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**ENERGY SAVING TECHNOLOGIES IN HIGHER EDUCATION
INSTITUTIONS OF UKRAINE
ЕНЕРГООЩАДНІ ТЕХНОЛОГІЇ В ЗАКЛАДАХ ВИЩОЇ ОСВІТИ
УКРАЇНИ
ЭНЕРГОСБЕРЕГАЮЩИЕ ТЕХНОЛОГИИ В ЗАВЕДЕНИЯХ
ВЫСШЕГО ОБРАЗОВАНИЯ УКРАИНЫ**

***Summary.** The peculiarities of the main tendencies of development of the state energy policy of Ukraine are considered, namely: ensuring sustainable development of the country and formation of energy efficient consciousness of*

citizens through active application of energy efficiency measures in higher educational institutions, use of energy saving technologies and decentralization strategies. The effectiveness of energy balance optimization is determined and energy savings are stimulated by applying the main measures of energy saving in the activities of higher education institutions, while minimizing energy losses to the environment and the cost of economic resources for energy. The consumption of different types of energy is analyzed. Energy-saving measures are distinguished, depending on the stage of work with energy, they are used: energy-saving measures in energy production, energy-saving measures in energy conversion, energy-saving measures in energy transportation, energy-saving measures in energy consumption. Proposals are provided on the directions of resolving the existing contradictions in the implementation of the state energy policy of Ukraine.

Key words: *energy, fuel and energy resources, rational distribution of fuel and energy resources, energy saving policy, energy saving, energy saving technologies.*

Анотація. *Розглядаються особливості головних тенденцій розвитку державної енергетичної політики України, а саме: забезпечення сталого розвитку країни і формування енергоефективної свідомості у громадян за рахунок активного застосування заходів щодо підвищення рівня енергоефективності у вищих навчальних закладах, використання енергоощадних технологій і стратегії децентралізації. Визначається результативність оптимізації енергетичного балансу і стимулюється енергозаощадження, шляхом застосування у діяльності вищих навчальних закладів основних заходів економії енергетики, мінімізуючи при цьому втрати енергії у навколишнє середовище і витрати економічних ресурсів на енергетику. Аналізується споживання різних видів енергетики. Виокремлюються енергозберігаючі заходи, залежно від того, на якому*

етапі роботи з енергетикою вони використовуються: енергозберігаючі заходи при виробництві енергії, енергозберігаючі заходи при перетворенні енергії, енергозберігаючі заходи при транспортуванні енергії, енергозберігаючі заходи при споживанні енергії. Надаються пропозиції щодо напрямів розв'язання наявних суперечностей реалізації державної енергетичної політики України.

Ключові слова: *енергетика, паливно-енергетичні ресурси, раціональний розподіл паливно-енергетичних ресурсів, енергозберігаюча політика, енергозбереження, енергоощадні технології.*

Аннотація. *Рассматриваются особенности главных тенденций развития государственной энергетической политики Украины, а именно: обеспечение устойчивого развития страны и формирование энергоэффективного сознания у граждан за счет активного применения мер по повышению уровня энергоэффективности в вузах, использование энергосберегающих технологий и стратегии децентрализации. Определяется результативность оптимизации энергетического баланса и стимулируется энергосбережение путем применения в деятельности высших учебных заведений основных мер экономии энергетики, минимизируя при этом потери энергии в окружающую среду и затраты экономических ресурсов на энергетику. Анализируется потребление разных видов энергетики. Выделяются энергосберегающие мероприятия в зависимости от того, на каком этапе работы с энергетикой они используются: энергосберегающие мероприятия при производстве энергии, энергосберегающие мероприятия при преобразовании энергии, энергосберегающие мероприятия при транспортировке энергии, энергосберегающие меры при потреблении энергии. Предоставляются предложения по направлениям разрешения существующих противоречий реализации государственной энергетической политики Украины.*

Ключевые слова: энергетика, топливно-энергетические ресурсы, рациональное распределение топливно-энергетических ресурсов, энергосберегающая политика, энергосбережение, энергосберегающие технологии.

Formulation of the problem. The need to ensure the sustainable development of society's economy, in general, is impossible without energy security. Its provision is becoming one of the primary tasks for the effective transformation of the economy and the implementation of economic policy. Since in the modern world energy is the basis of virtually all spheres of life, ensuring the energy efficiency of the state and its energy resources is one way to ensure global energy security and economic security of any state. Therefore, solving energy problems will contribute to the full development of the energy sector and the functioning of all economic and government institutions located in the country. Since energy policy is primarily the energy efficiency of the state and its availability of energy resources, it is the minimization of energy costs in its production, distribution, and use that will help increase energy efficiency and achieve maximum and energy saving energy use by all economic entities.

Analysis of recent research and publications. To date, many scientists have studied energy issues, finding ways to ensure global energy security and discovering new opportunities for energy-saving energy use, as well as defining the concept of energy, including V. Kupchak, V. Lagodienko, V. Pavlov, A. Yakymchuk. However, transformation, economic development, and changes in approaches to energy policy are forcing us to turn to the theoretical heritage of the past and use the experience of scientists to find solutions to new problems facing humanity in an era of complex economic crises and threats to global energy security.

Setting objectives. The article aims to study theoretical and practical methods of improving energy efficiency of the state, state institutions, including

higher education institutions, and overcoming energy security (methodological, technological, intra-industry, environmental, financial, economic, and political problems) to model and solve them. Scientists forecast that by 2050. We expect a significant increase in demand for energy resources (almost twice), showing the feasibility of studying energy security, the energy efficiency of the state, and the use of energy-saving technologies as an integral part of economic security and sustainable development of the state.

Presenting main material. Today, transformation processes in the economy significantly affect the formation of energy policy: changing ways of using energy resources, there are several problems associated with high energy consumption, new methods of energy production from alternative and renewable sources, implementation of development in production, processing fossil fuels, energy production, distribution and consumption, the number of innovative energy-saving technologies is increasing to increase energy efficiency and reduce the negative impact on the environment from energy use, including the depletion of natural resources.

Energy policy, like any other policy, is implemented through government intervention. By developing strategies, using them, and new approaches to energy production, transportation, and consumption, public authorities address energy policy issues or a set of interrelated issues. Thus, energy is a set of industries that study and use energy resources to produce, convert, transmit and distribute energy. There are thermal energy, nuclear energy, hydropower (these species are most developed in Ukraine), as well as wind and solar energy, etc. [4].

Then, energy-saving - activities (organizational, scientific, practical, information), which are aimed at the rational use and economical use of primary and transformed energy and natural energy resources in the national economy and which are implemented using technical, economic, and legal methods [5].

Scientists Borovik Yu. T. and Yelagin Yu. V. Pavlov K.V., Pavlova O.M., Kupchak V.R., Korotya M.I. having analyzed foreign experience in the use of

energy-saving mechanisms, note that: "different taxation schemes are used to encourage energy-saving or to combat inefficient or excessive energy consumption; financial incentives are used: in complex programs that combine the interests of government agencies, the public and business circles; to encourage the implementation of energy-saving policies by increasing the economic attractiveness of relevant investments and procurement or reducing operating costs" [2; 6; 7; 8; 9; 10; 11; 12; 13; 14; 15].

Energy-saving policy - administrative, legal and financial, and economic regulation of extraction, processing, transportation, storage, production, distribution, and use of fuel and energy resources for their rational use and economical consumption [5]. All connections and relations in the field of energy-saving, which are carried out on the territory of Ukraine are regulated by the Legislation of Ukraine on energy saving.

The purpose of energy-saving legislation is to regulate relations between economic entities, as well as between the state and legal entities and individuals in the field of energy-saving related to the extraction, processing, transportation, storage, production, and use of fuel and energy resources, ensuring the interest of enterprises, organizations, and citizens in energy saving, the introduction of energy-saving technologies, development and production of less energy-intensive machines and technological equipment, consolidation of responsibility of legal entities and individuals in the field of energy-saving [5].

It should be noted that only with a reliable supply of energy resources is the full development of the energy sector and the functioning of all economic and state institutions of the country.

No less important and relevant is the next problem of energy, which is the irrational use of fuel and energy resources. Fuel and energy resources - a set of all-natural and transformed fuels and energy used in the national economy [5]. Rational use of fuel and energy resources - achieving maximum efficiency in the use of fuel and energy resources at the current level of development of machinery

and technology and while reducing the man-made impact on the environment [5]. To prevent additional and wasteful energy losses in the environment and the cost of economic resources, it is necessary to use and save energy efficiently.

Saving fuel and energy resources - a relative reduction in the cost of fuel and energy resources, which is manifested in the reduction of their unit costs for production, the performance of works, and provision of services of established quality [5]. By using the aforementioned methods, it is possible to increase the energy efficiency of any business entity, including budget organizations and institutions whose activities are not based on commercial nature, such as higher education institutions financed from the budget of Ukraine.

Due to technical progress on innovative energy-saving developments, it is possible to significantly minimize energy losses to the environment and the cost of economic resources. This has contributed to the development of financing mechanisms for energy-efficient and energy-saving technologies.

Energoeffactive products, technology, equipment - products or methods, means of its production, ensuring the rational use of fuel and energy resources compared to other options for use or production of products of the same consumer level or with similar technical and economic indicators [5].

In recent years, the energy sector is increasingly penetrating other areas of human life and industry, forming strong intersectoral ties. As a result, energy problems significantly affect the activities of enterprises and organizations, increasing their costs, which can be significantly minimized by using energy-saving technologies, which in turn help reduce energy costs in its production, distribution, and use.

The introduction of energy-saving technologies in the economic activity of enterprises is one of the important steps in solving many environmental problems - climate change, air pollution, depletion of resources, and more [1, p. 53].

For Ukraine, the spread of their use in the overall energy balance with the simultaneous introduction of energy-saving technologies will not only increase energy supply but also improve the environmental parameters of society [3].

Energy-saving technologies are a set of achievements of scientists: techniques and technologies that are designed to achieve the most efficient and energy-efficient use of energy and help increase energy efficiency.

Energy-saving - activities (organizational, scientific, practical, information), which are aimed at the rational use and economical use of primary and transformed energy and natural energy resources in the national economy and which are implemented using technical, economic, and legal methods [5].

Conventional energy-saving measures can be divided into the following types, depending on the stage of work with the energy they are used: energy saving measures in energy production; energy saving measures for energy conversion; energy saving measures for energy transportation; energy saving measures for energy consumption.

For example, these could be new alternative types of internal combustion engines and hybrid systems that minimize energy consumption during production and transformed, improved networks with additional insulation to reduce heat loss during transportation, the use of new materials for energy-saving power lines, thereby reducing the cost of each unit of electricity, etc.

The main energy-saving methods and measures that are actively used by economic and government institutions, including higher education institutions to improve energy efficiency, can be divided into several types, depending on the type of energy that should be saved: saving electricity; gas savings; water saving; heat-saving; fuel economy [1, p. 53-54].

Today, the use of energy-saving technologies is especially relevant in the activities of higher education institutions. This increases the level of energy efficiency, reduces the cost of economic resources when paying for utilities, increases the investment attractiveness of energy efficiency measures and

projects, and in general significantly increases the energy efficiency of any higher education institution, positively affecting the optimization of energy balance region and even the state.

The most effective result from the use of energy-saving technologies and measures can be achieved by comprehensively applying various energy-efficient techniques in practice, combining them, and implementing innovative developments.

For example, to minimize the cost of electricity in higher education, it is necessary to use it only when necessary, to make maximum use of daylight; installation of intelligent automated distributed lighting control systems will also help to optimize resource costs, and the use of lighting control devices and lighting devices, if necessary - more efficient energy consumption; while the installation of energy-saving lighting devices will maximize the level of energy efficiency of the institution, when without the use of electricity is impossible, given that universities are active consumers of electricity: about 50-70% - lighting, 10-30% - consumers with electric motors, about 10- 20% of electricity is used by various heating systems and up to 10% of electricity is consumed by computers.

Application of even the simplest measures to reduce thermal energy costs, such as proper insulation of heated premises, replacement of obsolete windows and doors with modern and more energy-efficient ones, installation of thermal energy consumption control systems depending on ambient temperature, thermal insulation networks to reduce heat loss to the environment during transport Energy, the use of heat metering units, the use of modernized equipment with higher heat generation are effective measures to reduce heat loss and save gas. If we modernize the ventilation systems in combination with the previous measures, update the thermal insulation of the foundation walls, basement, and roof ceilings, rationally use fuel and energy resources that give us heat, we can maximize the energy efficiency of public institutions such as higher education institutions.

approximately 53-70% of thermal energy is consumed, 16-30% for hot water supply, and 10-25% for ventilation for the same energy.

Selecting the optimal power of the boiler and pump and, if possible, switching to alternative heating or obtaining energy from alternative sources can also reduce both energy losses and the negative impact of energy use on the environment. Unfortunately, due to the insufficient level of capital expenditures for energy-saving measures and the lack of targeted budgets in higher education institutions aimed at achieving energy-saving goals, the aforementioned measures to improve energy efficiency are only partially used.

Analyzing the energy-saving technologies and measures that are currently in high demand in universities, it should also be noted that the strategy of decentralization is becoming increasingly popular. It is about creating local and individual energy sources that help reduce the path of energy through heating networks and reduce heat loss to the environment. In addition, insulation of thermal networks is used, because a large percentage of thermal energy is lost during distribution, but reducing the distance from supplier to consumer due to decentralization is more energy-efficient and pays off over time.

This method of saving increases the efficiency and energy saving of energy sources helps the intensive development of its resource base, reduces disparities in energy development, promotes rational and efficient distribution among consumers, and optimizes energy balance.

The decentralization strategy plays an important role for communal housing complexes, educational institutions, buildings, and dormitories.

If we talk about the cost of water resources, it should be noted that about 55-70% of cold water is consumed by student dormitories, and educational buildings - 30-45%. These costs can be reduced by modernizing the water supply system, using water intake, energy-saving technologies, namely: automated water meters, automatic flow regulators, and the use of the residual potential of heat carriers for water heating. The application of these measures individually or in

combination can increase the level of rational use of water resources and reduce their costs.

Conclusions. The article considers the basic concepts of energy, features of its development trends related to the energy sector, and the specifics of its measures to optimize and improve energy efficiency and energy efficiency in Ukraine and some government institutions, especially in higher education. The practical application of the main and priority measures mentioned in the article aimed at improving the energy efficiency of universities will increase the investment attractiveness of energy efficiency measures and projects, stabilize energy consumption and increase savings in energy and utilities, help increase energy supply University. Active use of energy-saving technologies and decentralization strategies in higher education institutions contribute to the efficient use of resources, intensive development of own resource base, stable and predictable policies to attract investment in projects to improve energy efficiency, optimize energy balance and create energy efficiency in the younger generation.

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