

Global challenges and opportunities for Arctic oil and gas projects

Alexey Cherepovitsyn¹, Evgeniya Rutenko^{2,*} and Sergey Yudin³

¹ Doctor of Economic Sciences, Professor, St. Petersburg Mining University, 199106, St. Petersburg, Russian Federation

² Postgraduate, St. Petersburg Mining University, 199106, St. Petersburg, Russian Federation

³ First Deputy, VIS Group, 121096, Moscow, Russian Federation

Candidate, St. Petersburg Mining University, 199106, St. Petersburg, Russian Federation

Abstract. Integrated development of hydrocarbon potential is one of the high-priority tasks of the government of Russia policy in the Arctic region. When determining the prospects of oil and gas projects, it may be necessary to envisage ways of responding to large-scale changes in the global energy system, which significantly affect the timing, commercial and budgetary efficiency of project activities in the Arctic. The high level of turbulence creates new challenges for the Russian and global oil and gas complex associated with the strengthening of competition in traditional markets of hydrocarbon resources, the progressive development of technological innovation, and changes in the price environment. The main direction of development of the Arctic oil and gas sector should be quick adaptation to new conditions, reassessment of strategic planning systems of key market players, as well as a targeted state policy in relation to the formation of a favorable investment climate and flexible taxation system in the region. For the purpose of the study, an analysis of the factors of instability of the global energy system and their influence on the efficiency of operation of arctic hydrocarbon fields is conducted. The characteristics of the main directions of government policy in the Arctic zone, stimulating the production of hydrocarbons, are given. The potential limitations and opportunities for the implementation of oil and gas projects resulting from the transformation of the global raw materials market are identified and systematized.

1 Introduction

In the long term, the geostrategic interests of the Russian Federation are associated with the unique mineral resource base and economic potential of the Arctic zone, the development of which is important for the effective growth of the country's economy, as well as for ensuring national security and state sovereignty. production of hydrocarbons in the Arctic zone will play an important role in the energy balance of Russia, being the basis for replacing the declining production at existing fields over the time horizon of 2035. In particular, the Arctic shelf can become the main source of oil and gas resources in the future both for Russia and for the world market as a whole [1].

The Russian sector contains about 41% of the world's Arctic oil reserves and 70% of gas reserves [2]. At the same time, the undiscovered potential is 91% on the shelf and 53% on land. While more than 350 oil and gas fields have been discovered in the inland zone of the Russian Arctic, there are about 30 on the Arctic shelf [3], [4].

The main onshore oil and gas reserves are confined to the Yamalo-Nenets Autonomous District. Good geological knowledge, close location to the existing transport infrastructure makes it possible to produce

almost 6% of Russian oil, 77% of gas condensate and 81% of natural gas in the region [5]. In addition, the oil producing complex of the Nenets Autonomous District, gas fields of the Krasnoyarsk Krai and the Republic of Sakha (Yakutia) have high production potential [4, 6].

The development of offshore oil and gas fields is at an early stage, however, by 2050, the Arctic shelf, whose reserves are estimated at more than \$20 trillion, will provide about 20%-30% of Russian production [6]. At the moment, more than 20 large oil and gas-bearing basins have been identified here. At the same time, hydrocarbon resources are distributed unevenly over the sea territories, and most of them fall on the western Arctic shelf (Kara, Pechora and Barents Seas), which can rightfully be considered a strategic reserve of the oil and gas complex of Russia [2], [7].

Today, the implementation of Arctic oil and gas projects is carried out in the conditions of global instability in the world energy market and structural reorganization of the oil and gas complex. Significant changes are taking place in the energy policy of countries with an emphasis on solving environmental problems and intensifying the use of energy-saving and resource-saving technologies. New key players emerge to begin to compete for traditional markets. Renewable energy sources significantly increase their share in the

* Corresponding author: evgewe@mail.ru

global energy balance [8]. The liquefied natural gas (LNG) market is expanding [9]. There are significant fluctuations in the supply and demand for energy resources, as well as in the price environment. The COVID-19 pandemic is changing the course of the global economy and the prospects of the oil and gas industry. In addition, the efficiency of the oil and gas fields exploitation is currently directly related to the transition to a new technological structure and the introduction of advanced technological solutions, including digital [10].

When developing Arctic oil and gas resources, special attention should be paid to environmental safety. Large-scale development of hydrocarbons, an increase in trans-Arctic traffic have a significant negative impact on the unique natural systems of the Far North. Consistent reduction of the impact on the environment, organization of environmentally friendly production and introduction of the best world practices in the field of environmental safety, compliance with environmental requirements in the extraction and transportation of resources are the targets of oil and gas companies. Climate change is also one of the major global challenges. The climate agenda requires players in the oil and gas market to reduce greenhouse gas emissions and expand the use of renewable energy in production activities. If no decisive action is taken today, subsequent adaptation to climate change will require significantly more effort and costs.

With such turbulence in the global oil and gas industry, the consolidation of efforts of the Russian government and Russian oil and gas companies indicates a disinclination to give up the implementation of complex projects in the Arctic region. It is important to assess and use the opportunities that large-scale market changes provide, as well as to develop measures to minimize the negative consequences of the transformation of the global energy system.

2 Trends in the global oil and gas sector

2.1 Strengthening the US position in the global oil and gas market

Over the past few years, the United States has demonstrated the largest steady growth in hydrocarbon production in the history of the market. to a significant expansion of the mineral resource base allowed for development. Not only has this changed the proportions of the market and the mechanism for setting prices for resources, but also intensified competition for traditional and promising sales markets for Russia. Thus, in 2012, due to an increase in production and a decrease in import of natural gas to the United States due to the "shale revolution", the adoption of an investment decision on the largest gas condensate field in the Russian Arctic – Shtokmanovskoye field - was postponed. global shocks in the oil and gas sector has negatively impacted the US shale segment in 2020. The annual long-term forecast of the World Energy Outlook (WEO) International Energy Agency (IEA) predicts a sharp decline in investments

and production volumes for this industry [11]. Nevertheless, the United States remains a key player in the global hydrocarbon production market.

2.2 Expansion of the LNG market

The leading trend in recent years has been the large-scale expansion of the global market for liquefied natural gas. In 2019, Russia became one of the five largest market players, and the Russian Arctic zone has become an important center for LNG production [12]. According to the plans of the Ministry of Energy, the share of Russia in the world market of liquefied gas will increase from the current 4% to 15%-20% by 2035 [13]. At the same time, other large players enter the global LNG market, acting as objective competitors of Russian Arctic projects in the sales markets. For example, Australia and Canada have big plans to increase their LNG production capacities. There are forecasts that by 2035 the US will rank first in LNG production, overtaking Russia, Qatar and Australia [11, 14].

2.3 Updating environmental protection issues

Currently, the structure of global oil and gas consumption is changing significantly under the influence of trends of decarbonization and the struggle for the use of environmentally friendly fuels from renewable energy sources [15, 16]. Thus, the share of renewable energy in electricity generation in Europe in 2020 exceeded the share of fossil fuels for the first time in history; Asia-Pacific Region (APR) plans to increase renewable energy capacity by 50% by 2025; renewable energy by capacity will overtake gas-fired power plants in the United States by 2040. Due to a wide range of government support measures, total investment in global renewable energy industry over the past 15 years has exceeded \$4 trillion [11, 14]. The ambitions of many countries to achieve climate neutrality increase the likelihood of introducing a carbon tax on fossil fuel imports in the coming years [17, 18, 19]. Although hydrocarbon fuels are not expected to be completely abandoned in the near future, the development of renewable energy sources can have a significant impact on the implementation of Arctic oil and gas projects focused primarily on export.

2.4 Decrease in global demand for hydrocarbons

According to the results of 2020, the global oil sector suffered more than the global economy as a whole. The world consumption of liquid hydrocarbons decreased by 8-12%, and world GDP – by 5-6% [11, 20]. The decline in oil consumption may be sustainable in the long term, for example, in May 2020, the heads of Royal Dutch Shell and BP declared that global demand may never recover to pre-crisis levels, meaning that peak oil demand has already been reached in 2019 [20]. In this regard, the top scenario of the Energy Strategy of the

Russian Federation until 2035, adopted in June 2020, implies not an increase in oil production, but rather maintaining values at the level of 2018 (555 million tons). The lower scenario implies a decline in production by 11.8% to 490 million tons [13]. The global natural gas market is undergoing negative changes as well. After a significant increase of 5.3% in 2018, global gas demand grew by 1.8% in 2019 and decreased by about 3% in 2020 [20]. This is a revolutionary turnaround in an industry oriented to dynamic growth. According to IEA's forecasts, demand for natural gas will continue to grow at 1.2% per year during the period of 2030-2040 [11], which is slightly lower than pre-crisis forecasts, since gas faces increasing competition from renewable energy sources, which are becoming more competitive in terms of the cost.

2.5 Changes in the price environment for hydrocarbon raw materials

The largest collapse in global oil prices in 2020 was triggered both by outbreak of the COVID-19 affair earlier that year and price wars of the key players. In April 2020, the price fell to an all-time low of \$ 8.48 per barrel in 1998. The IEA predicts an increase in oil prices to \$ 0 per barrel by 2025 and to \$75 by 2030 [11]. A drastic decline in resource prices will adversely affect the launch and implementation of Russian Arctic oil and gas projects, which have high economic and environmental risks [21]. For most fields, the low price combined with high costs will make production unprofitable, even though the presence of fiscal preferences. significant price increases are not expected; this is due to the fact that major producers of conventional oil will act in such a way as to prevent prices from rising to a level that would provoke either a rapid increase in shale production in the United States, or a faster shift of consumers towards other energy sources.

2.6 Decrease in investment to the oil and gas sector

The decline in global demand for hydrocarbons and price volatility increase uncertainty and risks for investors and have an adverse impact on the level of investment attractiveness of the oil and gas industry [22]. According to IEA estimates, spending on hydrocarbons decreased by USD 1 trillion in 2020, which is equivalent to a decrease in market size by about 28%-30%. As a result, by the end of 2020, global investments in the oil and gas sector decreased by 30%-35%. By 2030, against the background of an increase in oil prices to \$75 per barrel, investments will start to recover [11]. At the same time, it is expected that the bulk of capital investments will be directed to compensate for the decline in production at the existing fields.

2.7 Development of technologies, digitalization of the mineral and raw materials sector

Hydrocarbon production in the Russian Federation is an area that today is difficult to provide exclusively with domestic technologies today. Moreover, the Arctic region and its extreme climatic conditions impose increased requirements for oil and gas equipment [23]. Currently, Russian subsoil users have a shortage of environmental and commercially viable technological solutions and engineering surveys for geological exploration and development of hydrocarbon deposits, and the US and EU sanctions introduced in 2014 have significantly limited access to foreign technology and investment [24]. In addition, often the matter is in replacing foreign equipment with domestic equipment, but about creating new technologies, since they have no analogues in the world. This requires significant financial resources and time.

2.8 The emergence of new sales markets

The decline in demand for hydrocarbons occurs simultaneously with its shift from developed economies to the countries of the Asia-Pacific region [25]. China, South Korea, Japan and India may become promising export destinations for Russian Arctic resources, which will compensate for the reduction in supplies to the countries of the European region. However, even entering new markets does not guarantee stable exports, so the feasibility of implementing Arctic projects should be considered in terms of future demand for energy resources [26].

3 State policy of the Russian Federation in the Arctic zone

Global challenges and constraints require efficient government policy to support complex oil and gas projects. The complexity of the projects is due to the harsh climatic conditions of the Arctic region, the need to comply with stringent environmental requirements and the use of expensive technology and equipment [27]. This results in high capital intensity of projects and a decrease in investors' interest [28]. underdeveloped or, in some places, completely absent transport and logistics infrastructure also leads to higher costs [29].

The last decade is a time of key decisions for the Arctic zone of the Russian Federation, the implementation of large-scale infrastructure and mining projects, attraction of investments, and the growth of the role of the Northern Sea Route. Consolidation of efforts of state authorities and major oil and gas companies is aimed at developing national programs and strategic documents for efficient development of the resource and economic potential of the region.

Today, Russia is creating the most favorable conditions for doing business and implementing investment projects for oil and gas production in the Arctic region [30]. The country has developed a basic system of tax preferences for Arctic oil and gas projects. In the conditions of low hydrocarbon prices, these measures allow developing previously unprofitable

reserves, including the gas condensate part and Achimov deposits of gas fields and oil rims. In addition, the government encourages new approaches to financing Arctic projects. One of these approaches is the introduction of a public-private partnership mechanism. This scheme has already proved its efficiency and effectiveness, especially in terms of constructing infrastructure facilities in the Arctic region. In 2020, a bill was drafted that establishes a new model for the activities of investors on the Arctic shelf. This solution guesses the Norway's experience in state regulation of activities in the Arctic region, allowing foreign and private companies to operate on their sites in consortium with a state operator.

Since 2017, on the basis of the principle of regional and sectoral development, there has been a mechanism to develop support zones in the Arctic region. This mechanism is focused on creating favorable conditions for the implementation of large-scale oil and gas projects along with the development of transport, energy and social infrastructure. The number of investment projects in the field of exploration, exploitation and processing of mineral resources is more than 60% of priority projects within the framework of developing support zones [31].

Also within the framework of the state policy for the development of the Arctic zone, infrastructural restrictions on the growth of mineral resources production will be removed. Today, there is an active development of marine, aviation, and coastal transport in the Arctic, modernization of the infrastructure of Arctic seaports, new port-industrial complexes are being created, and the capacity of sections of the railway network is expanding [32].

In addition, the issue of the producing domestic equipment for production of hydrocarbons is being actively addressed at the state level in Russia. The result is active design and testing of technological systems for exploration, production and processing of minerals in the Arctic. A significant achievement was the creation of prototypes of the first Russian subsea production equipment. The Russian technological base for the LNG liquefaction, storage and transportation, as well as the supply of spare parts, is actively developing. The departure of foreign service companies from the Russian market contributed to the start of intensive activities to build up our own service competencies, search for import substitution opportunities and new partners, primarily in the Asian region. In the last decade, the quick improvement of oil and gas technologies has become a key factor in the development of the industry. Due to the intensified introduction of Russian innovative technologies, including digital technologies, it becomes possible to develop complex Arctic reserves and significantly reduce the costs of hydrocarbon production. In the future, advanced knowledge-intensive developments are able to significantly increase the volume of profitable reserves, reduce the cost of their exploitation and transportation, thereby increasing the benefits of subsoil users and the budgetary efficiency of oil and gas projects.

4 The influence of factors of global instability on the implementation of oil and gas projects in the Arctic region

The analysis of the factors of global instability of the world energy market makes it possible to identify the most adverse factors for the implementation of production in the Arctic, as well as factors that can have a favorable impact (Figure 1).

Global Trends	Challenges and Opportunities for Arctic Oil and Gas Projects
Strengthening competition in hydrocarbon markets	Challenges: - loss of traditional sales markets for Arctic resources; - postponement of the launch of new oil and gas projects.
Expansion of the LNG market	Opportunities: - increasing LNG capacities; - entering new sales markets; - diversification of the activities of oil and gas companies.
Transition to a low-carbon economy, development of RES	Challenges: - decrease in the export of Russian resources; Opportunities: - development of natural gas production projects.
Decrease in global demand for hydrocarbons	Challenges: - decrease in the export of Russian resources; - postponement of the launch of new oil and gas projects.
Changes in the price environment for hydrocarbon raw materials	Challenges: - decrease in the commercial and budgetary efficiency of existing projects, postponement of the launch of new projects; - price wars between competitors.
Decrease in investment to the oil and gas sector	Challenges: - postponement of the launch of new oil and gas projects; Opportunities: - development of public-private partnerships, attraction of foreign investment.
Development of technological innovations, including digital technologies	Challenges: - changes in the timing of projects due to the lack of Russian technologies and equipment for activity in arctic conditions; Opportunities: - reducing dependence on imported equipment, machinery, technologies, service; - formation of our own scientific and technological groundwork.

Fig. 1. Global trends in the world energy complex and their impact on the implementation of Russian Arctic projects (supplemented by the authors).

5 Conclusions

Thus, today, there is a twofold situation in the implementation of oil and gas projects in the Russian Arctic zone. On the one hand, in the past few years, an intensification of project activity for the development of the hydrocarbon potential of the Arctic zone, supported by state support in the framework of defining the macro-region as the main tool for implementing geopolitical interests and ensuring national security of the Russian Federation has been observed. For these purposes, the Arctic infrastructure facilities are being modernized and updated, a set of incentives for subsoil users is being developed, conditions are being created for investment and business activities in the region, and the Russian Northern Sea Route is being transformed into an international commercial transit route.

On the other hand, serious changes in the organization of the world economy and energy markets, trends of decarbonization, technological transformation and digitalization of the oil and gas complex, strengthening the competitive position of renewable energy in the market can create threats to the stability and sustainable development of capital-intensive, high-risk, requiring technological renewal Arctic projects.

Tough price competition provoked by the imbalance of supply and demand and, as a result, a sharp drop in hydrocarbon prices, and a significant change in the structure of energy consumption, call into question the

effectiveness of new project activities in the Arctic and increase the risks of changing the timing and reducing the profitability of current projects. Long-term forecasts do not guarantee a quick stabilization of the market, reducing the investment attractiveness of Arctic projects.

But the low competitiveness of Arctic projects, in particular offshore projects, does not mean that further exploration and development of this extremely promising oil and gas region should be abandoned. In addition, some changes in the global oil and gas market can be used for more efficient development of the resource potential of the Arctic.

For example, Russian Arctic LNG projects have significant prospects. This will be possible due to their favorable geographic location and the use of the shortest delivery route – the Northern Sea Route. In addition, LNG projects have low operating costs and also enjoy tax incentives provided by the state. huge reserves of natural gas and the experience of the Yamal LNG project, which has demonstrated the technological feasibility of building and operating LNG plants in the Arctic, provide increased attention to the region and arouse interest in the implementation of new projects.

The development of renewable energy reduces the demand for hydrocarbons. Of traditional raw materials, natural gas can compete with renewable energy, which is the only energy source that simultaneously ensures energy security and sustainable development on a global scale. This is due to the economic and environmental advantages of natural gas against the background of the growing importance of climate policy in most countries of the world. In this regard, there are significant prospects for the development of Arctic gas fields.

It is also important to take advantage of the growing market opportunities in the Asia-Pacific Region. Expanding the geography of supplies and increasing cooperation with customers from APR countries, whose economies are actively recovering from the consequences of the pandemic, is an important strategic benchmark for of Arctic oil and gas projects, as well as an opportunity to ensure the throughput capacity of the Northern Sea Route.

The main factors of global instability identified in the study, as well as the resulting restrictions on project activities in the Arctic and the emerging prospects, should be taken into account both in the strategic planning of Russian oil and gas companies and in the framework of the state policy of subsurface use in the Arctic zone of the Russian Federation.

The implementation of Arctic projects will be a response to the challenges facing the Russian production sector in the long term. Integrated development of the northern hydrocarbon potential will create an opportunity to form a new production base for the oil and gas industry. In combination with the geographical proximity to the largest sales markets, the EU and APR, and the developed transport and logistics system, the operation of Arctic fields will increase the competitiveness of the Russian oil and gas industry and ensure the leading position of Russia in the unstable global energy sector.

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