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**PROBLEMS OF METHODOLOGIES OF ENERGY AUDIT OF THE HOUSING AND
COMMUNAL SECTOR OF THE REPUBLIC OF UZBEKISTAN**

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Summary

This report describes the status of energy policy of the housing and communal sector in the Republic of Uzbekistan regarding the methodology for determining the energy efficiency of buildings. Also, it identifies the key problem and barriers for developing an effective methodology for determining the energy consumption according to European methods of calculation of energy performance for new and existing buildings in the Republic of Uzbekistan.

Keywords: energy efficiency of buildings, effective methodology for determining the energy consumption.

INTRODUCTION

The issues of saving and rational use of energy resources together with the aspects of energy saving, energy efficiency, and, consequently, environmental problems become more and more actual and their solution has become a strategic task for many countries of the world, including the Republic of Uzbekistan. At the moment, the country possesses significant non-used energy-saving potential, which, according to some specialists, is comparable with the growth of production of all primary energy resources. Inefficient use of energy will lead to energy shortage in the near future and can significantly affect the rate of economic growth of the country. The energy intensity indicators of the country's economy are significantly higher than those of developed countries. The rate of reduction of energy intensity in the absence of a coordinated government policy on energy efficiency could slow down sharply, which would lead to even more dynamic growth of domestic demand for energy resources. Increasing hydrocarbon production and developing transport infrastructure will require significant investment. It should be noted that improving the efficiency of energy resources will solve two problems associated with both a significant reduction in the cost of its production and the economic growth of the country. In 2020, the Legislative Chamber of Oliy Majlis of the Republic of Uzbekistan adopted a new version of the law "On the rational use of energy"[1], according to this law, energy efficiency indicators for energy-producing and energy-consuming equipment and products are established and energy consumption standards are mandatorily included in technical passports, repair, and regime cards, instructions for operation of equipment and products that produce and

consume energy. The norms of energy consumption for heating, ventilation, and air conditioning of buildings and constructions are established in construction norms and rules. Every five years, energy consumption standards are subject to revision and adjustment to reflect advances in advanced technology. Despite the implementation of a number of legislative initiatives, and measures on energy efficiency and energy saving in the Republic of Uzbekistan, the general policy and regulatory framework is focused on large enterprises on energy production and consumption, but there is not much attention paid to the residential and communal sectors. However, the residential sector of the Republic of Uzbekistan is one of the largest consumers of heat and electricity. On average, buildings in the Republic of Uzbekistan consume 2-3 times more energy per square meter than buildings in the northern countries of Western Europe. The major part of the housing stock consists of multi-apartments buildings with centralized heat and power supply, low level of thermal protection of enveloping structures, absence in many cases of energysaving engineering equipment, automation, and metering equipment, development of organizational and economic mechanisms, and measures contributing to the reduction of heat consumption for heating, ventilation and hot water supply of residential houses. In the Republic of Uzbekistan, a task was set to reduce energy consumption for heating and cooling in multi-story residential buildings in 2020-2022 in all regions of the country by improving the thermal protection of buildings, introducing energy-efficient technologies, and installation of renewable energy sources.[2] However, at the moment in Uzbekistan, there is no standardized system of collecting national normative and technical documents on energy efficiency and energy saving in buildings and constructions[3], harmonized Unlike CIS countries, the regulatory framework of the European Union has quite an integral structure, which involves many organizations, starting from interdepartmental, interstate cooperation, and ending up with solutions to energy problems on the global level. This established system is constantly being developed and supplemented. One of the methods of evaluation of buildings in terms of energy efficiency is energy certification, which provides a basis for the evaluation and comparison of energy consumption of various buildings. Also, the system is the basis for financial incentives, and obtaining an energy efficiency class creates the prerequisites and motives for designing new energy-efficient buildings and modernizing existing ones [4]. In the law of the Republic of Uzbekistan "On rational use of energy" there is no paragraph on the introduction and necessity of energy audit of the housing stock with entering the data into the energy passport of the building. Taking into account the experience of our neighboring countries, the Republic of Kazakhstan according to the mentioned Law "On Energy Saving and Energy Efficiency Improvement" of the Republic of Kazakhstan [5] for the objects of the housing stock and administrative buildings energy audits remain voluntary. Despite the fact that the legal basis for energy audit was established several years ago in the Republic of Kazakhstan, at the moment the energy inspection using devices is not widespread. There are several reasons for this, including the lack of state incentive mechanisms, the lack of qualified professionals, modern equipment and technology, the lack of a quality control system for auditing services, and the lack of interest in energy audits among end-users. So far, this allows developers not to comply with existing energy efficiency norms and standards. Energy certification of buildings, compared to the use of other tools (energy audit, energy passport), has a number of undeniable advantages. Currently, there is no effective methodology for determining the energy efficiency of residential buildings and constructions in Uzbekistan. Barriers hindering the development of the mentioned methodology [6] can be divided into four main groups: – lack of motivation; – lack of information; – lack of experience

in project financing; – lack of organization and coordination. The lack of motivation lies in budgetary constraints, relatively low tariffs and the withdrawal of the resulting savings, the possibility of transferring the increase in costs to the consumer, and the lack of means of regulating consumption. In fact, no one can give a clear answer to the question of who benefits from energy savings. The main problems are its withdrawal in the budget and tariff processes. In such circumstances, an increase in energy prices motivates not to improve the efficiency of use, but to justify further increases in tariffs, or additional requests for budget financing. Lack of information. Information and motivational support for the preparation and implementation of decisions on energy saving and energy efficiency are underdeveloped. Initiatives need to be taken in the construction sector of the market to ensure greater awareness of energy efficiency issues in general. This is dictated by the fact that energy efficiency is often ignored when major construction-related decisions are made. This includes the design of new buildings, their construction or purchase, and the purchase and renovation of existing buildings. The reason for the lack of attention to energy efficiency is often that important decision-makers in the building sector (i.e., from architects to owners) have limited information or little interest in energy efficiency. Ironically, this situation occurs despite the fact that energy costs represent a large percentage of the costs associated with maintaining a building. Policy measures to raise public awareness of energy efficiency can include public information campaigns, the provision of informational material, the creation of information centers, or the development of energy efficiency legislation covering energy supply, purchase decisions, or building maintenance. One strategy that promises to be particularly effective is the mandatory provision of building energy performance assessments to prospective buyers/tenants. The most appropriate way to provide this information is through a certification scheme for the energy performance of buildings. If not included as a mandatory issue, experience shows that this information will not be provided. Such a scheme should be complemented by robust procedures for monitoring and measuring energy performance and can be supported by incentives for efficiency. Lack of experience in financing energy efficiency projects by investment banks. Funding requirements for energy efficiency and cost reduction projects tend to be significantly more stringent than for new construction projects. This applies most of all to HOAs (Homeowners' Associations), which are most often in such a financial position that they do not have their own funds to address energy conservation and energy efficiency issues. For them the test of financial sustainability is insurmountable and, consequently, it is impossible to obtain credit resources for development. Lack of organization and coordination occurs at all levels of decisionmaking. The problem of improving energy efficiency is not perceived as a means of solving a wide range of economic and environmental problems. There is a lack of synchronization of various areas of legislation: urban planning is not related to the development of energy systems; legislation on public procurement does not contain requirements for energy efficiency, etc. To eliminate the mentioned barriers, first of all, state support for energy saving and energy efficiency is needed. The European Commission Directive on the Energy Performance of Buildings (EPBD) [7], adopted in 2002 and recast in 2010 (2010/31/EC), obliges member states to set minimum energy performance standards for new and renovated buildings. According to the requirements of the Directive, each EU member state must implement energy performance certificates for buildings. The Directive specifies that buildings under construction must meet minimum energy performance requirements, taking into account the local climate and resources and the possibility of using renewable energy sources. The directive requires the energy performance of buildings to be calculated on the basis of a

methodology that may vary regionally, but includes, in addition to thermal insulation, other factors of increasing importance, such as heating and air conditioning units, the use of renewable energy sources and building design. In addition, according to the Directive, each Member State must ensure a uniform approach to this process, to be carried out by qualified and/or accredited experts whose independence must be guaranteed on the basis of objective criteria. The purpose of this approach is to ensure a common "rules of the game" in terms of the Member States' attempts to ensure energy savings in the building sector and to help them ensure transparency of the energy performance of buildings to potential owners or consumers in the European real estate market. The 2002 Energy Performance of Buildings Directive (EPBD) requires each member state to adopt a calculation methodology to determine the energy performance of buildings, based on certain rules. The methodology for the calculation of the energy performance of buildings must include at least the following: (a) Thermal characteristics of buildings (envelope and internal partitions, etc.). These characteristics may also include airtightness; (b) the heating system and the hot water supply, including their insulation characteristics; (c) Installation of air conditioning; (d) Ventilation; (e) Integrated lighting system (mainly in the non-residential sector); (f) Location and orientation of buildings, including outdoor climate; (g) Passive solar systems and sunlight protection; (h) Natural ventilation; (i) indoor climatic conditions, including the design room microclimate. Further, if necessary for the calculation, the positive effects of the following must be taken into account: (a) Active solar systems and other renewable energy heating and power systems; (b) Electricity produced by CHP; (c) Centralized heating and cooling systems; (d) Natural lighting. The calculation methodology must take into account the standards or rules applicable in EU member states according to their legislation. The energy performance of buildings must be presented transparently and may also include an indicator of CO₂ emissions. The European Community has prepared corresponding European EN standards, which must be adopted in the member states. These are, for example, simplified calculation formulas that member states can approve and apply at their discretion. Some member countries have chosen the option of integrating the calculation methodology into software or spreadsheets. In many cases, independent software developers have created licensed computer applications or software modules that conform to the calculation methodology of a particular member state. Most often, such applications are tested and approved by government agencies with expertise in building energy systems. According to the Directive, Member States must take the necessary measures to ensure that new buildings comply with the minimum energy performance requirements for buildings. In addition, for new buildings with a total usable floor area of more than 1000 m², Member States must ensure the technical, environmental, and economic feasibility of alternative systems, such as Decentralized energy supply systems using renewable energy, CHP SYSTEMS Centralized heating and cooling systems, if available, Heat pumps in certain conditions are considered and taken into account before construction begins. However, an audit of the energy performance of existing buildings should ideally look for opportunities and potential for energy savings and cost reduction. Energy efficiency measures can be implemented to reduce a building's energy consumption and improve indoor climate quality. In many cases, these measures pay for themselves by reducing energy costs in a short period of time (2-5 years) and by permanently saving energy and reducing costs over the next few years. Identifying such profitable investments in energy efficiency with recommendations on how to implement them technically and financially should be a strategic goal of a building energy audit. According to the new 2010 version of the EPBD, a heating or air conditioning audit report must be submitted after each audit. The inspection report must include the results of the inspection and recommendations

for cost-effective improvements to the energy performance of the inspected system. In addition, the 2010 revised EPBD requires that a heating or air conditioning system report be submitted after each inspection. The inspection report must contain the results of the inspection and recommendations for cost-effective improvements in the energy performance of the inspected system. CONCLUSIONS As a result of studying the regulatory and technical framework for energy saving in the Republic of Uzbekistan, it was concluded that it is mainly focused on large enterprises for the production or consumption of energy. However, energy consumption, both heat, and electricity, in the housing and communal sector of the Republic of Uzbekistan are not given due attention, and therefore it is necessary to develop an effective methodology for determining energy consumption in the housing and communal sector of the country.

LITERATURES

1. Law of the Republic of Uzbekistan "On the rational use of energy" 412-I-son 25.04.1997.
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Резюме

ПРОБЛЕМЫ МЕТОДОЛОГИИ ЭНЕРГЕТИЧЕСКОГО АУДИТА ЖИЛИЩНО-КОММУНАЛЬНОГО ХОЗЯЙСТВА РЕСПУБЛИКИ УЗБЕКИСТАН

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В данном отчете описывается состояние энергетической политики жилищно-коммунального хозяйства Республики Узбекистан в части методологии определения энергоэффективности зданий. Также определены ключевые проблемы и барьеры для разработки эффективной методологии определения энергопотребления по европейским методам расчета энергоэффективности для новых и существующих зданий в Республике Узбекистан.

Ключевые слова: энергоэффективность зданий, эффективная методика определения энергопотребления.

Түйіндеме

ЎЗБЕКСТАН РЕСПУБЛИКАСЫНЫҢ ТҮРҒЫН ҮЙ ЖӘНЕ КОММУНАЛДЫҚ ШАРУАШЫЛЫҚ АУДИТІНІҢ ӨДІСТЕМЕЛІК МӘСЕЛЕЛЕРІ

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Бұл баяндамада Өзбекстан Республикасы тұрғын үй-коммуналдық шаруашылығының энергетикалық саясатының жай-күйі ғимараттардың энергия тиімділігін анықтау әдістемесі тұрғысынан сипатталады. Сондай-ақ Өзбекстан Республикасындағы жаңа және бар ғимараттардың энергия тиімділігін есептеудің еуропалық әдістері бойынша энергия тұтынуды анықтаудың тиімді әдістемесін әзірлеудің негізгі проблемалары мен кедергілері анықталды.

Түйін сөздер: ғимараттардың энергия тиімділігі, энергия шығынын анықтаудың тиімді әдісі.

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