The role of energy security in the element base of the industrial region innovative development

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Abstract. The article examines the peculiarities of the relationship between energy security and innovation processes in the industrial region. Systemized approaches to the methodology for calculating the level of financial security have been consolidated. It is concluded that it is appropriate to use an indicative method of energy security analysis as a classic epistemological variant of the study of the energy security phenomenon. As a result of the assessment of the energy security level of the Kemerovo (Kuzbass) region it is concluded that all indicators of energy security except a certain degree of depreciation of the fixed assets of the fuel and energy complex enterprises have acceptable pre-crisis values. According to the share of own sources in the balance of electricity, the disposable capacity of power plants and the capacity of the largest power plant in Kuzbass region is in the pre-crisis zone, which determines its energy independence. It is noted that the share of coal as the dominant fuel resource in the structure of fuel consumption is at the pre-crisis level. The energy supply is emphasized to cover not only the issues of production, supply of energy resources and availability of energy sources, but also the aspects of the ecology and energy resources accounting. This determines the necessity to adjust the methodology for determining the energy security. It is proposed to supplement the methodology of assessing the level of energy security with indicators that take into account the diversification of sources of electricity generation both as a main resource and the possibility of commercial accounting of electricity consumption. The statement about the impact of the innovation level of energy on the level of region energy security and the pace of innovation process is justified.

1 Introduction

Energy plays a special role in the economy of any state and at present there is no sphere of activity not related to energy consumption. The increase in global energy consumption was caused not only by the growth of energy consumption by the developing countries, but also with the spread of the Internet which today has a share of 6% of the global electricity consumption. The international trade in energy resources has changed greatly and its turnover has significantly grown adding new stakeholders [1, 2, 3]. There has been a division of all countries into energy-rich and energy-dependent ones. Therefore, the focus of experts, international organizations and business falls on the problem of ensuring energy security and monitoring its indicators making this issue sharp and urgent.

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The search for a new way of Russia's development conducted by many scientists and experts contains the elements of innovation policy to certain degree. Researchers agree that today the development of civilization is taking place along with the predominance of the high technological paradigm which contributes to the efficient use of all kinds of resources and minimizing the burden on the environment. In academia and the economic community there is a continuing debate about the impact of all factors on the direction and pace of social and economic development and its sustainability. An additional range of questions arises when studying the impact of economic sanctions on the Russian economy, the assessments of which are ambiguous [4, 5, 6].

Under the conditions of economic turbulence the development of high-tech production in all sectors of the Russian economy, as well as in other countries, contributes to its continued competitiveness in the global economy improving the level of national security and its components (food, economic, financial etc.) and expanding the investment process [7, 8]. In its turn, the investment process is inseparable from innovation, which in the regions requires special conditions, for import substitution as well. Import substitution policy as a factor influencing the investment process becomes a long-term strategy for economic development for Russia and a natural respond to the change in external or domestic economic and political environment.

Many theoretical and practical questions remain unanswered when analyzing the adaptation of regions to the new economic conditions and the stimulation of the investment process in regions with different economic structure. The study of this process in its relations to the regional financial security presents a scientific challenge that has practical implementation as a system of regional policy management and its innovative, investment and financial aspects [9, 10, 11]. The question of the level which should be considered financially safe still remains open. The object of this study is Kemerovo region as one of the regions of the mineral and raw materials cluster, as its economy to a great degree determines the level of Russia's energy security. The subject of the research is the energy security of the region and its dependence on the innovation process.

2 Methods

The region-level study of the energy security was conducted using a dialectical approach to the study of these issues in their interdependence with other aspects of social and economic life. Materials of official statistics bodies and reports of energy companies engaged in the production and supply of electricity and heat power industry were used as a data base. Regulatory and legal documents and acts defining the specifics of energy policy, official documents and analytical articles of domestic and foreign researchers and practitioners, materials of official websites of energy companies have been also studied and analyzed.

At the empirical level of the energy security research we used methods of economic monitoring, analysis and synthesis as well as statistical methods. A large number of criteria for assessing energy security are used as a basis for an indicative analysis system in Russia and abroad. In the works of many international and Russian authors their number varies from 5 to 20 criteria. The researchers of the Ural branch of the Russian Academy of Sciences have developed a methodology that includes 9 of such indicators. The method of indicative analysis allows to assess the level of energy security with sufficient accuracy determining the situation by the degree of crisis which is understood as a threat for the economic system.

A similar methodology with proven and recognized assessment criteria was used in assessing energy security. Threshold levels of criteria have been drawn from the established knowledge system of many expert assessments. At the theoretical level of cognition the method of analogies, abstraction, evolutionary method in combination with historical
method were used. However, in our opinion, the use of such a set of methods from the point of view of epistemology is not an optimal option and can’t be free from criticism. In the context of economic instability and divergent social and economic dynamics of the regional development there is a need for adjustment of the methodology of indicative analysis, this effort is presented in this research.

3 Results

Studies to assess the level of energy security of the country and regions are conducted in several stages, the first of which is the analysis of possible threats to the energy system. These can be technical, natural or political and economic threats resulting from environmental or human activities that can cause disruptions in the supply of oil, gas, coal or electricity as well as sharp substantial increases in resource prices.

The next crucial task is to classify external and internal threats, actual and possible threats, determining the shape and intensity of each particular type of threat and the pace at which they reach the maximum acceptable level. The information obtained is quantified through the performance of energy supply and energy systems as well as by comparing their actual values with thresholds. Their aggregate presents an information base for justifying and making decisions on energy security in the region or in the country as a whole.

The essence of this phase is a comprehensive assessment of the level of energy security using integral quantitative and qualitative characteristics. Monitoring is carried out at all stages of the energy security assessment. This method can be described as a set of continuous monitoring and analysis of the processes that take place in the industry and affect the level of energy security. Monitoring as a method of analysis has a research purpose and objectives. In particular it is the detection of security threats, assessment of current and expected levels of energy security, gathering information to justify the vector of energy development, determining the directions of investment and innovation processes [11, 12]. The final stage of monitoring is an indicative analysis of the energy security on a country scale or regional level based on comparing the values of indicators with the thresholds set by the expert method. This is the basis of the indicative method as a classic version of the epistemological measures to study the phenomenon of energy security.

Serious defects in the regional energy supply haven’t yet happened; the fuel and energy complex manages to solve tactical and strategic problems of energy security of the region rather successfully. But the difficulty of forecasting energy development indicators remains so the transition to a dangerous state of crisis and a sharp decline in the level of energy security is not completely ruled out. If energy security management measures are not taken on time with full mobilization of domestic material, labour, raw materials and other resources, the situation in the region and the country as a whole can become significantly worse.

If the monitoring of energy security on a number of indicators shows that they are on a crisis level, it means that the region is exposed to external and internal threats to energy security and this requires their urgent neutralization and elimination. As a rule, the security system can’t be restored by itself and the process requires an outside interference. The set of the key indicators for monitoring the level of energy security proposed by the authors is quite various.

According to our calculations of the energy security level of the Kemerovo region (see Table 1.) it is possible to conclude that all indicators of energy security except a certain degree of depreciation of the fixed assets of the fuel and energy complex enterprises have acceptable pre-crisis values. Certain concerns are raised by the indicator of the share of own sources in the balance of the main types of petroleum products, which is connected to the
very small volumes of own production of this type of fuel combined with its high consumption. It is worth noting that the value of the dominant fuel resource in the consumption of boiler and furnace fuel, reflecting the specifics of the raw material base of the Kemerovo region that is the predominance of the coal industry is at the pre-crisis level.

Table 1. Assessment of the energy security of the Kemerovo region, 2018.

| Criteria/parameter of energy security | Index | Condition |
|--------------------------------------|-------|-----------|
| 1. The share of own resources in power energy balance | 69.3% | Pre-crisis |
| 2. The share of own sources in the balance of boiler and furnace fuel in the federal district as a whole | 317% | Pre-crisis |
| 3. The share of own sources in the balance of the main types of petroleum products in the federal district as a whole | 32.1% | Crisis |
| 4. The ratio of the available capacity of power plants as a whole in the zone of the combined power grid, which includes the region's power grid, to the maximum electric load | 81.2% | Pre-crisis |
| 5. The share of the dominant fuel resource in the consumption of boiler and furnace fuel | 61.7% | Pre-crisis |
| 6. The share of capacity of the largest power plant in the total capacity of power plants in general in the combined power system | 24.6% | Pre-crisis |
| 7. Average depreciation of fixed assets in enterprises related to the production and distribution of electricity and heat power | 51.8% | Crisis |
| 8. Average depreciation of the fixed assets in enterprises related to production, processing and allocation of fuel resources | 6.2% | Crisis |

A significant threat to the energy security of the region is observed in the high depreciation of the fixed assets of enterprises operating in the electricity sector, both in manufacturing and mining industries. Its value corresponds to the highest crisis threat level. Besides, among the negative trends we can name the energy capacity of the gross regional product of Kuzbass region which is three times higher than the national average.

This indicator can be used as an additional criterion for assessing the level of the energy security. Its advantage lies in the simplicity of calculation and comparability with the average Russian level. Efficiency in the use of resources including energy is becoming a crucial element of the economic development, innovation and management. This efficiency can be evaluated in a variety of ways from simple and more qualitatively focused to complex and multifaceted with taking into account different factors and their correlation. Today's level of computer modeling and calculations greatly expands the researcher's feasibility of study but can also mislead from the understanding real economic phenomena into the field of mathematics and virtual reality.

4 Discussion

According to our calculations the Kemerovo region can be characterized by a high level of energy security. In the crisis zone there are indicators such as the share of own sources in the balance of the main types of petroleum products, the degree of the fixed assets depreciation for the energy companies and enterprises involved in the mining, processing and allocation of fuel resources. According to the share of its own sources in the balance of electricity, Kuzbass region is in the pre-crisis zone with the disposable capacity of power plants and the capacity of the largest power plant, which determine the region’s energy
into the field of mathematics and virtual reality. Today's level of computer modeling and calculations greatly expands the researcher's complex and multifaceted with taking into account different factors and their correlation. Can be evaluated in a variety of ways from simple and more qualitatively focused to crucial element of the economic development, innovation and management. This efficiency average Russian level. Efficiency in the use of resources including energy is becoming a product of Kuzbass region which is three times higher than the national average. Manufacturing and mining industries. Its value corresponds to the highest crisis threat level. Depreciation of the fixed assets of enterprises operating in the electricity sector, both in plants and the capacity of the largest power plant, which determine the region's energy electricity, Kuzbass region is in the pre-crisis zone with the disposable capacity of power and allocation of fuel resources. According to the share of its own sources in the balance of the main types of petroleum products, the degree of the fixed assets depreciation for the energy companies and enterprises involved in the mining, processing the balance of the main types of petroleum products, the degree of the fixed assets energy security. In the crisis zone there are indicators such as the share of own sources in the balance of the whole...