

**II International Scientific Conference GCPMED 2019
"Global Challenges and Prospects of the Modern Economic Development"****ENERGY EFFICIENCY AS A FACTOR FOR INCREASING
COMPETITIVENESS ECONOMIES OF THE REGION**

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Abstract

The development of the Russian economy is interfered by unsolved problems with its structure and efficiency. One of these problems is high power consumption. Over the past 25 years, it has fluctuated significantly, in the 2000s it has decreased, then it has stabilized and began to decline. The article compares the energy consumption of Finland and the Republic of Karelia. The authors reveal regional energy problems, provide a classification of regions and measures to improve energy efficiency. Measures have been developed and proposed to improve the situation in the energy sector of the Republic of Karelia. The author considers the main sources of energy, as well as advantages and disadvantages of modern energy systems. The analysis in the article is focused on identifying key characteristics and development tendencies of renewable energy, in the context of limited investment resources, lack of energy resources, high energy tariffs, exhaustion of fossil fuels, increased costs for developing new deposits, and complicated access to new technologies. The data on the development of renewable energy industry at the world level and at the regional level of the North-West Federal District are presented. The expected results of scientific research can contribute to deepening knowledge on studied phenomena, in particular, this concerns the improvement of public policy instruments in the field of development of organizational and economic aspects of the Regional Energy Policy.

2357-1330 © 2020 Published by European Publisher.

Keywords: Northern border region, energy conservation, energy efficiency, energy intensity of the economy, energy resources.



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1. Introduction

Historical analysis shows that in the middle of the XX century the scientists relied greatly on nuclear energy. So, it was assumed that the atomic energy would help to cope with the planned shortage of minerals, as well as solve the problems of finding additional fuel and energy resources for further economy development and ensure the transition of society to a new development stage. However, the idea of inexhaustibility of this energy potential was erroneous. Once again mankind faced the problems of exhaustion of subsoil reserves, low efficiency of the energy delivery system, monopolization of the energy market and, as a result, price increases, forcing consumers of fuel and energy resources to spend resources more economically. Considering the experience of the first world energy crisis of 1972-1973, the issue of economy is especially relevant. Every year, the interdependence of energy and economy is strengthened and projected onto the social sphere, which is confirmed by identified and recognized energy-economic patterns (Golovanova, 2009):

1. Economic growth is accompanied by the increase in energy consumption. During the XX century energy consumption in the world has grown more than 10 times, and per capita – 5 times. According to the US forecast, the average annual growth rate of primary energy consumption will be 1.9% up to 2025.

2. The role of energy as an industry in economic development is growing – it produces over 35% of all industrial products, and forms more than 30% of all federal budget revenues.

3. It is the increase in energy prices that determines production energy costs and products competitiveness, including in international markets.

4. The availability of significant energy reserves determines not only economic, but also political advantage of the state.

2. Problem Statement

The nature of energy-economic problems is associated with the specifics of the region and the degree of its possible provision of energy resources for regional development.

According to the availability of energy resources, four groups of regions are distinguished:

- 1) energy-deficient;

- 2) with own resources;

- 3) provided with tested energy resources, the use of which is impractical for economic and environmental reasons;

- 4) provided with energy resources, but their extraction and production are problematic due to limited financial resources.

The Republic of Karelia is referred to the fourth group. In most entities of the Russian Federation, the potential of local fuel is lower than existing needs and, moreover, the deficit will increase in the future. Today, the north of Western Siberia (Tyumen Region), Central Siberia (Kuzbass, hydropower of the Angara-Yenisei complex), a number of regions of Eastern Siberia and the north of some European part of Russia (Timan-Pechora basin, shelf of the Arctic seas). Today Karelian energy is energy-deficient.

Approximately 50% of the electricity demand (about 1100 MW) is covered by its own capacities, and the remaining has to be purchased in neighboring regions – the Leningrad and Murmansk regions.

3. Research Questions

On the territory of Karelia there are a huge number of old boiler houses with low efficiency and high operating costs. But there are also positive trends. Since late 1990s, natural gas started to be mined in Karelia, and all large enterprises use it as the main fuel in exchange for fuel oil and coal, and the gasification in the republic also takes place. Until 2020, the Republic of Karelia provides measures to reduce energy shortages developed by RAO "UES of Russia" together with the Ministry of Industry and Energy of Russia. The Beloporozhskaya, Marine and Segozero hydroelectric power stations are constructed with the total capacity of 268 MW. Small hydropower plants and Petrozavodsk TPP are reconstructed and re-equipped; new power lines with voltage of 330, 220, 110 and 35 kV are developed. These measures will reduce the deficit of electricity in the region from 50 to 35%. Missing energy is expected to be imported from neighboring regions. But there are alternative ways to reduce the region's energy dependence. The solution is energy savings, or easier energy efficiency and generating of additional capacity. Up to the third of all energy covers the maintenance of housing and communal services in Karelia.

4. Purpose of the Study

The main objective of this article is to study the influence of factors affecting energy efficiency dynamics of the Russian economy and assessing the potential prospects of its change, elaboration and selecting scenarios of Russian economy development and its regions in the conditions of limited investment resources, exhaustion of existing fuel and energy resources, increasing development costs of new fields, complicated access to new technologies, increasing environmental risks and risks of technological disasters, associated with equipment deterioration.

The solution to this objective will allow developing a methodological approach to create models and scenarios of economic development based on the interaction of macro and meso-level; to develop new and update existing models of economic energy efficiency for the research; to assess the impact of structural shifts and sectors on the change of economic energy efficiency of the North-West of Russia.

5. Research Methods

Studying the issues related to the waste in the sphere of power and also implemented projects show the broad prospects of using main types of waste in a power complex. The main difficulties of unified methodical approach are varieties of research forms and methods. In this regard, the general methodology of this research was created on the system approach and complementary methods: comparative analysis of power sources from waste; situation and strategic analysis of opportunities of waste use in the sphere of power, the analysis in relation to northern regions; case - study method for the research of implemented projects in the field of energy; standard and legal analysis of adopted acts and strategy.

6. Findings

Please replace this text with context of your paper. Increasing the competitiveness of the region's economy is associated with the fact that state creates necessary conditions for the development of production factors, which include energy. They play the main role in the functioning of the region, providing infrastructure development and goods and services production. Taking into consideration price increase for energy resources, energy conservation and decrease in energy intensity, competitiveness is becoming sharper. This can be confirmed by the work of researchers (Proskuryakova & Ermolenko, 2019; Karanfil & Li, 2015; Shahbaz, Loganathan, Sbia, & Afza, 2015).

In the rating of the business climate (<https://www.doingbusiness.org>) the World Bank highlights the availability of electricity as one of key criteria. According to this rating, Russia takes 184th place out of 185 possible. In order to connect to electricity, a Russian entrepreneur needs to spend 281 days and go through 10 procedures, in the leading countries it takes less than 20 days and requires only 3 procedures.

However, Russia is still in the top ten countries in terms of energy efficiency. The energy intensity of the Russian economy is twice that in China and India, 6 times in the Republic of Korea, 7 times in the USA and Finland, more than 13 times in Japan.

Considering territories with similar climatic conditions, the difference is significant. The research of the energy intensity of Finland's GDP and GRP of the Republic of Karelia revealed that in 2010 3.3 kWh is spent per GRP unit in Karelia against 0.47 kWh in Finland; Karelia spends 7 times more electricity per 1 euro of GRP than in neighboring Finland (Table 01).

Table 01. Average energy consumption per 1 m² in the Republic of Karelia and Finland

Region	Heating		Hot water		Electricity		Total
	kWh /yr	%	kWh /yr	%	kWh /yr	%	kWh /yr
The Republic of Karelia	234	78	30	10	36	12	300
	90	60	30	20	30	20	150

Source: authors.

In the nearest future, the energy intensity of the economy of the Republic of Karelia, expressed in the amount of energy per GRP unit, will be reduced and the gap between the same indicator will decrease, this will positively affect the competitiveness of the region, which will result in additional investments and contribute to further economy development of the Republic of Karelia.

Reducing the energy intensity of the economy was achieved by economic relations in manufacturing sector and in everyday life. These changes were the result of the development of a new regulatory and legislative framework, new management system, personnel training in the field of energy conservation, the number of events such as exhibitions, seminars and competitions. The effect of reducing energy intensity in production and services is achieved through measures to eliminate energy waste, the use of energy-efficient technologies, machinery and equipment, and the use of renewable energy sources.

In a competitive market, energy conservation is becoming a special type of business for financial institutions and energy service companies (ESCOs). This type of business appears with a steady demand for specific goods and services and develops with the country transition to a market economy

(competition). These companies carry out a set of measures aimed at reducing energy losses and improving the efficiency of energy resources: financial and energy audit, accounting and control of energy consumption, consulting services, investing in energy efficiency projects, installation of control devices, practical energy-saving projects. Thus, these events create the prerequisites for competition.

Energy saving does not create a new regional product, but energy costs are reduced, which results in increased product competitiveness at the markets of various levels, not only regional but also international ones, which positively affects economy development. The energy conservation policy slows down the growth rate of energy resource consumption, and also reduces the negative impact on the environment; in addition, this allows preserving non-renewable energy resources for future generations.

Savings of 1% of energy resources provide an increase in national income by 0.35 – 0.4%. Energy saving here requires 2-3 times less investment than its additional production, processing and transportation. In the European Union, the cost of using energy-efficient technologies of 1.5 euros achieved a multiplier effect of 4.5 euros. The saved unit of energy also leads to a significant environmental effect at all stages, from fuel extraction and its conversion into thermal and electric energy, finishing with its transfer to the final consumer (Jalas & Juntunen, 2015). Market mechanisms and government policies for efficient energy resources have a significant influence on the environment and energy effectiveness.

In the studies and publications of recent years, the theoretical foundations of energy conservation have been formed and currently they are a new scientific tendency in oil-producing countries (Nahla, 2019). Energy conservation is inseparable from the economy and interconnected with management methods and tools of the region's competitiveness. In connection with the diversity of energy conservation, some of the issues, especially the technical plan, have already been sufficiently studied and are considered to be advanced in practice. Economic issues, management methods and technologies in the energy intensity system require further research and improvement.

For further development and successful modern economy, there should be coordinated and balanced functioning of three flows: information, material and energy. The finance movement, as a rule, should be preceded by modeling and informed decision-making in the conditions when the goal is sustainable social development, taking into account increasingly stringent restrictions (Druzhinin, Shcherbak, & Tishkov, 2018).

The process of commodity production in the modern world is characterized by multi-stage. There are two large groups: goods of the commodity group and goods of final consumption, which are produced from the goods of the first group (Velikhov, 2011; Tishkov & Shcherbak, 2015).

The goods of the first group comprise raw materials for consumer goods and are characterized by high energy intensity in their production and relatively low price in world markets. This group includes: metals, chemical fertilizers, cement, raw wood, etc. The second group includes goods that make up the final consumption products: these are engineering products, household goods, electronics, transport, etc. These goods require significantly lower energy production costs, while their price (per unit of energy spent) is substantially higher in comparison with the commodity group goods.

The study of the price ratio and energy costs revealed that in the modern economy 1 thousand dollars can be earned on the world market from one ton of oil energy equivalent that is needed for

commodities production, but 14 thousand dollars can be earned with the same energy costs in the production of final goods.

This feature of commodity production is effectively used by many developed countries to modernize their economies. Most of their own industries, focused on the production of raw materials, are exported outside the country and are located in the countries with developing economies. At the same time, there is production development of final consumer goods. This strategy results in significant improvement in the environmental situation and creates an economy with efficient energy resources.

7. Conclusion

Russia has high potential of increase in energy efficiency in all branches of economy, its use will allow to reach the new level of development, to overcome dependence of economy on energy costs, to improve social and economic provisions of the country, to increase the level of life quality of the population. There are some steps that have to be taken: organization of accounting of resources consumption and energy stimulating measures which will make projects on energy saving investment attractive, creation of motivation system to energy saving both from buyers and sellers' parts, development of standardization and competition among suppliers and consumers of energy resources.

Alternative energy sources have considerable ecology-economic potential, the example of Finland shows that even the stations using solar energy can function in the north. Use of RES will also contribute to innovative development of the country. It is necessary to use system approach at the implementation of energy saving concept and to adapt foreign experience of various instruments to increase energy efficiency for innovative energy saving technologies and activization of renewable energy.

Acknowledgments

This article was prepared as part of the President Grant No MK-229.2019.6.

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