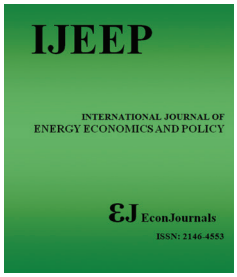

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Economic Growth Modeling for the Republic of Kazakhstan Based on the Higher Energy Efficiency Level

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ABSTRACT

The research on high energy efficiency achievement is believed to be relevant because this issue of energy policy is currently considered as one of the main tools for modernization of the industry of the Republic of Kazakhstan. Thus, in spite of the significant energy potential, Kazakhstan is much behind developed countries regarding energy efficiency values. So the goal of the research is to develop a model describing conditions how to achieve energy efficiency as a factor in the sustainable economy development in Kazakhstan. The following methods were used in the research: (1) Mathematical statistics: the Pearson r-coefficient was calculated at the stage of searching the correlation between energy efficiency and GDP dynamics. The Pearson's r was determined (−0.31) to be negative and weak, confirming the hypothesis that the energy efficiency state does not significantly affect the Kazakhstan GDP dynamics; (2) cognitive modeling: a cognitive map was developed to analyze the relationship between the energy efficiency and the economic development of Kazakhstan, to determine the economic development potential by refusing global energy efficiency projects and solving local problems related to reduced cost of energy resources instead.

Keywords: Energy Efficiency, Energy Saving, Resources, Economic Growth
JEL Classifications: O14, D24, C41

1. INTRODUCTION

Currently energy is believed to be a key for industrial production, transportation services, housing and communal functioning, favorable living conditions for the population. Accordingly, energy is an industry that significantly determines a level of social and economic development of the country. However, not always the energy at a national level seems to be the basis for sustainable economic development. Excessive energy intensity of the economy reduces its efficiency, and the intensive use of energy resources results in aggravation of environmental problems, and the state lose prospective to transfer to sustainable, harmonious development.

All of the above creates a strong incentive to find possible ways to ensure high energy efficiency of the economy to be a strategic task for all countries.

The developed countries have started developing energy-efficient and energy-saving measures back in the 1970s and today they already have significant achievements in this area (Great Britain, Denmark, Germany, Sweden, Italy, Norway, Japan, etc.).

To implement energy-efficient policies is considered as one of the main tools for modernization of industry, housing and communal services and transportation of the Republic of Kazakhstan as the most energy-intensive sectors of the economy. A successful policy

for energy conservation and energy efficiency will ensure the country's energy and environmental safety. Besides, increasing energy efficiency stimulates the introduction of new innovative technologies and solutions, improving interaction of the science development and technology transfer.

At the same time, it should be admitted that, having a high energy potential, the Republic of Kazakhstan just about to begin its energy-efficient development, understanding that only this way allows to ensure energy independence, improve industrial efficiency (by reducing energy costs), increase the competitiveness of domestic products, improve the investment attractiveness of the country, increase environmental sustainability, and ultimately, achieve sustainable economic development of Kazakhstan.

The purpose of this article is to develop a model of conditions for achieving energy efficiency as a factor in the sustainable development of the economy of Kazakhstan.

2. LITERATURE REVIEW

In recent years, many scientists from Kazakhstan have investigated energy efficiency issues (Alimbayev and Kazakova, 2009; Boribay, 2016; Sultangaliev and Markovsky, 2015; Saylaubekov et al., 2015; Karipzhanova, 2015).

Also foreign researchers wrote about this issue (Kiely, 2010; Pears, 2004; Gillingham et al., 2009; Harvey, 2010; McLean-Conner, 2009; Moeller, 2002; Sioshansi, 2013; Solmes, 2009; Zambini, 2006; Yang, 2015; Khairullina et al., 2019).

Several articles related to energy conservation issues have been published in the International Journal of Energy Economics and Policy in recent years.

In the article "Hybrid Energy Systems Model with the Inclusion of Energy. Efficiency Measures: A Rural Application Perspective" measures are considered to improve energy efficiency through technical solutions reducing energy consumption. The authors point out on the current increased energy demand in developing countries, which makes them search for new ways to energy conservation (Babatunde et al., 2018).

In the article "Modeling Energy-Efficient Consumption at Industrial Enterprises" energy efficiency issues are explored at the microlevel, and the authors point out on similar conceptual models of energy consumption used by manufacturers in different fields of the economy, that allows developing a universal solution for modeling these processes. The main problem of modeling is to find an adequate target function based on several parameters of energy consumption and energy efficiency (Todorov et al., 2019).

Also, researchers consider the issue of improving the energy efficiency of fossil-fuelled energy systems (Palanichamy et al., 2015). In the article, the authors reasonably point out that energy efficiency is believed to be the simplest and most cost-effective approach for the power engineering and manufacturing industries to meet the growing demand for cleaner energy. At the same time, the energy efficiency of fossil-fuelled energy systems in developing countries seems to be abnormally low, and this is very important for our work, bearing in mind that the problem is typical for the energy sector in Kazakhstan.

Modern researches are focused upon searching for energy policy instruments to improve energy efficiency, to solve regional security problems associated with the development of projects aimed at increasing energy efficiency (Foggia, 2016).

Energy efficiency is described in the works to be an integral part of energy management, its practical aspect, oriented at advanced technologies and innovative power equipment to reduce energy consumption, thereby achieving increased efficiency of all economic activity, the stable economy development.

However, in the scientific literature, the issue remains controversial if the energy efficiency has any impact indeed or it's just the desire to affect economic development dynamics. This problem regarding the economic situation in the Republic of Kazakhstan has not been solved in literature yet. Also issues have not been studied if energy efficiency would actually increase economic indicators of the state development; no mathematical statistics methods were used to prove this hypothesis, so any relationship between energy efficiency growth rates and economic growth rates can hardly be seen.

In order to establish this relationship, the Pearson criterion is advisable since it is used in economic studies more often than other statistical criteria (Gafarova et al., 2015; Grishin, 2016; Zulfugarova, 2018). This approach gives an opportunity to suggest some hypotheses about the correlation of Kazakhstan GDP dynamics and energy efficiency, and check their reliability using the specified criteria.

3. METHOD OF DATA ANALYSIS

A general scientific methodology was used in the research, in particular the following methods: theoretical, structural and system analysis, methods of mathematical statistics, and the method of cognitive modeling of economic processes.

Theoretical methods (analysis, synthesis, classification) allowed to determine the concept of "energy efficiency" and structural elements of energy efficiency; structural and system analysis was used to summarize facts determining the energy efficiency state; mathematical statistics methods were used at the stage of revealing the correlation between the GDP dynamics and energy efficiency; the method of cognitive modeling was used in development of conditions for achieving energy efficiency and economic growth.

A pilot of the developed model was tested at Al-Farabi Kazakh National University, the Department of International Relations and World Economy through its discussion by a group of reviewers. As a result of the discussion, the model was recognized to be fundamentally new, it really describes the relationship between the energy efficiency state and economy development, and corresponds to the current economic situation in the Republic of

Kazakhstan and allows for strategic planning to improve energy efficiency due to solving problems of economic growth.

The study was carried out in several stages:

- Researches on issues of energy efficiency in the Republic of Kazakhstan and abroad were analyzed;
- Using the Pearson correlation criterion, the relationship between the GDP dynamics and the energy efficiency dynamics in the Republic of Kazakhstan was studied;
- At the last stage, a cognitive analysis was used consisting of several stages:

  Stage 1 - formulation and clarification of the problem to be solved during the cognitive modeling process;
  Stage 2 - cognitive structuring of knowledge about the situation: determination of the most significant conditions affecting the situation;
  Stage 3 - building a model: assessment and determination of the relationships between the revealed conditions for achieving economic growth and energy efficiency; building a graph model.

4. RESULTS AND DISCUSSION

4.1. Energy Efficiency of the Republic of Kazakhstan and the Issue of Economic Growth

For the Republic of Kazakhstan, achieving high energy efficiency is believed to be a strategic task, since the country has high reserves of coal, uranium, oil, natural gas to be efficiently used. The total amount of recoverable fuel resources (oil, gas, coal, and uranium) of Kazakhstan makes about 34.9 billion tons of oil equivalent, thus the domestic consumption of these resources is low efficient, and the republic economy is characterized by high GDP energy intensity that is double the world average being an object of concern of domestic economists and politician (On implementation of the 2030 Agenda for Sustainable Development, 2019).

At the same time, concerns have also focused on the following questions: to what extent does the energy efficiency state in Kazakhstan affect the GDP dynamics? Is there any relation between these indicators? Does energy efficiency ensure the country's economic growth, or vice versa, reduce the growth rate?

To answer these questions at the first stage of the research, we suggest some hypotheses to be verified (Table 1).

These hypotheses will be tested using the Pearson correlation coefficient (Pearson's r) (Table 2). The correlation coefficient can take values from −1 to +1. Thus, a value of -1 will indicate no correlation between the level of energy efficiency and GDP dynamics, 0 - a zero correlation between these values, and +1 - a complete correlation of the studied values. That is, the closer the correlation coefficient value to +1, the stronger the relationship between energy efficiency and GDP and, accordingly, the closer the correlation coefficient value to −1, the weaker the relationship between energy efficiency and GDP.

We calculated the Pearson r-coefficient. In this case, evaluating the strength of the correlation coefficient relationship, we use the Chaddock scale (Table 3).

In accordance with the indicators given in Table 3, we concluded that Pearson's r is −0.31, a weak negative correlation, i.e. the hypothesis is confirmed that the energy efficiency state in the Republic of Kazakhstan is weakly correlated with the GDP dynamics, does not significantly affect the dynamics of this indicator (sector 1.3 in the hypothesis matrix).

This conclusion, on the one hand, can be perceived positively, since the assertion that the energy efficiency state hinders the sustainable development of the Republic of Kazakhstan is rejected. On the other hand, the data obtained allow to say that the energy efficiency state does not ensure the sustainable economy development in the republic.

The explanation that the energy efficiency state does not have a significant impact on the GDP indicator lies in the economy structure of the Republic of Kazakhstan with non-energy-intensive sectors leading in the economics, such as services 53.2% and production of goods 39.2% (Kazakhstan's GDP Structure in 2018, 2018).

The volume of energy-intensive industrial production (really requiring an increase in energy efficiency) in the GDP structure is only 29.7% (Kazakhstan's GDP structure in 2018, 2018). Industrial production is provided by the potential of the extractive

Table 1: The matrix of hypotheses on the correlation of the GDP dynamics and energy efficiency in the Republic of Kazakhstan

No.	1.	2.	3.
1.	There is a close relationship between the energy efficiency state and the GDP dynamics, and energy efficiency has a negative impact on the GDP dynamics	There is a close relationship between the energy efficiency state and the GDP dynamics, and energy efficiency affects the GDP dynamics	There is a close relationship between the energy efficiency state and the GDP dynamics, and energy efficiency has a positive effect on the GDP dynamics
2.	There is a relationship between the energy efficiency state and the GDP dynamics, and energy efficiency has a negative impact on the GDP dynamics	There is a relationship between the energy efficiency state and the GDP dynamics, and energy efficiency affects the GDP dynamics	There is a relationship between the energy efficiency state and the GDP dynamics, and energy efficiency has a positive effect on the GDP dynamics
3.	There is a weak relationship between the energy efficiency state and the GDP dynamics, and energy efficiency does not significantly affect the GDP dynamics	-	-

Table 2: Calculation of the Pearson's coefficient based on data on the GDP dynamics and energy efficiency in the Republic of Kazakhstan

Years	Energy intensity, (conventional tons)*	Previous year growth index (PGI)	GDP over the previous year (million tanga)**	Previous year growth index (GDP GI)
2009	1.48	-------	17,007,647.0	-------
2010	1.84	1.24	21,815,517.0	1.28
2011	1.73	0.94	28,243,052.7	1.29
2012	1.53	0.88	31,015,186.6	1.09
2013	1.44	0.94	35,999,025.1	1.16
2014	1.74	1.20	39,675,832.9	1.10
2015	1.53	0.87	40,884,133.6	1.03
2016	1.54	1.006	46,971,150.0	1.14
2017	1.53	0.99	53,101,281.8	1.13
2018	1.46	0.95	61,819,536.4	1.16
∑		9.016		10.38
∑ Wed		1.001		1.15
Deviation from∑Wed				
Years	**∑ Wed- (PGI**	**X**	**∑ aver- GDP GI**	**Y**
2010	1.001-1.24 =	−0.239	1.15-1.28 =	−0.13
2011	1.001-0.94 =	0.061	1.15-1.29 =	−0.14
2012	1.001-0.88 =	0.121	1.15-1.09 =	0.06
2013	1.001-0.94 =	0.061	1.15-1.16 =	−0.01
2014	1.001-1.20 =	−0.199	1.15-1.10 =	0.05
2015	1.001-0.87 =	0.131	1.15-1.03 =	0.12
2016	1.001-1.006 =	−0.005	1.15-1.14 =	0.01
2017	1.001-0.99 =	0.011	1.15-1.13 =	0.02
2018	1.001-0.95 =	0.051	1.15-1.16 =	−0.01
X^2 ; Y^2				
2010	-0.239^2 =	0.057	-0.13^2	0.016
2011	0.061^2 =	0.003	-0.14^2	0.019
2012	0.121^2 =	0.014	0.06^2	0.003
2013	0.061^2 =	0.003	-0.01^2	0.000
2014	-0.199^2 =	0.039	0.05^2	0.002
2015	0.131^2 =	0.017	0.12^2	0.014
2016	-0.005^2 =	0.000	0.01^2	0.000
2017	0.011^2 =	0.001	0.02^2	0.000
2018	0.051^2 =	0.002	-0.01^2	0.000
∑		0.136		0.054
X • U				
2010	−0.239×−0.13 =	−0.031		
2011	0.061×−0.14 =	−0.008		
2012	0.121×0.06 =	0.007		
2013	0.061×−0.01 =	−0.0006		
2014	−0.199×0.05 =	−0.009		
2015	0.131×0.12 =	0.015		
2016	−0.005×0.01 =	0.000		
2017	0.011×0.02 =	0.000		
2018	0.051×−0.01 =	0.000		
∑	−0.026			

*Fuel and energy balance of the Republic of Kazakhstan 2006-2010 (Ministry of National Economy of the Republic of Kazakhstan, 2006). Fuel and energy balance of the Republic of Kazakhstan 2010-2014 (Ministry of National Economy of the Republic of Kazakhstan, 2010). Fuel and energy balance of the Republic of Kazakhstan 2014-2018 (Ministry of National Economy of the Republic of Kazakhstan, 2014). **The main social and economic indicators of the Republic of Kazakhstan. (Ministry of National Economy of the Republic of Kazakhstan, 2018)

sectors of the oil and gas industry, thus the industry share in GDP reaches 25.8% (Nazarbayev, 2012), respectively, other sectors of the republic energy-intensive industry provide only 3.9% of GDP.

Available resources, fully meeting the industry needs, do not stimulate the transition to innovative, energy-saving technologies, showing the resource curse paradox.

Under such conditions, the 2020 Energy Saving Program, curtailed back in 2016, has lost its relevance, since it is clear that under

Table 3: Indicators of the strength of the relationship between the variables* (Values and strength of the correlation coefficient, 2020)

Value	Interpretation
From 0 to 0.3	Very weak
From 0.3 to 0.5	Weak
From 0.5 to 0.7	Average
From 0.7 to 0.9	High
From 0.9 to 1	Very high

*In negative correlation, the values of the relationship strength between the variables are changed to the opposite

current conditions it is impossible to achieve by 2020 the goal to reduce GDP energy intensity by at least 40%, especially since the result achievement would not entail a significant increase in GDP.

So we can say that the task to increase the level of energy efficiency in Kazakhstan makes sense and becomes important if to develop intensively energy-intensive industries with an innovative focus in the republic. Until now, it does not make sense to even talk about the reduction in the energy saturation of production, since the growth in these resources extraction and consumption and the GDP dynamics are not related, i.e. economic growth is not ensured by energy efficiency; moreover, it does not require the creation of conditions for this.

This conclusion is also confirmed by the absence of a visible correlation between the trends in energy generation, consumption, and in the industrial production growth in the Republic of Kazakhstan over the past 10 years (Table 4 and Figure 1).

If the dynamics of consumption and production in certain time periods visibly coincide (2009-2014, 2016-2018), then the dynamics of industrial manufacturing, as follows from Figure 1, does not have any pronounced coincidences with the dynamics of other studied indicators.

Thus, the engineering sectors, chemical and oil refining industries should currently become strategic sectors of the economy of the Republic of Kazakhstan. In case of an increase in the share of these industries in manufacturing with increased energy efficiency, the economics growth and GDP can really be increased in the Republic of Kazakhstan. In other scenarios, the increase in energy efficiency will hardly provide the republic with the necessary rates of economic development, becoming just an external attribute of the national economic policy.

4.2. Development of a Map of the Relationship between the Level of Energy Efficiency and Economic Development, Determination of Ways to Achieve Energy Efficiency

According to the methodology of cognitive modeling (Axelrod, 1976; Trachtengerz, 1998), we gradually build a cognitive map:

1. To determine the main conditions affecting the development of the fuel and energy complex and the energy system of Kazakhstan.
2. To find out causal relationships between the determined conditions, to form a matrix of interconnections, and then to build a cognitive map with description of the relationship

Figure 1: Dynamics of industrial manufacturing and indicators of extraction, generation and consumption of energy resources in 2010-2018 (indices)

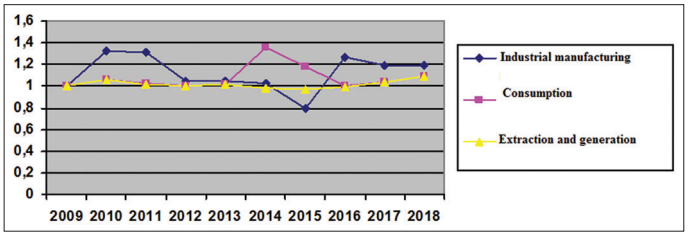


Table 4: Dynamics of energy resources extraction, generation, consumption and industrial production in 2010-2018*

Indicators	Years									Deviation 2018/2009	
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Abs	%
Extracted and generated	266189	284461	290394	292752	301112	295729	287174	286644	300,460	330242.5	64053.5	24.0
Previous year's growth index	---	1.06	1.02	1.008	1.02	0.98	0.97	0.99	1.04	1.09	---	-
Consumed domestically	122391	130551	135687	136906	139572	190488	224867	225315	236395	257835	135444.0	110.6
Previous year's growth index	-	1.06	1.03	1.008	1.01	1.36	1.18	1.001	1.04	1.09	-	-
Industrial output	9 121 525	12 105 526	15 929 052	16 851 775	17 833 994	18 529 225	14 903 099	19 026 781	22 790 209	27 218 063	18096538.0	198.3
Previous year's growth index	----	1.32	1.31	1.05	1.05	1.03	0.80	1.27	1.19	1.19	-	-

*Fuel and energy balance of the Republic of Kazakhstan 2006-2010 (Ministry of National Economy of the Republic of Kazakhstan, 2006). Fuel and energy balance of the Republic of Kazakhstan 2010-2014 (Ministry of National Economy of the Republic of Kazakhstan, 2010). Fuel and energy balance of the Republic of Kazakhstan 2014-2018 (Ministry of National Economy of the Republic of Kazakhstan, 2014)

between promising areas of the economy development of Kazakhstan, energy efficiency conditions and their impact on the GDP, budget fill rates, economics competitiveness, etc.

The designations in the matrix (Table 5) and on the map (Figure 2) correspond to the following conditions for achieving economic growth, changes in the economic system of Kazakhstan (proposed by the author):

a_1 - GDP; a_2 - industrial manufacturing volume; a_3 - development of energy-intensive innovative sectors of the national economy; a_4 - a level of the national economy competitiveness; a_5 - investment in the development of energy-saving technologies; a_6 - extraction of energy resources; a_7 - a level of the competitiveness of national manufacturers; a_8 - profitability of products /services; a_9 - reduction in energy consumption; a_{10} - budget full rates.

Given these conditions, a matrix of the mutual influence of these conditions was built (Table 5).

Table 5: Matrix of the mutual influence of conditions characterizing the economy development in the Republic of Kazakhstan and conditions for energy efficiency

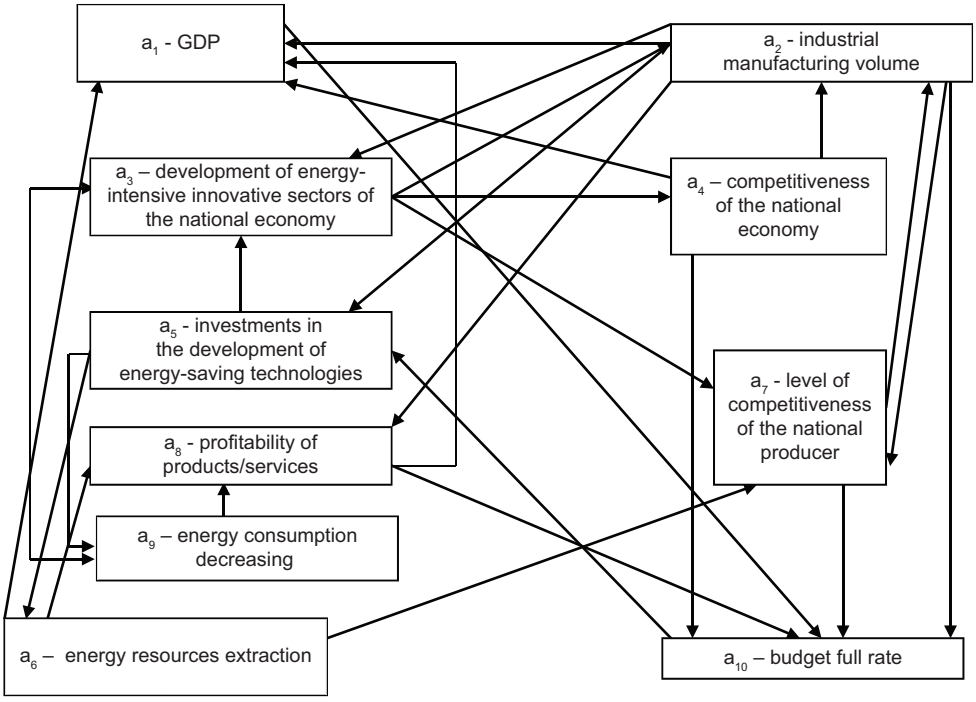
	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9	a_{10}
a_1	x	+	0	+	−	+	−	+	−	+
a_2	+	x	+	0	+	−	+	+	−	+
a_3	0	+	x	+	+	−	+	+	+	−
a_4	+	+	+	x	−	−	−	−	−	+
a_5	0	+	+	−	x	+	0	−	−	+
a_6	+	−	−	−	+	x	−	+	−	−
a_7	−	+	+	−	−	+	x	−	−	+
a_8	+	+	−	−	−	+	−	x	+	+
a_9	0	0	−	−	+	−	−	+	x	
a_{10}	+	+	0	+	+	−	+	+		x

Based on the matrix, we could build a cognitive map (Figure 2), which describes the relationship between conditions for increasing the economy growth in Kazakhstan thanks to developed energy-intensive innovative industries in connection with the need to increase the level of energy efficiency of industrial manufacturing. The influence of these conditions is determined by the logic of the economic system development, and by the logic of structural changes and economy growth (Mironov and Konovalova, 2019).

The cognitive map allows to give explanations and recommendations for the development of an economic model of Kazakhstan, taking into account the energy efficiency factor and the above provision on the absence of a direct impact of energy efficiency on GDP.

1. Energy efficiency is indirectly associated with GDP growth, through factor a_8 (profitability of products/services), depends on investment in the development of energy-saving technologies a_5, as well as on the development of energy-intensive innovative sectors of the national economy a_3. In this logic, factor a_3 is the key, because it generates a request to reduce energy efficiency and the system responds to this "request" in the form of a reduction in energy consumption. In turn, factor a_3 forms the conditions for GDP growth through a_2 (industrial manufacturing volume), a_4 (national economy competitiveness level) and a_7 (national producer competitiveness level), a_8 (product/service profitability). In fact, energy efficiency, in corresponding "request" from the economic system, can stimulate the production efficiency growth leading to achievement of GDP growth. Not only structural changes in the economy may become a "request" for reducing energy intensity, but rather building up export-oriented and energy-intensive sectors of the economy, traditional for Kazakhstan.

Figure 2: Cognitive map of the economy development in the Republic of Kazakhstan under energy efficiency (compiled by the author)



Thus, the first recommendation for the formation of a national model of the Kazakhstan economy is to take into account the energy efficiency factor as an element of increasing the overall efficiency of national production, bearing in mind that this goal should be linked to the broader goals of the industrial complex development in Kazakhstan.

2. The problem of achievement of economic growth through energy efficiency management seems to be important as well. As stated in the Concept for Transition of the Republic of Kazakhstan to Green Economy, the economy energy intensity of Kazakhstan is twice as high as the average for OECD countries and by 12% higher than the level of Russia (Decree of the President of the Republic of Kazakhstan, 2013). Accordingly, energy costs affect the cost of Kazakhstan products, their price competitiveness, sales volumes, and, accordingly, the GDP indicator. However, the law of energy cost by Subetto (2015) should be considered, which proves the economy competitiveness is to be achieved in many cases not by reducing energy intensity, but by reducing the cost of energy generation.

In this regard, the second recommendation is to develop a system of rational management of energy efficiency in Kazakhstan, bearing in mind that the problem of economic growth can be solved not only by setting global objectives, such as reducing the energy intensity of industrial manufacturing in general, but solving a local problem - reducing energy costs by increasing its generation efficiency, which seems to be very important for Kazakhstan (Subetto, 2015).

3. It should be borne in mind that transition from resource-oriented economic growth to high productivity and innovation based growth is a complicated problem. This requires multibillion-dollar investments from the state for a high-quality education system, a breakthrough in science and technology, which is to be a task for the next decade (Almerekov, 2018).

At the same time, large oil reserves in Kazakhstan allow to become one of the middle-income countries within a relatively short time (Almerekov, 2018), and the country hardly should refuse the energy-intensive economy model, concentrating significant resources on reducing energy costs. In this regard, Kazakhstan needs to focus on balanced growth, when a reduction in energy consumption does not slow the further development of the leading industries in Kazakhstan, and energy efficiency is not considered to be an end in itself, but part of the growth strategy of Kazakhstani industry.

Given the above, it should be noted that, according to specialists worldwide, energy consumption can be reduced by about 1% per year by equipment modernization and replacement in various industries (Bashmakov, 2010). In this regard, we can agree that "Kazakhstan can reduce energy demand in major energy-consuming sectors by 10% by 2030 (Decree of the President of the Republic of Kazakhstan, 2013). However, at the same time, other problems inevitably arisen in the economy of Kazakhstan should be taken into account when solving energy efficiency issues:

- The diversion of a significant amount of resources from other economic sectors in Kazakhstan, particularly from the social sphere, as stated in the theoretical postulates explaining the society's production capabilities;
- No guarantees that increased energy efficiency under current conditions of world markets tumble would lead to the growth of the country's economy or the competitiveness of local products in the next decade. Thus, the third recommendation for solving the problem of economic growth of the Republic of Kazakhstan by increasing the energy efficiency is to form an economically reasonable investment policy in the energy sector connected with the national development strategy in the medium term.

5. CONCLUSION

Summarizing the article, it should be noted that the issues of energy efficiency of the Republic of Kazakhstan are believed to be in the decision-making strategy and require an appropriate approach to forecasting. Due to the high complexity of solving energy efficiency problems, this system formalization for further development of the economy of Kazakhstan seems problematic, but possible provided that mathematical statistics and cognitive modeling methods are applied. The list of conditions obtained from modeling can serve as a base for a strategy for achieving the goals of economic growth and energy efficiency of the Republic of Kazakhstan and scenarios for its implementation. The study of conditions and causal relationships based on mathematical statistics and cognitive modeling methods in the analysis of energy efficiency conditions, considering them in assessment of the current economic situation, opens up potential for creating a model for the development of the national economy of the Republic of Kazakhstan.

In particular, we have to remember in the model development that achievement of energy efficiency in the current economic conditions (including global conditions) has not only a positive impact on the Kazakhstan economy, but also negative effects due to limited production capabilities in economic development, with a significant uncertainty factor that makes it difficult to create any accurate forecast for the development of the national and global economy.

In this regard, currently the Republic of Kazakhstan should refuse global projects in the energy efficiency and solve local problems associated with the reduced cost of energy resources instead.

Further researches may determine directions for investment policy in the energy sector associated with the development strategy of the Republic of Kazakhstan.

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