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Article

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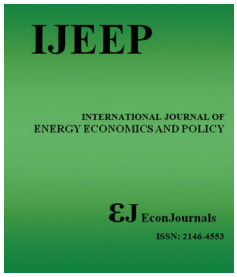

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Organizational and Economic Mechanisms of Energy Conservation and Energy Efficiency Management in Kazakhstan

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ABSTRACT

The article considers the problem of low energy efficiency of the Kazakhstan economy and identifies opportunities for its improvement. The energy intensity indicator and the GDP structure by industry are analyzed relatively to developed countries and countries with similar climatic and territorial conditions. The legislation of recent years in the field of energy sector was studied, as well as a number of programs and strategies for energy conservation. The main problem points in the field of energy conservation and energy audit procedure are clarified by the authors. The prevalence of regulatory methods over economic ones in energy efficiency management in the country is reveled. The possibilities of using stimulating organizational and economic mechanisms for the development of energy saving as opposed to regulatory measures are considered. The use of a number of financial mechanisms to finance the transition of enterprises of Kazakhstan to the cost-effective energy conservation mode is justified.

Keywords: Energy Efficiency, Energy Intensity, Kazakhstan
JEL Classifications: Q4, Q43, Q48

1. INTRODUCTION

The problems of energy efficiency and energy saving today are relevant around the world, which is associated primarily with limited natural resources. An increase in the cost of raw materials and energy costs leads to a decrease in the competitiveness of domestic industry products compared to foreign counterparts. A high share of energy costs in the overall cost structure of industrial production leads to the fact that the issue of energy conservation becomes the essence of the problem of energy efficiency. To solve this problem, it is necessary to use the currently relevant economic and organizational mechanism of resource conservation.

The criterion for the effectiveness of the resource-saving mechanism can be the degree of incentive to reduce energy and environmental costs in the production process. Since the costs of material resources can be expressed through energy resources and dominate the cost structure, the effectiveness of the control mechanism should be manifested in a decrease in the unit costs of energy resources, expressed in the energy intensity of the gross national product, national income or other energy intensity indicators.

The transition to a market economy has not created the prerequisites for the formation of a resource-saving mechanism at all levels of industrial management in the Republic of Kazakhstan. A number of theoretical, methodological and practical problems remained unresolved. They include the justification of the methodology for the formation of the mechanism of resource and energy conservation at various levels of industrial production management; development of a classification of factors that affect

the level and dynamics of resource and energy conservation in industry, taking into account the internal and external economic environment of an industrial enterprise, etc.

2. LITERATURE REVIEW

Previous scientific studies had studied certain aspects of energy use in Kazakhstan. Sarbassov et al. (2013) and Karatayev and Clarke (2016) explored the energy system of Kazakhstan and the potential for energy efficiency improvements. Energy consumption in different industries and its effects on environment has been studied: air and water pollution from energy sector (Dahl and Kuralbayeva, 2001), carbon emissions (Xiong et al., 2015), efficiency potential in city heating system (Tokbolat et al., 2013) and others.

Issues concerned the high level of energy intensity of Kazakhstan industry were discussed in works by Cornillie and Fankhauser (2004), Gómez et al. (2014), Kerimray et al. (2018).

Cornillie and Fankhauser (2004) on the example of countries with transitional economy, including Kazakhstan have found out main factors influencing energy intensity. Furthermore, Gómez et al. through the qualitative analysis with 'bottom-up' model tried to explore the reasons of high energy intensity in Kazakhstan and provided recommendations for energy savings in every subsector. The study by Kerimray et al. (2018) provided the review of energy consumption trends in Kazakhstan for the period of 15 years as well as discussed several important discrepancies in energy statistics in the republic.

Opportunities of green energy use in Kazakhstan are considered in some studies: Teleuyev (2017) has analyzed legal regulations and conditions of green energy use; Karatayev et al. (2016) has identified key barriers that prevent diffusion of renewable energy technologies in Kazakhstan; Abayev et al. (2018) has found out the potential of solar energy use based on solar photovoltaic panels in rural areas of the Republic of Kazakhstan.

Despite the wide range of issues concerned the field of energy saving and energy efficiency, the previous studies had not clearly indicated the economic foundations of the transformation and development of the energy system in the republic. Nevertheless, the experience of developed countries suggests that energy efficiency should be based on an organizational and economic mechanism, which includes tax and depreciation benefits, subsidies and soft loans and other types of incentives that make the task of energy saving attractive to all market players.

3. ENERGY INTENSITY

The economy of Kazakhstan at the present stage is characterized by high energy intensity. According to this indicator, the country is in the top five most energy-intensive countries, surpassing a number of developed European countries by more than 3 times. In this regard, the program "Energy conservation 2020" was adopted in the republic in 2013, which set the task of reducing the energy intensity of the gross domestic product by at least 25% by 2020. In this regard, in Kazakhstan, energy conservation and energy efficiency of all sectors of the economy are currently priority tasks, which are aimed at improving a whole range of energy, environmental and economic issues. The solution of this problem will contribute to the development of the country.

The energy intensity of GDP is the most common indicator of the energy efficiency of the country's economy and is calculated as the ratio of primary energy consumption (coal, oil, gas and other energy resources) to the value of the real GDP of the state. According to this indicator, Kazakhstan during long period belongs to the group of countries with the highest energy intensity (Table 1), despite a 30% reduction in energy intensity between 2000 and 2014 (Cornillie and Fankhauser [2004], Kerimray et al., 2018). At the same time, the energy intensity of Kazakhstan's GDP, in general, tends to decrease, even with growing energy consumption per capita. The high energy intensity of Kazakhstan's GDP is partially due to a number of natural reasons:

- Severe harsh continental climate, long and cold winters
- The prevalence of energy-intensive sectors of the economy in the structure of GDP
- Growing technological backwardness of energy-intensive industries and housing and communal services
- Significant territory and low population density
- A significant length of the transport infrastructure (oil and gas pipelines, power lines, water conduit).

It should be noted that the energy intensity of GDP is a limited indicator, the direct use of which can lead to a number of incorrect conclusions. A comparison of countries in terms of energy intensity must be made taking into account the structure of GDP and the climatic characteristics of the countries being compared. In this regard, in order to compare the level of energy intensity of economies of different countries, it is necessary to consider countries with a similar economic structure and with comparable natural, climatic and geographical conditions (Table 2).

The following countries were selected for the comparative analysis with respect to the Republic of Kazakhstan:

Canada - severe climatic conditions, a large area, low population density (3.5 people/km²), energy-intensive sector of oil production from tar sands.

Russian Federation - severe climatic conditions, a large area, low population density (8.56 people/km²), energy-intensive oil production in the northern regions of the country, a similar type of transition economy.

China - a similar structure of GDP, the fastest growing large economy in the world.

The USA and Japan are an example of developed post-industrial countries, examples of the best practices of energy-efficient technologies.

Consideration of the energy intensity of the country calculated on the basis of data on GDP (PPP) shows that the difference between Kazakhstan and countries being compared is not so significant. For

Table 1: Energy intensity of Kazakhstan compared with selected countries

Country	Population (mln, 2015)	GDP (per Capita, PPP, current international dollars), 2015	Energy intensity of GDP (koe/$2015p), 2018	Renewables, %, 2018
Kazakhstan	17.625	24739	0.181	17.8
China	1376.049	13368	0.131	26.3
Russian Fed.	143.456	27063	0.215	17.2
Japan	126.573	39502	0.079	17.5
Canada	35.940	45661	0.176	65.9
USA	321.774	54993	0.117	17.5

Composed by author based on data https://www.populationpyramid.net; The World Bank https://data.worldbank.org/; Global Energy Statistical Yearbook 2019

Table 2: GDP structure of selected countries

Country/sector composition	Kazakhstan	China	Russian Fed.	Japan	Canada	USA
Industry (including construction)	34.1	40.7	32.1	29.1	24.8	18.2
Agriculture	4.2	7.2	3.1	1.2	1.7	0.9
Services, including	61.7	52.1	64.8	69.7	73.5	80.9
Transport	10.2	4.9	8.9	6.8	7.2	19
Trade	15.8	10.6	20	13	14.1	-
Financial sector	18.3	12.5	15.9	18.1	25.7	33
Social sphere	5.3	4.6	6.6	31.8	11.1	28.9
Other services	12.1	19.5	13.4		15.4	

Composed by author based on data Central Intelligence Agency World Factbook https://www.cia.gov/library/publications/resources/the-world-factbook/; Statistic Times http://statisticstimes.com/economy/countries-by-gdp-sector-composition.php; Kazenergy http://www.kazenergy.com/ru/analyst/191/

example, the energy intensity levels of GDP (PPP) of Canada and Kazakhstan are almost identical (0.176 and 0.181). From OECD countries, Canada is most closely related to Kazakhstan in terms of climatic conditions, size of territory, population density, and GDP structure.

4. ENERGY CONSERVATION POLICY

The most important body responsible for the implementing of energy policy in the country is the Ministry of Energy, which assumed the functions of a regulator in this field after the liquidation of the Ministry of Industry and New Technologies, while the energy efficiency sphere is under the responsibility of the Ministry of Investment and Development. The state policy, which ensures energy efficiency, is mainly focused on the modernization of various sectors of the economy where the bulk of energy is consumed (Baybekova, 2018).

The current policy is based on the following legal acts:

- The law of the Republic of Kazakhstan dated July 9, 2004 "on the electric power industry"
- The law of the Republic of Kazakhstan dated December 25, 2008 "on competition"
- The law of the Republic of Kazakhstan dated July 4, 2009 "on supporting the use of renewable energy sources"
- The law of the Republic of Kazakhstan dated January 9, 2012 "on state support for industrial and innovative activities"
- Decree of the Government of the Republic of Kazakhstan dated June 28, 2014 "on approval of the Concept of development of the fuel and energy complex of the Republic of Kazakhstan until 2030."

The basis for the implementation of energy conservation policy is the current regulatory framework. On January 13, 2012, the President of the Republic of Kazakhstan signed the laws of the Republic of Kazakhstan "On energy conservation and improving energy efficiency" and "on introducing amendments and additions to some legislative acts on issues of energy conservation and improving energy efficiency." The Resolution of the Government of the Republic of Kazakhstan dated August 29, 2013 on approval of the "Energy conservation 2020" program was adopted. The latter program aims to reduce the energy intensity of GDP by 40% by 2020 relative to the level of 2008.

The adopted legal acts include the implementation of the following measures:

1. The gradual reduction in the use of incandescent lamps
2. Mandatory use of energy consumption standards for industrial products and services for all industrial enterprises
3. Implementation of mandatory energy efficiency requirements for all types of vehicles, electric motors, buildings and constructions
4. Application of the classification of energy efficiency of buildings, constructions, and the rules for their determination and revision
5. Development of rules for conducting energy audit at industrial enterprises and buildings
6. Introduction of requirements for the introduction of energy management systems at enterprises consuming more than 1,500 tons of fuel equivalent (1050 toe) per year
7. Using the mechanism for evaluating the activity of local executive bodies on energy conservation and energy efficiency
8. Development of the rules for the activity of training centers for advanced training of individuals and legal entities that carry out energy audit and (or) energy conservation expertise, as well as the creation, implementation and organization of an energy management system.

In the framework of the adopted Law "on energy saving and improving energy efficiency" (2012), the principles of energy audit

for the main group of consumers of energy resources that are subjects of the state energy register (SER) are defined. In accordance with the current legislation, SER entities are required to obtain an energy audit opinion identifying the potential for energy conservation and to ensure the implementation of energy conservation measures to achieve the identified potential. The provisions of the energy audit were defined in the Law "on energy conservation" (1997), however, at that time the energy audit was not mandatory and was not regulated by the relevant regulatory legal acts.

Since the introduction of requirement on mandatory energy audits, the right to conduct energy audits has been transferred to organizations that have received accreditation certificates from an authorized body in the field of energy conservation and energy efficiency. In 2016, in order to reduce the burden on small and medium-sized businesses, the President signed a number of regulatory legal acts on the reduction of permits and simplification of licensing procedures, according to which the energy audit activities were transformed to a notification procedure. Currently, more than 130 organizations are engaged in energy conservation and energy efficiency activities, with more than 290 energy auditors certified by the authorized body. However, about 40 organizations did not conduct a single energy audit.

However, despite the efforts undertaken to create an effective regulatory framework in the field of energy conservation and energy efficiency, there are a number of problematic issues. To date, the market for energy audit services lacks mechanisms of fair competition. This is due to the fact that energy audit in Kazakhstan is a relatively new area, and the legislative level in the field of energy conservation and energy efficiency does not include requirements for the quality of energy audit and the responsibility of energy auditing organizations for the quality of the issued conclusions. In addition, there is a problem of low qualification of personnel and professional groups of experts involved in energy audit. Certification of energy auditors is carried out by the authorized body in the field of energy conservation and energy efficiency improvement on the basis of qualification requirements established by the law "On Energy Saving and Energy Efficiency Improvement" (2012) and relevant normative legal acts. The certification procedure is carried out on the basis of the documents submitted without a personal meeting, on a free basis, therefore, the responsibility of the authorized body and the individual is not defined. As a result, low-quality energy audits are carried out, and, accordingly, there are risks of failure to fulfill the tasks set by the President of State to reduce the energy intensity of the economy and increase competitiveness. Since 2016, the Ministry of Energy, together with the Electric Power and Energy Saving Development Institute, conducted an analysis of 525 energy audit reports, which revealed that more than half of them (330) did not comply with the established Energy audit rules (Energy Media Information portal, 2019).

To improve the current situation in the field of energy audit, the Ministry of Energy has developed the concept of the Law of the Republic of Kazakhstan "on amendments and additions to some legislative acts of the Republic of Kazakhstan on energy saving and improving energy efficiency."

Within the framework of this concept, it is supposed to introduce bodies to confirm the compliance of personnel in the field of energy conservation and energy efficiency. They will conduct certification of candidates for energy auditors not formally, but assessing the level of knowledge and competencies of the candidate through an interview or exam. In addition, according to the plan of the nation "100 specific steps" it is proposed to develop the institution of self-regulation in the business environment. It is assumed that government bodies will control directly over self-regulatory organization, but not over market participants.

World experience in the formation of self-regulation shows that it arose from the need of manufacturers of goods (or service providers) to independently regulate relationships with consumers. In Kazakhstan, it is proposed to introduce a mechanism of self-regulation of energy auditing activities on a mandatory basis. Thus, Kazakhstan will create a state system for regulating activities in the field of energy conservation based on self-regulation when state authorities deal only with self-regulatory organizations that independently carry out the function of supervision and control over the activities of energy auditors (The draft Law of the Republic of Kazakhstan, 2018).

5. MECHANISMS OF ENERGY EFFICIENCY MANAGEMENT

It is important for Kazakhstan to maintain progressive movement in the implementation of incentive mechanisms, since the current legislation, generally focused on prohibitions and restrictions, hinders the ability to achieve significant energy efficiency gains. In the process of developing an energy conservation mechanism in industry, it is necessary to differentiate modern methods and forms of its implementation by areas of production, including industry sectors, levels of government, territorial units, and time periods. Such a classification allows, on the basis of factors that most affect the energy intensity indicators of various levels, to create an energy-saving management system in industry. State programming, structural adjustment of industrial production, subventions, tax benefits, soft loans, depreciation, etc. are of great importance in this case.

A significant role in the implementation of state energy-saving policies is played by state programs to support the industrial sector. First of all, this refers to technical development programs developed by government bodies together with major national and transnational industrial corporations. In particular, these programs relate to the energy industry, the accelerated development of science-intensive industrial production with relatively low specific energy consumption, the creation and implementation of low-waste and non-waste technologies, the integrated use of raw materials and the increase in the use of industrial waste for energy recovery.

In 2014, Kazakhstan adopted the Concept for the Development of the Fuel and Energy Complex of the Republic of Kazakhstan until 2030. This program includes issues for energy efficiency in the sectors of coal and oil industry, gas and electricity. It also provides some measures for energy efficiency and energy saving (Table 3).

Table 3: Energy efficiency and energy saving measures

Tasks	Mechanisms
Formation of a regulatory framework	A system of regular incentives to improve energy efficiency; Creation of a training system in the field of energy conservation; Popularization of energy saving among the population.
Optimization of infrastructure, introduction of new technologies	Modernization of fixed assets of industrial enterprises; Transport modernization; Decrease in the level of losses in electricity and heating, decrease in costs for the generation of electric and heat energy; Conducting a regular energy audit at industrial enterprises.

Composed by authors

At the same time, the energy saving 2020 program, adopted earlier, was cancelled in 2016 and its goals were not achieved.

Thus, the concept implies a system of economic mechanisms in the field of energy efficiency, but they are not specified, which can lead to difficulties in implementing the program.

In developed countries, various forms of incentives are used including tax and depreciation incentives, subsidies, and soft loans. Economic incentives play a special role for industrial enterprises as the main consumers of energy resources. The economical, rational use of fuel and energy, as well as water, leads to a reduction in budget costs for fuel and energy supply of industrial facilities.

One of the forms of state regulation of energy consumption in industry under the conditions of market relations can be an incentive depreciation policy implemented during creating and using highly efficient energy-saving technologies and equipment. Accelerated depreciation in this case contributes to energy conservation from two points of view (Masserov, 2011).

Firstly, it allows to depreciate the value of fixed assets (which is usually a large part of fixed capital) at higher depreciation rates, creating the possibility of a faster turnover of capital and acceleration of technical re-equipment. Secondly, it means tax subsidies. By the end of the depreciation period of industrial equipment, the loss of raw materials will decrease by 15-20%. Thus, the acceleration of depreciation of equipment will reduce not only the work period of outdated equipment, but also reduce direct losses of energy resources.

In developed countries, government regulation of energy conservation has become widespread through a tax policy, usually using tax credits on the amount allocated for R&D on energy conservation. In the USA, Japan and Western European countries there are state bodies with the help of which state intervention is strengthened or weakened, the priorities of certain elements of the economic mechanism of energy conservation and its individual directions are changing.

In our opinion, establishing of such body would be useful in Kazakhstan. Leading enterprises, joint stock companies, research institutes and design bureaus in this field should be involved in the process of developing decisions on priority areas of energy conservation and related activities. The functions of the structures involved in the development and implementation of state regulation of energy conservation in the region should include the selection of priority areas of energy conservation based on forecasting, growth rates and the sectoral structure of industry and the economy, directions and growth rates of scientific and technological progress, current and forecasted environmental situation in the region; development of forms and methods for regulating energy consumption (resource conservation) in priority areas; development of relevant recommendations; assessment of the effectiveness of the proposed activities and the resources necessary for their implementation; preparation of an appropriate regulatory framework.

Development of energy conservation policy in the republic demands on investments which, in their turn, require legal conditions for their attraction, as well as removing the information barrier in this area between countries and regions. Many international institutions and states are engaged in solving the global problems of providing energy resources, cutting greenhouse gas emissions and global warming. Therefore, Kazakhstan has a possibility of attracting foreign investment in energy conservation through the participation in joint programs of solving the global problems of civilization.

The sources of investment for the implementation of energy conservation programs can be funds from international and foreign organizations, foundations and states, budgets of various levels, extra-budgetary funds and organizations. At the same time, the application of traditional methods of economic incentives can also help stimulate energy conservation: tax incentives, for enterprises that produce goods that meet international standards in terms of energy intensity; depreciation benefits; income tax benefits; benefits for customs duties on energy-saving equipment; soft loans; deferred loan repayments; tax credits for energy saving projects, including ones with the participation of a foreign investor. Participation in projects with partners from other countries is a good opportunity for the country to solve regional economic and social problems.

In Kazakhstan, the use of a system of administrative methods to stimulate energy conservation is limited by economic and financial conditions. Currently, the implementation of energy saving programs, in our opinion, should be based more on economic mechanisms. For the successful implementation of energy-saving policy in industry in the republic, it is necessary to develop an institutional and economic mechanism and create a regulatory, productive and personnel base that would make energy conservation not only profitable, but also relatively simple.

Currently, energy saving in the production and non-production sectors is far from being fully implemented. This is explained by the unstable financial situation of most enterprises, the unpreparedness of the relevant services and personnel for the implementation of energy-saving policy. The most important tasks in this area include the system of standards for energy consumption, benefits

and fines for consumers and energy producers, energy-saving equipment, metering and control devices; a system for monitoring the use of energy in the region; development of a methodology for enterprise surveys to identify energy saving potential and develop management decisions; the organization of preferential trade in metering devices, measuring and control over the use of energy resources, special energy-saving equipment and materials; identification of the main participants in the process of managing energy-saving activities, determination of their functions, rights and obligations.

The state should provide restrictions on the provision of financial resources for consumers who do not pay enough attention to energy conservation problem. From the perspective of organizing energy-saving activity, the key issue is the financing energy-saving projects and programs. Each project requires an individual decision in choosing sources, mechanisms and financing schemes. Therefore, the task of improving the regulatory framework is to expand the choice of such decisions.

Financing of energy saving programs is supposed to be carried out at the expense of the republican and local budgets, funds of investors, own funds of enterprises, expected future savings of energy resources.

State financial support stimulates the attraction of investments and self-investment of enterprises in energy conservation. The main option for obtaining budget funds is the inclusion of energy saving projects in regional and national programs.

Another option for financing energy-saving measures at industrial enterprises is returnable "revolving" mechanism of financing from the funds of the republican and local budgets. The essence of this mechanism is that the organization performing energy-saving work at public sector facilities allocates an initial amount of funding from the budget that is significantly less than that required for work at all facilities, but sufficient to carry out energy-saving measures for some special facilities. As a result of the work, the energy consumption of the certain facilities will decrease. Thus, the amount of budgetary subsidies for them may be reduced. At the same time, part of the resulting budgetary savings is used to repay the loans received, and part is used for the targeted accumulation of funds intended for financing energy-saving work at the next part of the facilities. Further funding may be provided from the budget and accumulated funds. In the end, accumulated savings are enough to finance the energy-saving works at enterprise, while the budget, without investing, gets the opportunity to reduce the cost of energy consumption. Various options are possible here: there is no reinvestment in energy conservation (organization uses the savings for its own needs); part of the savings is reinvested; all savings are reinvested. Maximum budget investments and their savings are obtained in the latest option.

For preparatory work, the formation of an energy conservation fund is necessary. It is formed by all participants of financial infrastructure of the region with the mandatory participation of an authorized body and a bank. The latter receives incentives for innovative activities in energy-saving projects with a payback period of 3-5 years. Financial resources of the fund are accumulated from regional tariffs for fuel and energy resources; payments of industrial enterprises for environmentally harmful emissions; fines charged by the ministry of energy in the order of their activities; income from the use of temporarily free funds of the fund itself (deposit, etc.); voluntary contributions of legal entities and individuals. The creation of the fund requires right balance between a reasonable centralization of funds, on the one hand, and a clear distribution of functions for the implementation of energy saving management systems among all recipients of fund, on the other hand.

The main results of the implementation of the energy conservation management mechanism should be the achievement of a state of energy saturation of the economy and the transformation of energy conservation at enterprises into a major source of meeting the region's energy needs. At the same time, the energy conservation policy should be directed not only to reducing the deficit of fuel and energy resources of the republic, but also the protection of the environment.

The transition of Kazakhstan to an energy-saving path of development is a prerequisite for the successful modernization of the industry, therefore, the design and implementation of the republican energy conservation mechanism is of great importance. Monitoring of its implementation must be carried out by all government agencies, transforming it into an energy conservation policy of the country.

6. CONCLUSION

1. Currently, the energy intensity of GDP in Kazakhstan, despite the decrease over the past decades, remains one of the highest in the world, which adversely affects the competitiveness of manufactured goods and increases environmental risks. This is largely due to the climatic conditions of the country, the large extent of the territory, as well as the presence of energy-intensive sectors of the economy. Reducing energy intensity in the republic is the most important task and can be achieved through the formation of a new approach to energy efficiency and energy saving, the use of alternative renewable energy sources, as well as the use of stimulating economic mechanisms.
2. Administrative measures taken in the framework of legislative acts to improve energy conservation and energy efficiency should be supplemented by economic mechanisms that make energy efficiency beneficial for the enterprise and motivate its participation in energy efficiency programs organized by the government. In foreign countries, the most effective mechanisms are tax incentives, loans at preferential interest rates, and preferential depreciation. In Kazakhstan, these mechanisms should be more clearly and thoroughly spelled out in energy systems modernization programs. A detailed development of the mechanism of tax preferences will contribute to a better understanding and demand for these mechanisms by enterprises.
3. The authors recommended a "revolving" mechanism for financing energy conservation, in which the burden on the

budget decreases over time, and an enterprise, through the redistribution of savings, gets the opportunity to finance energy conservation in subsequent production areas. The advantage of this mechanism is the reduction of costs from the state and local budgets, as well as the formation at the enterprise of a system of gradual financing of the transition to energy conservation without allocating own funds for this modernization. In the unstable financial situation of Kazakhstani enterprises, this mechanism is a promising mean of modernizing the fixed assets of the enterprise and increasing its energy efficiency.

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