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REGULATION OF ENERGY SAVINGS AS A BASIS OF EFFICIENCY OF COMMUNAL HOUSING

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Abstract: The paper investigates the problem of energy efficiency and energy saving in the residential sector. The issues of energy efficiency of housing due to the introduction of energy-saving technologies are investigated. The leading foreign experience in using energy-efficient technologies has been analyzed. Successful measures in the world's leading countries have been offered to reduce energy consumption in the residential sector of Ukraine. The necessity of implementing programs to support energy efficiency programs have been justified on best practice in the leading counties.

Keywords: Energy efficiency, Energy saving, Environment, Financial support, Housing and communal sector.

1 Introduction

In the conditions of world social and economic processes, any country's main task is energy supply security. On the one hand, state energy security comes to the fore with reference to the exhaustibility of energy supply [1-5]. On the other hand, the problem of energy security is as urgent for Ukraine as for most European countries because Ukraine and EU countries are among countries with low energy supply, which can threaten these states' national security [8, 10, 12, 22, 23, 30].

The necessity to ensure the energy security of Ukraine is emphasized in the Presidential Programme of economic reforms called "Prosperous Society, Competitive Economy, Effective Country" for the period of 2010-2014 and the Energetic Strategy of Ukraine to 2030 [37]. Under these conditions, problems of energy efficiency growth, energy-saving, and reduction of energy negative impact on the environment require settlement. These problems are relevant for the housing and communal sector of the country.

2 Literature Review

The beginning of specific scientific applications on issues of energy saving and energy efficiency falls on the beginning of the 1990s from Chas to Ukraine independently. A significant contribution to the development of science and impetus to further Energy Saving Policy and Energy Efficiency components have made different specialists [28, 38, 39, 40].

Problems of functioning and development of the energy complex, the formation of energy security are the subject of many scholars' components considering them both at the level of national goocarbons and in the regional aspect [34].

However, with significant development, actuality and urgent and urgent problems of detecting and implementing energy-saving potential do not decrease, gaining in the conditions of power-dependent and energy, new angles in Ukraine, which requires theoretical substantiation and development of conceptual approaches.

3 Materials and Methods

The object of research is the housing and communal sector of the regions. The subject of research is the process of energy conservation of the communal sector and energy security [13, 27, 34].

The research methods are as follows:

- Monographic research method;
- General scientific methods such as comparison, generalization, synthesis;
- Mathematical and statistical methods.

The research hypothesis lies in the municipal housing sector, taking into account its financial position, which is the most underdeveloped sphere with many problems that have recently become more relevant. Low energy efficiency is one of the main factors of such issues. Consequently, this proves the presence of a systemic crisis in the field that requires a lot of attention from the state and the community and requires fundamental changes.

4 Results

The objective process of socio-economic reforms undertaken in the country covers all economic and social infrastructure areas and aims to increase their effective functioning and sustainable growth. Urgency, the objective necessity of reforming housing and communal services, is due to the fact that the modern state is characterized by high energy consumption and using grants in economic and resource provision. Among the problems of housing and communal services (HCS) of the country that require urgent attention is preserving and maintaining housing and energy saving.

The housing and communal sector is among the most energy-intensive sectors of the national economy that significantly contribute to CO2 emissions. Boiler and furnace fuel consumption in the country makes 65-70% of the total fuel used for production and operation needs. Thus, for example, in 2005, about 100.6 million tons of standard fuel was used. Its CO2 combustion emissions made 324.9 million tons [15]. The average annual fuel needed by the national housing and communal sector for public and residential buildings supply is about 2200 million GJ. It is economically viable and technically applicable to reduce the amount to 800 million GJ. Thus, CO2 emissions in the atmosphere will also reduce. Housing and communal sector enterprises consume 8 billion kW of electricity and 10 billion m3 of natural gas annually. More than 70 million tons of fuel, almost three times more than in the EU countries, is spent on housing heating.

In Ukraine in 1993, new standards of thermal housing protection (amendment to Building Code II-3-79) were set. The next step was to introduce the new generation's standards outlined in BC 2.6-31:2006 "*Houses and Buildings Construction. Building Insulation*", which took effect on April 1, 2007. These standards meet European requirements for building energy efficiency. Thus, according to new standards, heat loss through windows in heat-insulated buildings is 13%, through walls, it is 24% and lowers compared with the buildings constructed by 1994. However, there are no reasons to be optimistic [37].

Firstly, most parts of the national housing had been built by 1994. The analysis of existing projects used to build multistoried buildings in Ukraine has shown that heat loss through outward walls is about 30%; through basement and attic ceilings is 10%, through the window and door cuts is up to 30% [27].

Secondly, despite the changes in protective constructions' heat insulation standards, national requirements remain the lowest in Europe [27]. Table 1 gives the comparative analysis of national standards and EU standards for heat transmission of protection structures.

Table 1: Comparative analysis of national standards and EU standards for heat transmission resistance of protection structures

Country	Heat transmission resistance, m°C/W				Specific heat losses, kilowatt-hour/m^2
	Walls	Covering	Flooring	Windows	
Ukraine	22,8	3,3	3,3	0,6	90-180
Russia	2,9	3,7	4,2	0,4	95-195
Germany	18-5,0	5,8	3,5	0,7	30-70
Lithuania	3,33	5,55	4,0	0,52	-
Denmark	3,3	5,0	3,4	0,4	55
Finland	3,5	4,5	4,5	0,47	-
Poland	3,0	3,0	3,0	0,5	70-100
Slovakia	3,0	5,0	5,0	0,59	30-100
Canada	3,2-4,1	6,6	6,6	0,6	30-70

Rates of annual energy consumption in housing stock are the following:

- In Western Europe is 150-260 kilowatt-hour/m2;
- In Scandinavia is 120-150 kilowatt-hour/m2 and is 60-80 kilowatt-hour/m2 for energy-efficient houses;
- In Eastern Europe, including Ukraine, is 250-400 kilowatt-hour/m2.

5 Discussion

Thereby, the housing stock of Ukraine needs forced reduction of irrational consumption of energy resources. It is known that the energy intensity index of the GDP in Ukraine is 0,89 kg s.f./$ that is 2,6 times more than the world average level. It indicates that obtaining the predicted level 0,36 kg s.f./$ by 2030 can be achieved only by introducing fundamentally new system technologies and energy expenditure record-keeping systems. However, the communal housing sector's current material and technical capacities with its degradation rates cannot reach even the approximate energy consumption level [33].

The EU energy strategy expects by 2020 to reduce the consumption of main energy sources by 20% by using alternative energy sources. The European Parliament directive (EU №2002/91/EU) obliges architects to reduce energy consumption in construction by improving technologies and expects to achieve 50% savings from the modernization of existing houses. In Ukraine, the Programme of energy savings was introduced in 1994 [35, 36], but effective mechanisms for its implementation in the communal housing sector have not been developed. It should be appropriate in this context to analyze the experience of leading European countries in energy efficiency and energy saving.

Energy-saving and improvement of the situation in the ecological aspect are a national and social problem. Consequently, the state financial support is used to attract private investments in energy savings at national and local levels in Europe. For example, before joining the EU (in 2004), Poland adopted the Law on Thermal Modernization in 1998 [13]. It stated that thermal modernization improves existing technical parameters of buildings to reduce heating needs with the further reduction of heating costs of the given building and provide a certain microclimate inside.

The Law provided for thermal modernization of residential housing, social and public buildings, and local heating systems. The implementation of the Law led to the reduction in energy consumption and redistribution of its structure. Thus, if in 1994 the communal housing sector consumed 38%, transport – 14%, industry – 34%, other branches – 14%, in 2002 these figures were 27%, 20%, 24%, and 29% respectively. It appears that the energy consumption of the communal housing sector was reduced by 11% [34].

In Denmark, the construction standards were implemented in 2006, reducing the need for energy supply by 25%-30% compared with the previous period [6]. Besides, the country has an effective system of monitoring compliance with construction standards. Today, four countries in the world: Denmark, Sweden, Ireland, and the USA have a developed system of standards for energy consumption.

The state financial support of Germany's communal housing sector is based on a stable economy and employment [13]. In practice, the most appropriate financial mechanisms to be used include loans with concessionary interest rates and forfeits [38, 40]. Loans can be given and are granted by different sources, namely, by the European Community, the federal government of Germany, the federal lands, some municipal groups, and sometimes even by the local energy suppliers.

The introduction of the credit facility with low-interest rates and grant possibilities is the important aspect that helps restructure the communal housing sector in the Eastern lands in Germany. These programs are aimed at taking energy-saving measures and modernizing housing in general. Most of these programs have been implemented; others moved to other areas, such as Russia [37].

Programs that are currently working in Nice and Germany are being realized through the attraction of cheap loans used for modernization and energy-saving measures in today's housing sector. Such loans and conditions are similar for the "old" and "new" federal states.

According to the concept "Scientific Principles of Housing Reform and Development," the reduction of CO2 emission ensured by introducing comprehensive measures to save energy and reduce pollution is an important factor. CO2 emission should be reduced to 40 kg per 1 m of area per year. Provided that energy consumption is reduced to a certain limit, then the grant money can cover up to 20% of interest charged on the initial loan [34].

Simultaneously, measures to modernize and repair houses (there are no special requirements for energy saving, just the ones required by the legislation) are being taken. Experience in implementing energy-saving measures in Germany confirms that it is important to combine information, legal requirements, taxes, and financial support when overcoming administrative, economic, and financial barriers.

State support in energy saving is rendered through:

- Relevant legislation measures (standards) for implementation;
- Financial assistance to implement energy-saving measures under certain conditions;
- Informing investors and consumers about the activities and results of their implementation;
- Clear procedures for taxation in this area.

State financial support can be provided only within existing budgetary resources; it should act only temporarily and be targeted. To avoid inefficient use of budgetary resources, financial assistance in Germany is given only to the energy-saving investment projects that promote environmental protection and are not expected to generate a profit within ten years.

The experience of "new" federal states in implementing energy-saving measures in houses indicates that housing modernization policy should be part of the overall strategy of economic modernization. Due to the migration of people from Eastern Germany, there was a danger that the newly refurbished buildings will be in no demand in the housing market. In this case, financial support may be ineffective because the government is involved in financing uninhabited housing repairs [19, 20, 21]. To avoid such cases, it is necessary to provide financial support to housing companies only if they have a long-term concept of modernization and after the preliminary analysis of assets has been conducted and/or rating system has been used [24, 26, 29].

Grants are indeed an effective and stimulating mechanism for financial support. Typically, the budget is usually low, and

political means cannot achieve this mechanism. This also applies to tax benefits. If fiscal resources are limited, as in modern Germany, it is more appropriate to implement the program budget support on the basis of return – namely giving loans with a low-interest rate, because they do not overload the budget.

The financial support system should be simple and clear; therefore, the loans and grants system should provide transparency of their distribution. In Germany, investors feel a lack of information. Banks, engineering services involved in the repair works, and planning structures do not provide sufficient information [6, 18, 25, 32]. This problem can be solved with the help of professional advisers that are in great demand now.

Nowadays, the Program's low-interest loan is the most important form of financial support in terms of resource preservation and energy saving in Germany's housing sector. According to the single model, the application consideration procedure submitted to the banks and savings offices is rather simple. The problem is that banks give low-interest loans only when requested and do not share information about low-interest loans as the consultations are expensive and do not cover profits.

As a rule, lawsuits concerning state financial support are not an exception apart from tax credits. That is why some investors prefer tax credits, as it is easier to plan them. For example, if some measures concerning energy saving were implemented, one could receive income tax benefits. Federal Government is responsible for developing specific conditions.

To summarize, there are some main requirements for any program of support:

- Simple scheme and clear rules of support [13, 14];
- Transparency of assistance distribution and free access to necessary information [15, 16, 17];
- High qualification of specialists in banks that deal with the financing of programs [40].

One of the domestic fuel and energy complex's conceptual tasks is the transition of the communal housing sector from gas to electricity with simultaneous modernization of unreasonably high energy consumption that needs technical decisions and legal support. When planning the measures concerning energy-saving, one should take into account the energy balance of the house considering its needs in the heating: the amount of hot water supply, loss of heat in the distribution net and drive, and also the level of effectiveness of the heat production systems. The comparison of calculating options with similar houses' indicators undergone full resource-saving modernization will show the quality of resource-saving in your house.

Energy certificates (or passports) of the houses where the quality of resource-saving during heating is fixed provide credible information for the house owners and residents. To issue an energy certificate, clear algorithms for calculating the general demand in resources and the rules of giving these figures in these documents are required. In the European Union-wide countries, the introduction of energy certificates (for every new house and old house in case of the changing of the owner) started several years ago according to the last directive of the European Union.

The energy certificate for a block of flats under the P96 series in Zaporizhzhya was approved by the center of logistics technologies at Zaporizhzhya National University and Institute of Facility Management (Berlin). They also distinguished expediency and consequences of its energy-technical sanitation with the further possibilities in managing property and surrounding area [38].

Systematical analyses of the municipal housing, region, or even country can be done based on houses' existing typology. The general quality characteristics of separate types of houses that cover all building technologies and periods of development are considered [24, 31]. On the analyses of typical samples – representatives of each set of houses concerning energy saving and financing, one can make general conclusions for all houses of a certain type before a particular analysis is done.

It is possible to calculate the total housing stock's energy-saving potential if statics provide the number of buildings of every series in the municipal general housing stock, region, or country.

There are 38 different types of houses according to German classification. Classification of the houses in Ukrainian city Uzhgorod includes 11 types of houses. It is possible to use the formulary *EUEVI* [38] to accelerate the analysis of data of the house that need improvement of energy indexes. The results of such examination are usually given in consultative reports about energy consumption. The final decisions about house modernization or restructuring are being made based on such reports.

As a rule, it is often necessary to deal with separate individual projects, but experience shows that the target function and economic measures are very alike [7, 9, 41-43]. The houses differ in energy-consumption and technical indexes as well as in ways of their construction, their compactness (exterior surface/ volumetric measures). However, the houses built in the same period have similar characteristics, making it possible to imply similar energy and technical restructuring measures [11, 44, 45].

Residential buildings with similar energy-relevant parameters are classified as one type. It enables the communities, regions, or countries to develop the programs of energy and technical restructuring of housing stock based on the system analysis of the houses-representatives from every housing type and to develop energy certificate as a part of the technical certificate of the buildings.

6 Conclusion

The communal housing sector, taking into account its financial state, is the most underdeveloped sphere with many problems that have recently become more urgent. Low energy efficiency is among the main factors of such problems [13, 15, 39]. So it proves the existence of a system crisis in the branch that requires much attention from the state and community and needs radical changes.

The residential properties use a sufficient part of the general amount of energy [6]. Lowering this part allows saving energy resources and decreasing the emission of carbonic oxide into the atmosphere. Consequently, the thermal technical restructuring of the buildings is the effective way to reach stability and improve the environment. It is also advisable to do thermal restructuring when the house's current or capital repair is conducted.

The analysis of foreign experience in solving energy efficiency problems declares the possibility to save fuel-energy resources due to the implementation of energy-saving technologies, materials, and organizational measures [27, 28, 34]. The experience of implementing energy-saving measures in Germany proves that a combination of such important components as information, legislative requirements, taxes, and financial support is very important to overcome administrative and economic obstacles.

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