

Thanks to these technologies, energy costs were reduced by 30%, and the attractiveness of the properties to tenants increased, making the complex one of the most sought-after business centers in Prague [13].

4. Reconstruction of a Residential Building in Karlovy Vary. A residential building in Karlovy Vary underwent a complete modernization of its heating system and facade insulation:

- Biomass boilers were installed, allowing the use of renewable energy sources for heating.
- Complete thermal insulation of the building was implemented, significantly reducing heat loss.

As a result, energy consumption for heating decreased by 35%, with the payback period for the investment being approximately six years. This project was partially funded by the European Union under a program supporting energy-efficient solutions [14].

Thus, it can be stated that property management plays a key role in promoting energy-efficient solutions in the leasing of properties. In this role, it involves the planning, implementation, and monitoring of the introduction of technologies that help reduce energy consumption and improve the operational performance of buildings. Through energy efficiency, landlords can offer more

competitive rental terms, and the properties themselves become more attractive to tenants. Several key aspects and outcomes that property management can ensure in this context include:

The implementation of energy-efficient technologies (such as smart lighting systems, thermostats, insulation, and renewable energy sources) significantly reduces heating, cooling, lighting, and other utility costs.

Energy-efficient systems often require less maintenance due to process automation and improved technologies, reducing operating costs in building management.

Modern energy-efficient buildings offer more comfortable working or living conditions as they provide more stable temperatures, better ventilation, and quality lighting. This can lead to tenants staying longer in such properties, reducing costs associated with finding new clients.

Longer lease terms and tenant loyalty reduce the costs associated with vacant spaces and the need to find new clients, further strengthening the financial stability of property owners.

The introduction of energy-efficient solutions helps property owners comply with modern environmental standards and regulatory requirements, which are becoming increasingly stringent in Europe and the Czech Republic. This reduces the risk of fines and additional modernization costs in the future.

Properties certified under standards such as LEED or BREEAM gain an additional market advantage. These certifications demonstrate compliance with high standards of energy efficiency and sustainability, which can be a decisive factor for tenants when choosing a property.

Therefore, property management that actively promotes energy-efficient solutions contributes to the creation of a sustainable and economically

advantageous business model that provides long-term benefits for both landlords and tenants.

CONCLUSION

Thus, it can be concluded that property management plays a crucial role in promoting energy-efficient solutions, ensuring sustainable development and competitiveness in rental properties. The analysis has shown that the implementation of modern energy management technologies, such as intelligent lighting and heating systems, as well as process automation, significantly reduces operational costs and increases tenant satisfaction. In particular, the adoption of energy-efficient measures leads to a 20-40% reduction in utility costs, enhances the market value of properties, and makes them more attractive to environmentally conscious tenants. Successful project examples in the Czech Republic confirm that government support and the integration of innovative solutions are important factors in the transition to energy-efficient standards. Thus, property management becomes a key tool for achieving sustainability and long-term profitability in the rental market, contributing to a reduced environmental footprint and strengthening the competitive position of properties in the market.

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