Regional Priorities of the Eastern Energy Strategy of Russia: the Past, the Present, and an Outlook for the Future

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***Abstract* — The study elucidates key defining features of Russia's economic development in the new economic context that made it necessary to reconsider energy policy priorities. We present the initial conditions, targets, and strategic directions for development of the energy sector in the eastern regions of the country. The study highlights priority areas of energy cooperation in technological innovations between Russia and countries of Northeast Asia and lists prerequisites and initiatives needed for their successful implementation.**

Index Terms: **Eastern Siberia, Russian Far East, Northeast Asian countries, eastern energy policy, energy sector, energy cooperation, international cooperation in technological innovations.**

I. Introduction

The unique features of Russia's economic development under the changed economic conditions have necessitated a reconsideration of the priorities of its economic and energy policy that had been adopted earlier.

Russia's national interests require intensifying its mutually beneficial energy cooperation with China, Japan, South Korea, and other countries of East and Northeast Asia [1, 2]. This priority direction of the country's energy sector development is referred to as «The Eastern Vector of Russia's Energy Policy» in official documents [3, 4], the essence of which, in conceptual terms, can be summarized as follows:

- creation of new energy hubs in the East of the country will help increase the energy security of Russia, restore and strengthen broken fuel and energy links between regions, solve a number of important problems on federal and regional levels;
- creation of mature energy infrastructure in the East of Russia and in Northeast Asia in the form of cross-border gas and oil pipelines and power transmission lines will reduce energy costs, increase the reliability of energy and fuel supplies to consumers in different countries, and be instrumental in addressing environmental issues.

Russia's eastern energy policy, being a part of its economic policy, is not an end in itself but a tool for facing many fundamentally important challenges at the federal, cross-regional, and regional levels.

II. Methodology

The basis for the development of a regional energy strategy can be a system of interconnected models, allowing for the development of energy programs of individual regions. The Melentiev Energy Systems Institute (ESI SB RAS) has developed appropriate methods and approaches to set up such a system of models [5, 6]. The Energy Systems Institute as part of its activities on the justification of the Energy Strategy of Russia-2030 and at the request of the regional authorities completed a large series of studies on the justification of long-term directions of development of the energy sector of the country and its eastern regions and several federal subjects of the Russian Federation situated within their borders [14–19].

As part of the overall research scheme (see Fig. 1) we have developed methods, models, software and information support for a comprehensive study of the problems of development and implementation of energy policy of Russia.

The basic methods and models (systems of models) of this general scheme include:

- models or studying external energy markets, i.e., the energy markets of the Northeast Asian countries;
- methods and a model for studying and making projections of the country's energy sector;
- methods and models for studying regional energy sectors and systems.

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III. Key Issues in the Development of a Regional Energy Policy

To develop an energy strategy, it is necessary to consider and address properly a number of important objectives: social, economic, political, geopolitical as well those related energy.

Social objectives are about improving the comfort, style, and quality of life of the population of Russia's eastern regions Economic objectives are related to improving operating efficiency and competitiveness of the economic system of the East of Russia, increasing the level of resource availability of the country and accessibility of the interior of the country, expanding active economic space of Russia, creating preconditions for attracting foreign capital and advanced technologies. Political objectives are related to the consolidation and integration of the federal subjects of the Russian Federation, strengthening the unity of the country's economic and energy space. Geopolitical objectives are aimed at strengthening Russia's position in the world economic system and in the community of Central and Northeast Asian states.

Addressing energy-related issues enables improving energy security performance of the country and its regions and ensuring greater adaptability and reliability of energy and fuel supply to consumers. Improvement of the territorial and production structure of the country's energy sector and especially its eastern regions, as well as the establishment of transport and energy infrastructure in eastern Russia (systems of oil and gas pipelines, power transmission lines enables creating a unified transport and energy space in Russia.

The eastern regions of the country – Eastern Siberia and the Russian Far East – with their powerful economic and energy potential are an outpost in the realization of Russia's national interests in this strategically important region of the world.

At present, Russia has completed a complex and laborious stage of work on forming a large number of policy documents, determining the strategic development of the economy and energy in the East of the country to 2030, taking into account energy cooperation between Russia and the countries of Northeast Asia: «The Energy Strategy of Russia to 2030» [4], the Eastern Gas Program – «The program of creating in Eastern Siberia and the Far East of a unified system of gas production and transport as well as gas supply considering possible gas exports to the markets of China and other countries of Asia-Pacific Region» [8], «Strategy of socio-economic development of the Russian Far East and Baikal area to 2025» [9], «Strategy of socio-economic development of Siberia to 2020» [10], etc.

The strategy for the long-term development of the energy sector of Eastern Siberia and the Russian Far East assumed a number of initial conditions and targets, the key among which are the following two.

1. In the next 15–20 years Russia will not be able to face head-on the challenge of making a foray into the

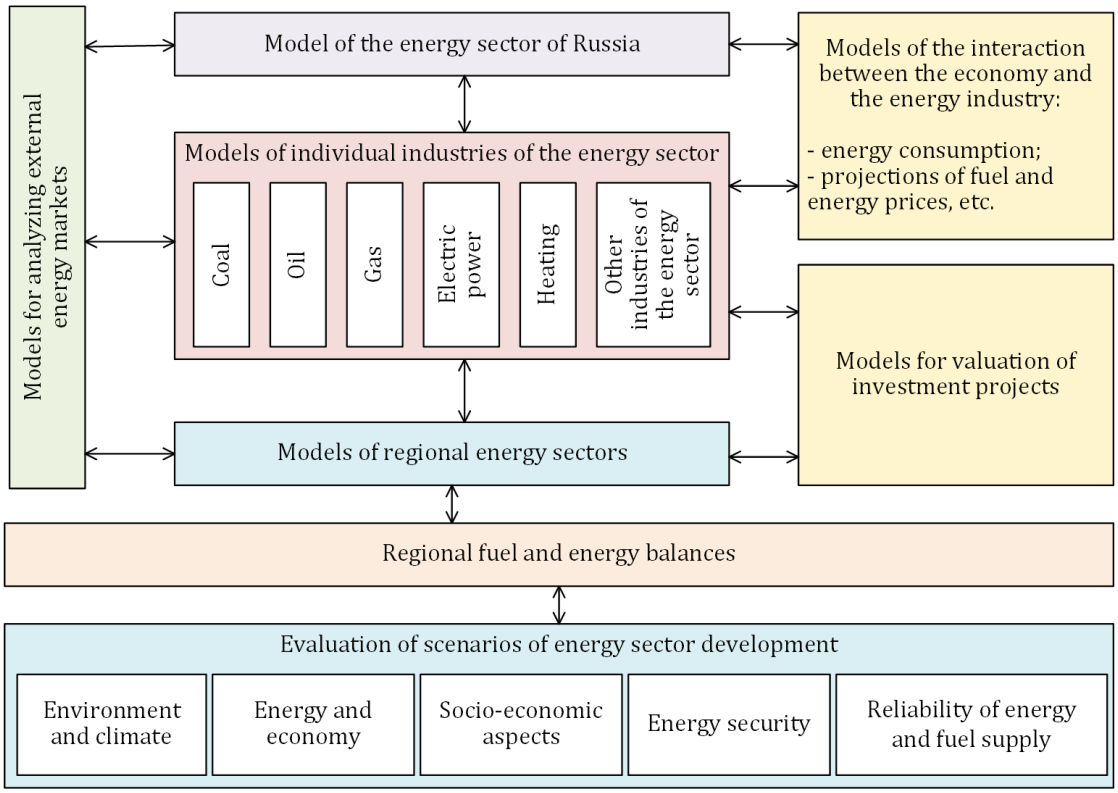

Fig. 1. The general scheme of hierarchical modeling of research on the development of the energy sector of the country and its regions.

undeveloped areas of Eastern Siberia and the Russian Far East. Therefore, the key is to preserve and strengthen the basis for future development.

This can be achieved by implementing the so-called strategic scenario of economic development of these regions. The strategic scenario of economic development of the eastern regions assumes that the economy of Russia and the eastern regions in qualitative and quantitative terms should approach the current average European level. At the same time, the economic growth rates in the regions under consideration should be above the Russian average. It is also envisaged to increase the share of these regions in the total population of the country.

2. Development of the energy industry in Eastern Siberia and the Russian Far East within the time frame under consideration will be focused not only on meeting its own demand for energy carriers but also on ensuring exports of Russian fuel and energy resources to energy markets of Northeast Asian countries.

Our analysis of the energy markets in China, South Korea, Japan, and other countries of Northeast and East Asia indicates that these countries have a niche for Russian energy resources, and Russia is ready to supply these countries with the following quantities of fuel and energy resources on mutually acceptable terms [4, 7, 11]: oil – from 69 mln tons in 2016 to 75–80 mln tons in 2030; natural gas – from 15 bln m^3 in 2016 to 50–60 bln m^3; coal – from 70 mln tons in 2016 to 75–85 mln tons; electric power – from 3.6 bln kWh in 2016 to 45–50 bln kWh.

In the context of new global and regional challenges, it is fundamentally important for Russia to pursue an active policy on technological innovations in its cooperation with the Northeast Asian countries in addition to trade in energy resources.

IV. Priority Areas of Energy Cooperation in Technological Innovations Between Russia and the Northeast Asian Countries

Russia's participation in the creation and joint management of *new oil and gas-chemical clusters* requires consideration of the following factors.

1. Currently, in Russia at all levels we are clearly aware of the need to supply international markets not only with mineral resources but also with its elaborately processed products with high added value. To this end, it is proposed to increase the production of petroleum products in the eastern regions of Russia, to create new industries for them to specialize in: oil-, gas-chemical industries, the demand for the products of which in Russia, globally, and in Northeast Asia is large enough. In the future, Russia could become the largest net exporter of polymer products in the region.

2. It is known that the oil and gas fields of the Siberian platform are unique for their helium and ethane content. For example, natural gas from Siberian platform fields contains 0.3–0.5% helium and 4.6–7.2% ethane. Helium reserves (categories C1+C2) of the Siberian platform are estimated at 8.5 bln m^3, or approximately 30% of the world's reserves. In the long term, Russia could become the largest exporter of helium.

The Ministry of Energy of Russia worked out the Plan of oil- and gas-chemical development in Russia to 2030, which was approved by the government commission on the energy sector on December 28, 2011, and its elaboration (Stage II) [12] was approved by Order No. 79 of the Ministry of Energy of Russia of March 01, 2012. The Plan provides for the creation of six new oil- and gas-chemical clusters in Russia by 2030:

- Northwestern;
- Caspian;
- Volga;
- West Siberian;
- East Siberian;
- Far Eastern.

Russia is interested in fruitful cooperation with foreign companies to form new oil and gas chemical clusters in the East of the country and to have joint sales of produced polymer products in Russian and foreign markets.

Russia's participation in the formation of cross-border power interconnections in Northeast Asia involves cross-border integration and cooperation in the area of electric power and is one of the components of Russia's Eastern Energy Strategy. This cooperation presupposes the development of cross-border electric power connections of eastern regions of Russia with «neighboring» countries: Mongolia, China, Japan, North and South Korea. What it involves is the possible parallel operation of the power systems of Eastern Russia (Eastern Siberia and the Russian Far East), Mongolia, the People's Republic of China, North and South Korea, and Japan. The area covered by such a cross-border power super-interconnection could include various types of power plants (thermal, hydro, nuclear, wind, etc.) with a total installed capacity of more than 500 million kW.

Eastern Siberia and the Russian Far East have built a major power base for the country: over 20% of the capacity of all Russian power plants is installed in these regions. The electric power export potential of the eastern regions that can be quickly deployed, according to various estimates, is 10–15 million kW, including 6–7 million kW in Eastern Siberia and 4–8 million kW in the Russian Far East.

Our calculations are supportive of the claim that reconstruction of existing power plants, completion of construction projects of power plants that are currently in progress, and commissioning of new power plants scheduled for construction in the near future in Eastern Siberia alone will allow for a large surplus of electricity (according to various estimates, from 30 to 40 billion kWh). This amount of electricity can be delivered via high-voltage power transmission lines both to the southeast (Mongolia, China) and to the Russian Far East. The construction of a high-voltage power transmission line between Eastern Siberia

and the Russian Far East will enable the IPSs (integrated power systems) of Siberia and the Russian Far East to operate in parallel, which will improve the reliability of power supply to consumers in these regions and create the necessary preconditions for the formation of the Eastern Wing of the global electric power system [13, 14].

At present Russian companies are investigating the possibility of joint construction in Russia, in cooperation with foreign companies, of export-oriented power plants and high-voltage power lines for large-scale electricity exports (in the amount of 60–70 billion kWh) from the eastern regions of Russia to the People's Republic of China, 20–25 billion kWh to the Republic of Korea, and 25–30 billion kWh to Japan. Russia and China can actively and fruitfully cooperate with Mongolia to form the cross-border Russia-Mongolia-China electric power system [15].

Russian electric utilities along with research and design institutes are actively involved in developing the concept of forming the Asian Super Grid [16].

Russia can actively and effectively cooperate with Mongolia in forming the Gobitec and using the potential of solar and wind power to create the Asian Super Grid.

Cooperation on innovative technologies in the coal sector is related to joint projects on integrated and involved processing of lignites and the creation of a new industry for the differentiation of the East of Russia in the form of coal-chemical production clusters.

The reserves of lignites in Eastern Siberia and the Russian Far East amount to more than 85 billion tons [17]. The largest lignite deposits include:

- deposits of the Kansk-Achinsk Basin in the Krasnoyarsk territory;
- Svobodninskoye and Sergeevskoye deposits in the Amur region;
- Kangalasskoye deposit in the Republic of Sakha (Yakutia);
- Ushumskoye deposit in the Jewish autonomous region;
- Mukhinskoye deposit in the Khabarovsk territory;
- Solntsevskoye deposit in the Sakhalin region.

Given the relatively low costs of coal production, it makes sense to organize joint ventures with foreign companies for comprehensive advanced processing of lignited on the basis of these deposits.

Products of advanced processing of coal (primarily motor fuel) can be supplied to Russian and foreign consumers.

Cooperation in securing *a reliable energy supply to isolated and remote consumers* in Russia's eastern regions through the construction of facilities that use renewable energy sources is also a promising area to be addressed by the regional energy policy. The draft of the Energy Strategy of Russia-2035 [18] provided during this period for a large-scale adoption of renewables (RES): it predicted an increase in the penetration of RES into total electricity generation from the current 0.2% to 3% in 2035. This is especially important for the economy of the eastern regions.

The use of renewable energy sources (mini-HPPs, geothermal power plants, solar and wind power plants) is a strategic priority for the development of the energy sector in the northern and remote communities of the East of Russia.

Total RES capacity additions in the areas of decentralized and unstable power supply in the eastern regions of the Russian Federation to 2035 are estimated at 600–870 MW under the baseline and moderately optimistic scenarios, respectively [19]. The largest share of the capacity of renewable energy sources commissioned in Eastern Siberia is accounted for by solar power plants (287–318 MW). In the regions of the Russian Far East, wind farms (84–155 MW) account for the great bulk in the mix of capacity additions. The total installed capacity of RES in the eastern regions by 2035 will increase 5.5–7.5 times and will reach 727–1,000 MW, of which 335–385 MW is solar power plants, and 100–210 MW is wind farms.

The most promising for the development of wind power in the East of Russia are the Kamchatka territory, Kuril Islands of the Sakhalin region, Arctic coast of the Krasnoyarsk territory and the Republic of Sakha (Yakutia), the eastern part of the Magadan region, Khabarovsk and Primorsky territories, and the north-east of the Chukotka autonomous district.

Priority areas for the development of solar power are the republics of Buryatia, Tyva, Khakassia, Sakha (Yakutia), Transbaikal territory, southern areas of Irkutsk and Amur regions.

We can expect fruitful cooperation with foreign companies in the construction of renewable energy sources and the creation of joint ventures in Russia's eastern regions.

Examples of such cooperation are joint projects with the Japanese companies Komichaltes Inc. and MITSUI & CO., LTD. for the construction of wind farms in the urban locality of Ust-Kamchatsk, Kamchatka territory, and the urban locality of Tiksi, Republic of Sakha (Yakutia).

V. Conclusion

Key takeaways from the research conducted to identify the regional priorities of Russia's Eastern energy strategy, both at present and in the future, are as follows:

1. The implementation of Russia's Eastern Energy Strategy is a very complex issue. Its complexity is due to its comprehensive nature as well as that it is implemented on a vast territory and involves a large number of Russian and foreign participants. Furthermore, program activities (especially cross-border fuel and energy projects) are very capital-intensive, and their implementation presupposes close international energy cooperation of countries at the federal (state), regional, and cross-regional levels.

2. The time is ripe to develop a strategy (roadmap) for energy cooperation between Russia and the countries

of Northeast Asia. Such a strategy, being backed by solid research data, should make clear what are the sequence of development of fuel and energy resources, the sequence and timing of their supply to their own consumers, the volume of exports/imports. It should also assess the socio-economic and other consequences of specific cross-border projects not only for individual companies but also for regions and the country as a whole.

3. To promote mutually beneficial forms of energy cooperation between Russia and the NEA countries, at the very least the following five conditions are to be met:

1) There must be a political will and a seriousness of intention on the part of the participants to implement a specific energy project that is mutually beneficial to each of the countries involved.

2) The economic and energy policies of central and regional authorities and businesses of the countries must be aligned during the formation of international projects in the field of energy.

3) A comprehensive, systematic assessment of the consequences (effects) for countries, regions, and energy companies resulting from the implementation of large international energy projects (especially so under great uncertainty of future development, economic risks, and global challenges) have to be carried out.

4) Mutually acceptable mechanisms for implementing international energy projects (organizational, economic, legal, and other mechanisms) have to be developed.

5) Projects that are international in their nature should be developed and implemented by an international team (at all stages: from the feasibility study and design work to their practical implementation).

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