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Innovative and Technological Development of the Fuel and Energy Complex of the Russian Arctic

Aleksandr N. Zakharov^{1✉}, Dr. Sci. (Econ.), Professor

Aleksandra A. Karpova², Student

^{1,2} Russian Foreign Trade Academy, Ministry of Economic Development, Vorobyevskoe shosse, 6A, Moscow, Russia

¹ azakharov@vavt.ru ✉, ORCID: <https://orcid.org/0000-0002-4400-7867>

² 1562sasha@mail.ru, ORCID: <https://orcid.org/0009-0005-0228-3432>

Abstract. The article discusses the process of development of the Arctic zone of Russia, in particular, in the energy and oil and gas industries. Particular attention is paid to the fact that comprehensive development of the Arctic is currently one of the strategic priorities of the state. As a measure to increase the attractiveness of this region for entrepreneurs, investments and innovations, a decision was made to create a special economic regime in the Arctic zone, which is already proving to be effective. The development of the Arctic is impossible without the active introduction of innovations and technologies adapted to specific natural and geographical conditions. Russian companies play a key role in this process, and cooperation with friendly countries such as China opens up new opportunities for solving common tasks and achieving mutual goals. The main areas of such cooperation are the development of trade in energy resources and the expansion of scientific and research cooperation, which ultimately contributes to more effective development of the Arctic region. The article also touches on the development of the Northern Sea Route logistics corridor, its infrastructure and its role in delivering resources from the Arctic to Asia. Examples of successful projects such as Yamal LNG and Arctic LNG-2, Prirazlomnaya and Kola wind farms are considered. In general, the article provides an overview of the current state of development of the Russian Arctic zone in terms of innovative development and its further prosperity.

Keywords: Arctic, Russia, energy, innovation, technology, oil and gas industry, Northern Sea Route, China, liquefied natural gas, development

Introduction

According to the Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035, a list of measures aimed at developing the fuel and energy complex and the innovative technological advancement of the Arctic was outlined in 2020. This is necessary to ensure that the development of such a remote and climatically harsh region with unique potential keeps pace with the times and corresponds to both Russia's internal needs and global trends. Among these measures, special attention should be paid to the introduction of a special economic regime in the Arctic zone, which will facilitate the transition to a closed-loop economy in the region. Current and planned geological exploration work requires private investments. The Russian Arctic has

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significant potential for the development of innovative industries and the creation of new industrial production facilities. The region's rich natural resources can be used to stimulate economic growth and improve the lives of the population if the necessary conditions are created for the effective development of oil and gas fields, the extraction of solid minerals and hard-to-reach hydrocarbon reserves, which will allow the region's potential to be maximized. It is important to expand oil refining and product manufacturing capacity, to maintain and increase the production of liquefied natural gas and gas chemical products¹. The implementation of these ambitious goals and new economic projects is only possible with adequate state support in areas such as technology development, stimulating the use of Russian-made industrial products, and maintaining cooperation with Arctic states in order to protect national interests and achieve the best results through synergy. This article will examine projects that ensure the implementation of these measures, as well as the prospects for Russia's Arctic regions.

Advanced Social and Economic Development Area "Capital of the Arctic"

The Arctic has relatively recently become part of the Advanced Social and Economic Development Areas (ASEDA) project in the Russian Federation. In December 2019, a draft resolution was developed to establish an ASEDA in the Murmansk Oblast to implement the program for the construction of a center for large-tonnage marine structures². NOVATEK's project to create a center for the construction of large-tonnage marine structures near Murmansk began in 2015. The plan was to create a line for the production, storage and shipment of liquefied natural gas, as well as for the repair and maintenance of equipment for Arctic oil and gas condensate fields.

In 2019, an important document was adopted that defined a new direction for the development of the Arctic and the Far East. According to this document, the Ministry of the Russian Federation for the Development of the Far East was renamed the Ministry of the Russian Federation for the Development of the Far East and the Arctic, and received new powers for the development of the Arctic region. In early 2020, a proposal was made to create a special economic zone, "Capital of the Arctic", in Murmansk. This became the ministry's first project implemented outside the Far East. A few months later, in April 2020, the Far East Development Corporation received the first applications from five companies that wanted to become residents of this ASEDA and build their businesses under the new conditions³.

Today, the region's entrepreneurial appeal is growing, and people are paying more and more attention to the potential inherent of the harsh, yet beautiful and rich Arctic environment.

¹ Decree of the President of the Russian Federation "On the Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035" dated October 26, 2020 No. 645. URL: <http://www.kremlin.ru/acts/bank/45972> (accessed 11 December 2024).

² The Cabinet of Ministers approved the creation of the "Capital of the Arctic" advanced development area in Murmansk. URL: <https://tass.ru/ekonomika/8459241> (accessed 20 January 2024).

³ Resolution of the Government of the Russian Federation No. 656 "On the creation of the area of advanced social and economic development "Capital of the Arctic" dated May 12, 2020. URL: <http://government.ru/docs/all/127875/> (accessed 13 September 2023).

New ideas and projects are emerging, created specifically with the characteristics and advantages that the North offers today. Innovative projects in the Arctic, specifically focused on fuel and energy development, are enabling the development of hard-to-reach deposits, reducing the risk of oil spills and leaks, and combating the negative impact of industry on the environment. This is undoubtedly in line with the main principle of Russia's chairmanship of the Arctic Council in 2021–2023 and the current values of our state: “responsible management for the sustainable development of the Arctic”. Technological innovations are being developed and are already being used in a wide range of areas within the energy sector. “They cover areas such as generation, transportation, conversion, diagnostics, management, automation and digitalization. The decisive condition for the development of the industry in accordance with modern requirements and, in particular, the unique requirements of the Arctic is the level of implementation of research and development (R&D) and the level of scientific and technological progress (STP),” note V.I. Salygin and S.S. Vopilovskiy in their research [1; 2]. The Russian energy sector has entered a new phase of its development, characterized by a rapid pace of modernization through the introduction of advanced technologies that support Russia's status as a global leader. This allows the industry not only to respond more effectively to the needs and expectations of the population, including concerns about energy security in the medium and long term, the rational use of energy resources and risk minimization, but also to regulate the instruments for responding to global processes.

Practical examples of successful innovation and technology projects

Let us consider examples of how leaders in the Russian oil, gas and energy industry are actively involved in the modernization of the Arctic zone and contributing to its innovative development. “In St. Petersburg, PJSC Gazprom Neft opened a Production Control Center at the Prirazlomnaya oil platform on the Russian Arctic shelf. This is the only and unique hydrocarbon production project operating in Russia on the Arctic shelf, possessing the appropriate environmental characteristics,” notes S.S. Vopilovskiy, Candidate of Economic Sciences, in his article. “Digital technologies and IT tools enable round-the-clock monitoring of key stages of oil production and shipment, control of equipment condition, and tracking of vessel movements taking into account ice conditions, which ultimately increases the speed and efficiency of decision-making for platform management in the Barents Sea. The main facility for the field's development is the Prirazlomnaya offshore ice-resistant oil production platform, which was created specifically for the development of the field of the same name. It handles all technological operations: drilling, production, oil storage, preparation, and shipment of finished products” [2]. S.S. Vopilovskiy also notes that “the characteristics and specific features of the Arctic region were taken into account when designing the Prirazlomnaya platform. It is designed for operation in extreme natural and climatic conditions and is capable of withstanding maximum ice loads. Furthermore, the equipment installed at the wells is aimed at preventing the possibility of uncontrolled oil or gas spills. The loading line for pumping oil to the tanker has an emergency shutdown and closure system that activates instantly.”

[2] The Pirazlomnaya ice-resistant fixed offshore platform is equipped with a modern monitoring system, which includes more than 60 sensors. These sensors provide continuous monitoring of the equipment's condition and respond immediately to any deviations from normal operating conditions. As a result of the operation of this platform, it was possible to extract a new type of oil called ARCO (Arctic Oil), which is a unique product obtained as a result of work on the Arctic shelf.

It should also be noted that in Russia's Arctic zone, the priority is given to environmentally safe projects that primarily use clean energy with zero greenhouse gas emissions, such as wind energy projects. The Russian Federation calls on the international academic community to cooperate in the implementation of Arctic scientific and industrial programs. Cooperation with the BRICS countries serves as an example the implementation of such programs. Plans include active participation in the construction of an Arctic cargo fleet and cargo terminals in the ports of Murmansk and Arkhangelsk [3]. In August 2024, at the Moscow Forum on the Climate Agenda, the BRICS countries adopted a framework program on climate and sustainable development, which will enable the countries of the association to identify measures to combat climate change without compromising the economic well-being of their states [4].

Let us consider the following example of the practical implementation of green energy projects. In December 2022, the first phase of the Kola Wind Power Plant was launched in the Murmansk Oblast. It is the largest wind farm in Russia and has unique properties that enable it to operate in harsh natural conditions. According to data from the PJSC EL5-Energo portal, 57 wind turbines are located on a 257-hectare site, generating electricity. A power line approximately 70 km long was built to integrate the station into Russia's Unified Energy System. The wind turbine blades are equipped with special systems that automatically stop their rotation if there is a risk of icing. The project is being implemented by PJSC Enel Russia, with more than 65% of the equipment and work carried out by domestic factories and companies [2]. It is important to note that Russia is relying on its own resources in its development, and the Arctic is now an environment where innovative domestic solutions are needed more than ever.

There is no doubt that it is extremely difficult to ensure sustainable development in the Arctic if only one state is involved. This applies not only to the preservation of natural diversity and the prevention of global warming, but also to the accumulation of forces to realize the region's economic and logistical potential. International partnership is especially essential when cooperation is required to prevent emergencies. This means constantly sharing experience and technology to analyze the situation, predict unexpected changes, and deal with the consequences. In this regard, Russia prioritizes maintaining friendly relations with the leading economies of the Eastern world, in particular China, in order to create innovative competencies and technologies and apply them in practice [5]. "China, despite not being an Arctic state, plays a key role in the development of the Arctic region, which is determined by its economic and political goals. As the world's second-largest economy, China seeks to gain a foothold in this strategically important region," writes Li Yonghui. In his article, he also draws attention to the fact that "China is showing increasing in-

terest in liquefied natural gas. For China, Arctic mineral resources are a key factor in diversifying the geographical structure of its energy imports.” The largest joint projects in this area belong to NOVATEK, namely the Yamal LNG and Arctic LNG 2 liquefied natural gas production and transportation complexes. These projects represent a striking example of innovative cooperation between Russia and China in the Arctic region in the energy sector. According to the Neftegaz.RU news agency, the rich resource base of the Yamal and Gydan peninsulas allows for the construction of new plants with a total production capacity of up to 50–80 million tons of LNG per year⁴. “The Yamal LNG project was largely implemented with the support of Chinese investment. Chinese companies made a significant contribution to the project, providing up to 60% of the required capital and up to 80% of the equipment, manufactured at Chinese shipyards. Furthermore, 20% of the project’s shares are owned by CNODC, and 9.9% — by the Silk Road Fund. China has become the largest foreign investor in the Yamal LNG project. It is also noted that the plant’s design capacity is 17.4 million tons per year, with CNPC contracted for 3 million tons per year, or approximately 20%.”⁵

Thus, despite its significant remoteness from the center and harsh conditions, the Arctic attracts Chinese companies interested in creating promising enterprises and establishing cooperation in energy resource extraction. China’s technological capabilities, combined with the natural resources of the Russian Arctic and the desire of domestic companies to build long-term cooperation, form the basis of existing and planned projects. China characterizes the relationship with the Russian Federation as “supporting healthy and stable development”, which, together with the desire to expand external investment within the framework of the “One Belt, One Road” initiative, creates a solid foundation for future joint Arctic projects, which will primarily serve as examples of effective capital and research and development integration capable of revitalizing this cold and harsh region [6].

Taking into account the above facts, it is worth noting the role of the Northern Sea Route, which harmoniously complements projects such as Yamal LNG and Arctic LNG 2, as it is the route through which Arctic resources are increasingly being transported to Asia. Rosatom State Corporation’s strategic goal is to transform the Northern Sea Route into an efficient transport artery connecting Europe, Russia, and the Asia-Pacific region. According to information presented in V.F. Pryakhin’s article, “a federal project for the development of the “Great” Northern Sea Route is currently being elaborated, involving the creation of a transport corridor from St. Petersburg and Kaliningrad to Vladivostok”. As part of the development of sustainable shipping along the Northern Sea Route and the Polar Silk Road, China has identified three main areas of activity: Arctic research to enhance navigation experience and understand the characteristics of these seas, China’s

⁴ Russia and China in the Arctic: Cooperation, Rivalry, and Implications for Eurasian Security. URL: https://russiancouncil.ru/analytics-and-comments/comments/rossiya-i-kitay-v-arktike-sotrudnichestvo-sopernichestvo-i-posledstviya-dlya-evraziyskoy-bezopasnost/?sphrase_id=35909425 (accessed 28 November 2024).

⁵ Spivak V., Gabuev A. Ice Age: Energy Cooperation between Russia and China in the Arctic. URL: <https://carnegiemoscow.org/2021/12/27/ru-pub-86088> (accessed 04 June 2023).

participation in Arctic shipping management (e.g., in the International Maritime Organization), and the pursuit of a balance between the economic and climatic components of shipping. In 2015, the Russian Ministry for the Development of the Far East and Arctic and the National Development and Reform Commission of the People's Republic of China signed a cooperation agreement on the Northern Sea Route. In 2019, an agreement was signed between NOVATEK, China COSCO SHIPPING Corporation Limited, Sovcomflot, and the Silk Road Fund to establish the Maritime Arctic Transport enterprise [7]. The company's activities are aimed at creating ice-class tankers and ensuring safe year-round transportation of LNG from the Yamal LNG, Arctic LNG 2, and other ongoing NOVATEK projects, as reported on the portal of Russian Council on International Affairs⁶.

According to Rosatom, transit via the Northern Sea Route reached record levels in 2023, with oil being the main cargo, amounting to approximately 1.5 million tons. It is evident that summer navigation brings additional economic benefits from shipments via the Northern Sea Route compared to shipments via the Suez Canal. Furthermore, in 2023, Novatek, the main shareholder of Yamal LNG, delivered approximately 32 cargoes of liquefied natural gas to Asia via the Northern Sea Route, accounting for more than half of the total cargo flow of 36 million tons [8].

Deliveries to Asia via this route can be made not only by Novatek, but also under long-term contracts with other project shareholders, such as China's CNPC and SRF. The Northern Sea Route is also the most cost-effective route for shipping LNG from Yamal LNG to Asia, reducing delivery time to three weeks compared to the traditional five-week route around Europe.

Conclusion

The development of Russia's Arctic zone is a key strategic priority for the state. In order to achieve the goals set, it is necessary to increase the volume of cargo transportation along the Northern Sea Route. This can be ensured by establishing regular routes, building new nuclear-powered icebreakers, and modernizing the infrastructure supporting this logistics corridor. Undoubtedly, human resources are fundamental to securing and developing all stages of energy resource extraction, processing and transportation, and attracting them to such a harsh region is another strategic challenge. Therefore, innovations are primarily being introduced in the area of living and working conditions, since before building new advanced technological enterprises, it is necessary to prepare and attract highly qualified personnel to the region and provide comfortable conditions for the "creative process" of developing innovations and unique solutions. Although the oil and gas industry itself can be characterized as fairly traditional, when it comes to the Russian Arctic, the innovative aspect lies precisely in ensuring that such well-established processes are carried out in harsh climatic and landscape conditions at the usual competitive speed and with the required quality. Ensuring the year-round operation of the Northern Sea Route in the future is im-

⁶ White paper: China's Arctic Policy: Jan. 26, 2018. *The State Council Information Office of the People's Republic of China*. URL: http://english.www.gov.cn/archive/white_paper/2018/01/26/content_281476026660336.htm (accessed 02 June 2023).

possible without the continuous improvement of the icebreaker fleet through domestic technologies and cooperation with specialists from friendly countries.

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