

The Current State and Prospects for the Development of the Russian Gas Industry in a New Geopolitical Landscape

T.V. Dzyubina^{1,*}, Zh.V. Kalinina¹, N.I. Ilkevich¹

¹ Melentiev Energy Systems Institute of the Siberian Branch of the Russian Academy of Sciences, Irkutsk, Russia

Abstract — The relevance of the research into the current state and directions of development of the Russian gas industry arises from factors influencing it. These include aging equipment, depletion of gas reserves in large fields, insufficient maneuverability, as well as profound shocks caused by the global economic crisis and changes in the geopolitical landscape worldwide. In this regard, it is crucial to add another dimension to the two main areas of the gas industry development (smart energy systems and integrated energy systems). This is research into the prospects for the use of Russian gas (exports and increasing domestic consumption) in the new geopolitical context. This paper also raises questions about the institutional organization of the gas industry and, as a consequence, problems in its management. The study examines the current state of Russian pipeline natural gas exports to the European Union and the East, in particular to China. It is also noted that there is a reduction in gas supplies to Europe due to the sanctions imposed by the EU and the USA in connection with the change in the geopolitical situation caused by the special military operation started on February 24, 2022. The main difficulties encountered by Russian gas companies are related to changes in logistics, i.e., the need to redirect gas export flows from the West to the East. In addition

to the fact that the existing gas industry infrastructure is designed to supply gas to the countries located to the West of Russia, many eastern gas markets are too distant geographically or focused on the supply of liquefied natural gas. China is not yet a full partner in the gas sector. Domestic gas consumption requires large investments both in the expansion of gas infrastructure and in the construction of gas processing plants in the country. Nevertheless, possible directions for the program of gas industry development in the coming years were formulated. Not all of the areas mentioned can be implemented and many of those that are possible may require additional investments and government support, especially since Western sanctions can potentially last for 3-5 years.

Index Terms — gas sector, gas exports, gas consumption, sanction pressure, turn to the East, development prospects.

I. INTRODUCTION

An analysis of the global trends, current state, challenges of the gas industry development and possible levels of gas consumption in Russia and other countries reveals that natural gas until recently has occupied an important place in the energy balance of developed countries of the world, including Europe and the countries of North-East Asia (NEA). Traditional consumers of Russian natural gas were the countries of Eastern and Western Europe. In the near future, we can expect two key factors that will determine the situation in this geopolitical direction: increasing gas supplies, leading to a “saturation” of the market and the geopolitical instability and unpredictability in this region. In addition, there are known restrictions on the further growth of Russian gas exports in this direction due to increasing competition with liquefied natural gas (LNG)

* Corresponding author.
E-mail: tvleo@isem.irk.ru

<http://dx.doi.org/10.25729/esr.2024.02.0002>

Received April 22, 2024. Revised July 2, 2024. Accepted August 2, 2024. Available online August 15, 2024.

This is an open-access article under a Creative Commons Attribution-NonCommercial 4.0 International License.

© 2024 ESI SB RAS and authors. All rights reserved.

from the United States, as well as due to the presence of legislation and sanctions blocking the dependence of individual countries on fuel and energy supply from one source.

At the same time, the interest of NEA countries in importing gas from Russia is high. Their need for natural gas in the face of competition with coal and nuclear energy, as well as liquid fuels, is steadily increasing. The energy markets of the NEA countries (China, Japan, and South Korea), as well as Turkey and India will be able to consume (in the event of timely decisions and the construction of gas transmission lines on the Russian side) many tens of billions of cubic meters of gas per year.

Hydrocarbon exports are one of the main sources of income for the Russian Federation. According to Rosstat, gas and oil exports accounted for almost a third of the federal budget (28%) in 2020 [1].

In 2021, gas production in Russia hit a record level and amounted to 763 billion m³, which is 10% higher than in 2020 and 3% higher than in 2019. Exports increased by 3%, reaching 250 billion m³ [2].

The current state of PJSC Gazprom can be judged by the published financial results according to RAS (Russian Accounting Standards) for the third quarter and 9 months of 2023 [3]. Revenue of PJSC Gazprom for 9 months amounted to RUR 3 960.6 billion, having decreased by 36.3% on a year-over-year (yoy) basis. Revenue for the third quarter amounted to RUR 1 217.5 billion (–28.1% yoy). The decrease in revenue was due to worsening conditions on the gas market and a decrease in the volume of supplies to the EU. Sales profit for 9 months was negative at –RUR 107.2 billion (RUR 2,036.7 billion in profit a year earlier). Sales profit for the third quarter was at RUR 86.2 billion (RUR 85.4 billion in profit in the third quarter of 2022). The decrease in sales profit can be attributed to a decline in revenue.

The net profit of PJSC Gazprom for 9 months fell by 44.2%, to RUR 446.1 billion. Net profit for the third quarter amounted to RUR 701.1 billion (RUR 196.9 billion loss a year earlier). Large profits in the third quarter are associated with non-cash items (exchange revaluations), as well as an increase in income from participation in other organizations by 29% (results of PJSC Gazprom Neft in 2022).

These results of PJSC Gazprom are quite expected: low gas prices, sanction pressure, and decreased supplies to Europe.

The current geopolitical conditions dictate PJSC

Gazprom to make new decisions and adjust the development prospects of the Russian gas industry.

II. FACTORS AFFECTING THE DEVELOPMENT OF RUSSIA'S GAS INDUSTRY

The activities of PJSC Gazprom are based on the principles of maximizing cash flow to the country's budget and generating maximum profits while minimizing costs. The company also places great emphasis on the interests of all shareholders involved. In terms of the interests of the economy, the gas system should develop to meet the economy's need for gas with minimal average costs.

In gas systems around the world, both in centrally controlled and market economies, capacity concentration processes have objectively led to the emergence of monopolies. The Unified Gas System of Russia (UGS) is a unique natural monopoly structure in the world. This system competes only with the coal and oil systems, as well as the nuclear energy system. In global gas markets, the UGS competes with the gas systems of other countries.

The factors contributing to monopolization are primarily inherent in the gas transportation through trunk and distribution pipelines in Russia and to foreign markets. These factors include:

- Huge scale of the UGS;
- Complex geological and climatic conditions for the development of fields and their operation, which require large long-term capital investments, especially at the initial stage of development;
- Continuity of the gas production and transportation process;
- Strategic importance of this product, determined by:
 - 1) Large-scale use of gas in the economy and by the population;
 - 2) Ability to influence inflationary processes in the economy;
 - 3) Use of gas supplies by government officials as a lever in resolving political issues.

The high share of PJSC Gazprom in Russia's total gas production and supply indicates that the gas industry is essentially monopolized.

According to Presidential Decree No. 220 of February 28, 1995, PJSC Gazprom is recognized as a natural monopoly, which is regulated by the government.

A specific feature of the Russian gas industry is that market methods of regulating the economy are not fully developed. PJSC Gazprom remains the dominant gas producer in Russia, which produces most of the gas, with

the main contribution to production made by its subsidiaries: LLC Gazprom Dobycha Urengoy, LLC Gazprom Dobycha Yamburg, LLC Gazprom Dobycha Nadym, LLC Gazprom Dobycha Nadym, LLC Gazprom Transgaz Surgut, and LLC Gazprom Dobycha Orenburg [4].

Due to its unparalleled position in the economy, PJSC Gazprom has been a frequent topic of discussion regarding potential reforms within the company and the entire gas industry.

Reform activity started in the early 2000s. The Russian Ministry of Economic Development zealously took up the task of eliminating natural monopolies and achieved considerable success in the electric power industry. It was planned that Gazprom should be next. The following options were offered [5].

1. Dividing into specialized subsidiaries (gas production, transportation, sales) with their subsequent complete separation.

2. Providing a mechanism for transparent access of independent producing companies to gas transportation, particularly for export deliveries (mandatory condition).

3. Liberalizing domestic gas prices, fully or partially, for example, through the establishment of two sectors – a free sector (for enterprises) and a regulated sector (for citizens and socially significant entities).

In fact, all serious discussions about the division of Gazprom were stopped in 2005 after a letter from the Chairman of the Board of PJSC Gazprom A.B. Miller to Russian President V.V. Putin. The liberalization of domestic prices, which Gazprom did not object to, was also considered socially dangerous.

The difficult economic conditions, in which PJSC Gazprom has found itself recently, coupled with the loss of the European market, may reignite the need to reform the gas industry. Given its strategic and social significance for our country, this reform will necessitate extensive expert and public discussion.

Until recently, the gas industry has played a significant role in the Russian economy serving as an “energy compensator” that supports the country’s energy sector and safeguards it against possible critical imbalances. However, 10 years ago it faced serious problems, namely: [6].

1. *Aging of equipment.* About 45% of equipment in gas supply systems (GSS) has a service life of more than 25–30 years, 27% - more than 40 years, and about 40% of the installed capacity of gas pumping units (GPU) needs to be

replaced and modernized. The gas distribution networks of cities and industrial centers are in even longer operation. According to conservative estimates, it is currently necessary to replace about 30% of physically worn out and the same amount of obsolete equipment.

2. *Depletion of gas reserves in large fields* in Nadym-Pur-Taz, Vuktyl, Orenburg, and other areas of the Russian Federation. A noticeable decrease in gas production from them is expected after 2035. However, now it is necessary to think about the development of new hydrocarbon deposits in the inaccessible territories of the Far North and the Arctic, the shelves of the Arctic seas, and the Far East. This will lead to a significant increase in the cost of field development and will require the development of modern, highly efficient and reliable methods for the production and transportation of natural gas.

3. *Insufficient maneuverability in the Unified Gas System.* A significant portion of underground gas storage facilities remained in the former republics of the Soviet Union, in particular in the Ukraine. This determines the low capacity of seasonal gas storage in Russia and significantly complicates ensuring the reliability of gas supply to consumers during periods of winter peak loads.

After the events of 2014 and February 24, 2022, the following factor has become one of the most crucial determinants.

4. *Profound shocks caused by the global economic crisis, as well as changes in the geopolitical situation.* Since the beginning of the special military operation (SMO), gas production in Russia has dropped by 28%, gas exports have decreased by 40%, and revenues from gas sales have fallen by 46% (06. 2022). The share of PJSC Gazprom in the European market fell to 9% in 2022 compared to 40% in 2021. Exports of pipeline gas by PJSC Gazprom to non-FSU (Former Soviet Union) countries (including China, Turkey, and Serbia) decreased from 185 billion m³ in 2021 to 100 billion m³ in 2022 [7]. This led to an excess of natural gas on the Russian domestic market.

All these factors influence the development of the gas industry and entail changes in gas consumption and the subsequent distribution of gas flow, both domestically and internationally. Given the last factor, the change in the geopolitical landscape caused by the start of the SMO and the introduction of tough sanctions, it is evident that there will be a significant alteration in the direction of gas exports, with a shift from the West to the East.

In addition to the promising directions for further development of the issues of methodological research

declared earlier [8], namely: *intelligent energy systems* (Smart Grid) and *integrated energy systems*, a third direction is to be added. This is research into *the prospects for the use (exports and increase in domestic consumption) of Russian gas in the new geopolitical landscape*.

All three areas are insufficiently developed and do not cover the problem as a whole.

Digitalization of the gas industry is driven by the need to increase its productivity and efficiency and, ultimately, reduce the costs of gas production and supply to consumers.

The investigation of integrated energy systems is needed to adequately reflect the joint functioning of various energy systems.

One of the most significant influences on the current development of the gas industry is the third direction, which involves researching the prospects for exporting Russian gas and increasing its domestic consumption under new geopolitical conditions.

III. REDUCTION IN RUSSIAN PIPELINE GAS DELIVERIES TO EUROPE

When considering the gas industry development prospects, we cannot ignore the events of 2014 and February 24, 2022. Over the past 9 years, Russia has lived under sanctions, but since the last of these events, the sanctions imposed by the European Union (EU) and the United States have intensified significantly.

This holds particularly true for the prospects for Russian gas exports in the face of new geopolitical circumstances. It is worth noting that the energy sector of Russia has been export-oriented since 1960–70, when large-scale oil production began in Western Siberia. In the 2010s, the share of Russian gas in EU consumption averaged 30–40%. It was assumed that there would be a consistent supply of Russian gas to meet the energy needs of EU countries until the 2040s, and even beyond that after 2050 as a raw material for the industry [9]. In March 2013, a roadmap for energy cooperation between Russia and the EU until 2050 was signed.

The geopolitical crisis of 2022 decisively altered these plans. The process of breaking established ties is painful for all parties and entails many legal, economic, and political consequences, many of which have not yet been fully studied or even realized. This is especially true for the gas industry, where the EU and Russia were most dependent on each other.

In March 2022, the European Commission published

materials according to which it was planned to significantly reduce Russian gas supplies to Europe in 2022, by approximately two-thirds of the total supply in 2021 (i.e. by more than 100 billion m³ per year). The Nord Stream 2 project was frozen.

According to some experts, “the plan to abandon Russian gas can be implemented only in the next 10–15 years.” However, this opinion proved to be very optimistic. Europe has decided to diversify its gas sources with the view to eliminating its reliance on Russian gas by the year 2030. The joint statement of the European Commission and the United States on energy security in Europe clearly outlines the goal to achieve independence from Russian gas by 2027. This objective can be achieved through the boost in imports (liquefied natural gas), the utilization of renewable energy sources, the implementation of energy saving measures, and various other strategies. However, these factors worsen the economic situation of the EU and lead to increased energy prices, ultimately resulting in a decline in real incomes of the population [10]. Nevertheless, there is a reduction in gas supplies from Russia to Europe.

According to Eurostat, from the 2nd quarter of 2021 to the 2nd quarter of 2023, the share of Russian gas in European imports decreased from 38.5% to 12.9%. This is the result of being forced to switch to payment “in rubles” (starting on April 1, 2022). Many European countries immediately completely refused to follow the new rules; as a result, PJSC Gazprom stopped supplying gas to them. Poland and Bulgaria were the first to refuse to pay in rubles. In response, PJSC Gazprom stopped supplies to them on April 27, 2022. At the end of May, Finland, the Netherlands, and Denmark were left without Russian gas along the chain. This also impacted Germany [11].

TABLE 1. Capacity of Export Gas Pipelines to Europe, Billion m³ Per Year

Gas pipelines	Capacity
Urengoy-Pomary-Uzhgorod	32
Progress	26
Soyuz	26
Yamal-Europe	32.9
Blue Stream	16
Turkish Stream	31.5
Nord Stream-1	55
Nord Stream-2	55

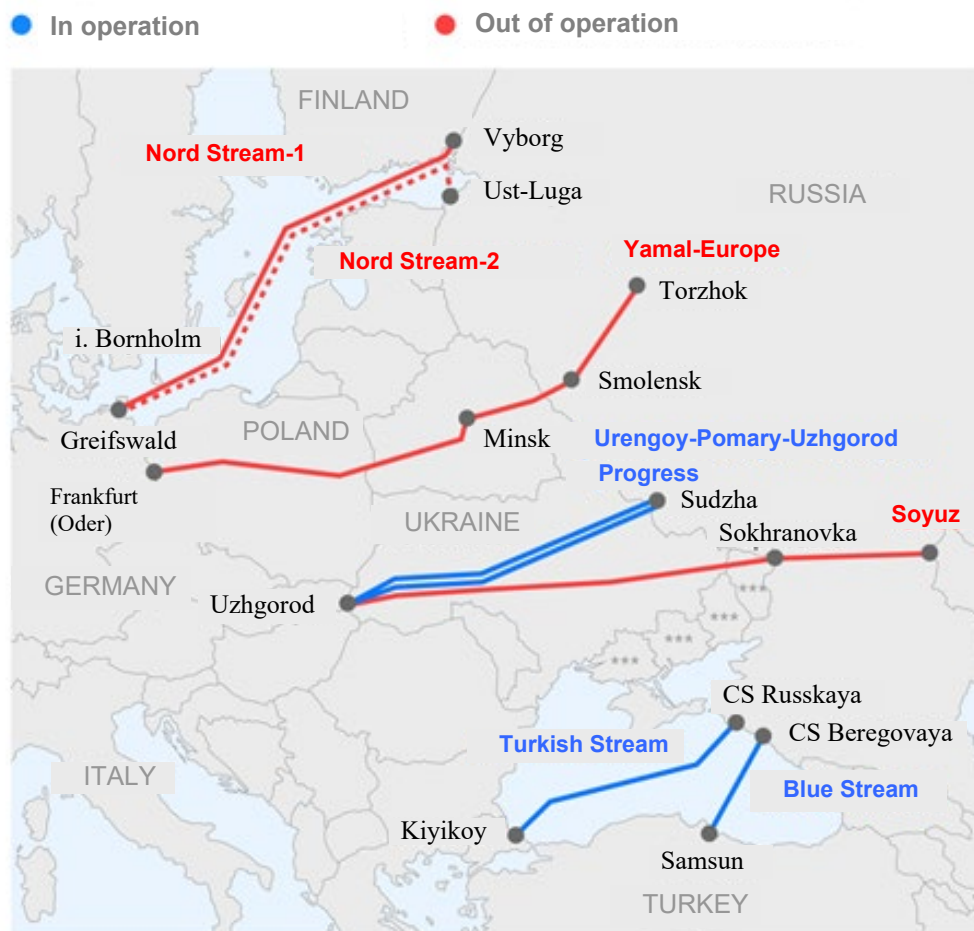


Fig. 1. Gas supply routes to Europe in 2023.

Currently, most of the pipelines connecting Russia and Europe are not functioning [1], Fig. 1 (sources: PJSC Gazprom, RBC). Russia supplies gas only under contractual obligations.

The capacity (annual throughput) of gas export pipelines to Europe is presented in Table 1.

On September 26, 2022, both the “Nord Stream 1” and “Nord Stream 2” gas pipelines were damaged by explosions in the Baltic Sea. The incident resulted in the damage of the linear part of the first gas pipeline (both lines) and one line of the second pipeline. On September 10, Chairman of the Board of PJSC Gazprom A.B. Miller announced the completion of construction of Nord Stream 2. The pipeline was tested and filled with a working volume of gas, but was not put into operation. Due to the destruction of gas pipelines, PJSC Gazprom incurred a loss of approximately \$300 million and saw a significant reduction in its export capacity by one third. However, it should be noted that both the gas pipelines “Nord Stream

1” and “Nord Stream 2” lost their significance due to the EU countries’ rejection of Russian gas.

The Yamal main gas pipeline – through Belarus and Poland – ceased to operate on May 11, 2022. Poland acquired PJSC Gazprom's 48% stake in the pipeline in Poland in 2023 and does not want to reopen the pipeline.

Thus, out of five pipelines, only two pipelines remain in operation: Turkish Stream through Turkey - Bulgaria and Ukrainian transit pipeline.

Russia supplies gas to Turkey through two gas pipelines that run along the bottom of the Black Sea. Through Blue Stream (capacity of 16 billion m^3 per year), gas is supplied only to the Turkish market, and half of the capacity of Turkish Stream (15.75 billion m^3 , out of 31.5 billion m^3 , operating capacity of approximately 12 billion m^3) is used to supply the countries of Southern and South-Eastern Europe. Gas goes to Serbia (2.2 billion m^3), Hungary (3.5 billion m^3), Bosnia (0.4 billion m^3), North Macedonia (0.4 billion m^3), and Greece (3 billion m^3).

Transit through Ukraine amounts to 13 billion m³ along one route, the second route is closed (combat zone). Gas goes to Slovakia (6.5 billion m³) and further to Austria (6 billion m³) or Hungary (1 billion m³). The agreement on transit through Ukraine expires by early 2025.

Now the main sources of pipeline gas supplies to the EU are (data for the first half of 2022 and the same period in 2023 [12]) Norway (through pipes on the bottom of the North Sea): 38.4 billion m³ in 2022, 38.2 billion m³ in 2023, a change of -0.5%; Algeria: 13.9 billion m³ in 2022, 13 billion m³ in 2023, a change of -6.5%; Russia: 44 billion m³ in 2022, 10.3 billion m³ in 2023, a change of -77%; UK: 8.6 billion m³ in 2022, 9.9 billion m³ in 2023, a change of +15%. In 2023, the rankings remained the same – Norway took the lead with a significant share of 54%; Algeria came in a strong second place with 19% of deliveries; Russia was not far behind Algeria with a share of 17% taking the third position.

Supplies of Russian pipeline gas were replaced mainly by supplies of liquefied natural gas. In 2022, EU countries increased LNG purchases by 58%, to 101 million tons. This allowed them to surpass the previous leading LNG buyers – Japan (73 million tons), China (64.5 million tons), and South Korea (47 million tons). LNG imports to Europe are equivalent to 137 billion m³ of natural gas, which is close to the volume of gas supplies from Russia in 2021 (about 140 billion m³). In 2022, they fell by more than half, to 60 billion m³ (according to Refinitiv).

The main suppliers of LNG to the EU are the USA (whereas their share of the European market in 2021 was 12%, in 2022, it was already 24%, and in November 2023, it reached 52%). According to the US State Department, in November 2023, American companies supplied 70% of their total LNG exports to Europe. The share of Great Britain in the European gas market was less than 5% in 2021, 12% – in 2022, and 15% in 2023 [13]. This is mainly transit gas from other countries. These are the main substitutes for Russian gas. Qatar, Norway, and other suppliers slightly increased their shares. Even China, due to a decrease in domestic demand, supplied LNG to Europe in the first half of 2022 (according to Nikkei Asia, the country supplied more than 4 million tons of LNG). The Russian Federation supplies only about 13% of LNG [14]. According to other data (Eurostat analysts), in 2023, EU countries spent a total of \$6.6 billion to purchase Russian LNG.

Thus, Russia was forced out of the European market. The European Union has replaced Russian gas exports much

more quickly than many expected. However, according to experts, the potential for a possible reduction in EU gas consumption was already fully exhausted in 2022-2023.

IV. TURN TO THE EAST

How do the imposed Western sanctions affect the Russian energy sector?

The imposition of sanctions has transformed the domestic energy sector, particularly the oil and gas industry.

The main difficulties for Russian oil and gas companies due to EU and US sanctions are related to changes in logistics, i.e., the need to redirect export flows to the East, to the countries of the Asia-Pacific region (APR). This is especially challenging because the existing infrastructure of the oil and gas industry is designed to supply oil and gas to the countries situated to the west of Russia.

According to Russian Deputy Prime Minister Alexander Novak, “hopes that we will at least restore supplies to Europe are small. A slight turnaround occurred in Central Asia - supplies to Uzbekistan began (currently for the heating season only, but given that their domestic production is falling and consumption is growing, they can switch to year-round imports). Apparently, Kazakhstan will also follow this path, but with the volumes much smaller than European ones. In 2021, Russia supplied 160 billion m³ to Europe whereas future gas supplies to Central Asia are expected to reach 10–15 billion m³. Prices are lower in that region, so the markets cannot be compared.”

In this regard, it is necessary to plan the development of gas exports to the APR countries (China, India, Mongolia, South Korea, Japan, and Vietnam) and an increase in gas consumption within the Russian Federation.

Projects of gas pipelines to China, which are being discussed and have already begun to be implemented, will be launched, according to experts, closer to 2030. All other markets are either too remote geographically (Pakistan, India) or focused on LNG supplies (Japan, Republic of Korea). Mongolia could become a new market, where gas consumption, theoretically, according to [9], could reach 2.2 billion m³ after 2025 and 5.7 billion m³ by 2050, if decisions are made on the Power of Siberia 2 gas pipeline. The DPRK, which shares a border with Russia, could become another new market.

The ongoing project of the Power of Siberia gas pipeline has ambiguous significance both for the export of natural gas to China (apparently, the second pipe is not in great demand, PJSC Gazprom is building the Power of Siberia 2

gas pipeline with its own money, the contract has not been signed between our countries), and for the development of the Eastern regions of Russia, because it passes through undeveloped and sparsely populated areas [15]. When transporting multi-component natural gas to the Amur Gas Processing Plant, located thousands of kilometers from the production center, it is crucial to consider potential substantial losses, including valuable gas components.

Nevertheless, we can note an increase in Russian gas supplies to China. In 2022, Russia exported 15.5 billion m³ to China via the Power of Siberia gas pipeline, in 2023, the supplies reached 22.7 billion m³. In 2025, exports should increase to 38 billion m³ (but this is almost four times less than annual exports to Europe). China, where gas consumption and imports are growing, is actively increasing its own production.

Previously, Russia mainly exported gas through pipelines, in particular to the EU. However, now the focus has shifted to liquefied natural gas. Increasing LNG production is one of the priority areas of work for PJSC Gazprom. The creation of new capacities is an additional opportunity to diversify the sales markets for the company's products and increase the flexibility of gas supply to Russian consumers. In addition, liquefied natural gas is an efficient, environmentally friendly motor fuel for urban transport.

In light of the foregoing, it is imperative to develop the transportation of liquefied natural gas along the Northern Sea Route (NSR) to facilitate the delivery of "Yamal-LNG" and "Sakhalin-2" products, as well as those of the planned production facilities "Baltic LNG," "Cryogas-Vysotsk" (including deliveries to Kaliningrad), and others crucial for supplying gas to consumer markets in the Far North, Far East, and Asia-Pacific countries. The NSR ensures a reduction in transportation costs from Yamal to Asia compared to the route through the Suez Canal. In this situation, the liquefied natural gas market acquires a vital role in ensuring exports to China, Japan, South Korea, Vietnam, India, and other countries.

However, the expansion of gas processing capacity in Russia faces a critical challenge: heavy reliance on imported technology and software. Current sanctions are blocking this crucial imports. Almost all Russian LNG plants use foreign equipment. This is especially true for cryogenic heat exchangers. Atomenergomash could establish production of these heat exchangers, but after 2025. The only exception is the fourth line of the Yamal LNG plant, which operates on the Arctic Cascade

technology patented by JSC Novatek [1].

High dependence on foreign technologies is also observed in a wide range of gas transportation items (powerful compressors for main pipelines; technologies for large-module construction of LNG plants near industrial centers; construction of Arc7 ice-class LNG tankers; insurance services for marine transportation of goods, ships, etc.). There are also problems with chartering methane carriers. According to Vessels Value, there were about 650 gas carriers operating in the world at the end of 2022, and another 285 should be launched in the next 3 years. However, the explosive growth of the LNG industry has led to a lack of capacity and freight rates for methane carriers have risen exponentially.

V. DOMESTIC GAS CONSUMPTION

An increase in domestic consumption of energy resources, in particular gas, could reduce the impact of Western sanctions on the Russian energy sector. Work in this direction has been going on for a long time.

The state "Program for establishing a unified system of gas production, transportation, and supply in Eastern Siberia and the Far East, given possible gas exports to the markets of China and other Asia-Pacific countries" (Eastern Gas Program) was approved in September 2007 by the order of the Ministry of Industry and Energy of the RF [16]. The program envisages the establishment of new gas production centers (Yakutsk, Irkutsk, Kamchatka, Sakhalin, and later Krasnoyarsk); integration of gas pipelines and gas fields of the Republic of Sakha, Primorsky and Khabarovsk Territories; Irkutsk, Amur, Kamchatka and Sakhalin regions into a single system to provide reliable natural gas supply to consumers in the energy sector, industry, agriculture, public utilities, and its export to Mongolia, Korea, and China. The program also suggests expansion of the Unified Gas System of Russia to the East. The production capabilities of Eastern Siberia and the Far East can reliably satisfy the demand for natural gas in this region for the next 30 years, and ensure gas supplies to Russian consumers and for export to APR countries [17].

However, it should be noted that the Eastern Gas Program poorly addresses or does not address in principle the use of C2+ and other valuable components of free and associated gases of the Siberian platform, the gas of which differs significantly in composition from the "dry" gas of the fields in Western Siberia.

Due to various economic and political factors, both

internal and external, the implementation of the gas program for expanding gas infrastructure of Eastern Siberia and the Far East, as well as the development of regional gas chemistry is progressing at a slow pace [17, 18]. The program's implementation requires an appropriate infrastructure that can only pay for itself within 5–7 years. In October 2023, PJSC Gazprom proposed reducing the company's investment program for 2023 by RUR 334.34 billion to RUR 1.965 trillion, and the budget for 2024 adopted by the Board of Directors of PJSC Gazprom approved the investment program with a total financing volume of RUR 1.57 trillion, versus RUR 2 trillion in 2023 [19]. The last time PJSC Gazprom reduced its investment program was in 2020 due to the consequences of the COVID-19 pandemic.

The Eastern Gas Program is of great socio-economic importance: despite the significant resources of natural and associated gas, the average level of gas infrastructure expansion in the Far Eastern Federal District is 23.9%, in the Siberian Federal District – 25%, while in Russia as a whole – 67.2%. The highest level of network gas infrastructure in these Districts was achieved in the Novosibirsk region (53.4%) and Khabarovsk Territory (59.6%). Some entities (Republics of Khakassia, Tyva, Buryatia; Trans-Baikal Territory; Amur and Magadan Regions; Jewish Autonomous Okrug), as well as some parts of the Krasnoyarsk Territory and Irkutsk region do not have network gas infrastructure at all [17]. On March 15, 2023, Energy Minister N. Shulginov claimed in the State Duma that the Eastern Gas Program would be adjusted to accelerate the expansion of gas infrastructure in Eastern Siberia and the Far East.

Gas supplies to the Russian domestic market remain more or less stable, but previously they were 2/3 in volume and accounted for about 20% in value. Table 2 shows Rosstat data on domestic natural gas consumption in Russia, both actual and expected.

Another direction in response to new challenges is oil and gas processing, i.e. it is necessary to develop the petrochemical industry in the Russian Federation. This

TABLE 2. Domestic Gas Consumption in the Russian Federation

Years	2021 (actual)	2022 (actual)	2023 (actual)	2025	2030	2040 – 2050
Billion m ³	470	484	503	500 – 520	530 – 560	550 – 650

involves constructing powerful gas processing plants (GPPs), which will use natural gas as a feedstock in the production of methanol, ammonia, other chemical products, construction materials, ferrous and non-ferrous metals. It is planned to expand gas processing capacities in central Russia, construct gas processing plants in the Leningrad region, as well as in Eastern Siberia and the Far East for the development of their resources. There are also plans to process significant volumes of liquid hydrocarbons from fields in Western Siberia [1].

VI. PROSPECTS FOR THE DEVELOPMENT OF THE RUSSIAN GAS INDUSTRY IN A NEW GEOPOLITICAL CONTEXT

The Russian gas industry is currently facing several potential risks [20]. These include the EU's gas market policy aimed at reducing Russian gas supplies; increased sanction pressure; the need to preserve natural gas transit corridors, in particular, the Turkish Stream infrastructure; the development of gas production from unconventional sources (shale gas), as well as the development of renewable energy sources; market risks, including currency, credit, and price ones (possible drop in oil prices, strengthening of the ruble, which would lower global competitiveness of the Russian economy); as well as environmental and climate risks.

The main challenges of the domestic gas industry include [1, 21] growing gas production in the USA; competition with other countries in the LNG exports sector; the EU's strong commitment to achieve energy independence; outdated equipment and technologies for gas transportation and processing; the depletion of easily recoverable reserves in Western Siberia; issues related to helium production and storage; stagnation and, in some cases, even decline in investments in gas production.

The PJSC Gazprom's position as the sole monopolist of gas transportation through trunk and distribution pipelines, both domestically and internationally, creates a situation where there is virtually no industry-wide mechanism for coordinating interaction to multilaterally discuss and solve problems of the gas industry development.

According to some experts [4], monopolism in the Russian gas industry and its impact on the economy and economic institutions are the main unresolved problems of the industry. Numerous discussions about reforming the Russian gas industry revolve around several questions. Should the current monopoly of PJSC Gazprom be maintained? Is a domestic competitive gas market

necessary? Is it necessary to divide PJSC Gazprom into several gas production and transportation companies? A significant drawback of reform proposals is the lack of assessing their consequences, which reflect the real behavior of the economic agents affected by them.

Monopoly lobbyists are actively promoting the idea of liberalizing the domestic gas market [4, 22]. Now wholesale prices are set by the state. Complete liberalization of the Russian domestic gas market in one go may result in irreversible negative consequences. Therefore, it is imperative to adopt a phased, gradual, transparent, and consistent approach to deregulation of the domestic gas market, ensuring equal opportunities for all its participants. The study [4] demonstrates the importance of managing the transition to market economic mechanisms in a manner that ensures controllability of the gas industry by the state and PJSC Gazprom.

At a time when PJSC Gazprom was investing its money in increasing the number of pipes for Europe, PJSC Novatek was developing LNG production and making strides to establish global presence. According to estimates [23], the volume of Russian LNG exports in 2035 will increase to 98.8–125.8 billion m³ and will amount to about half of the total volume of gas exports, which will boost the influence of PJSC Novatek and other energy companies. In their opinion, to achieve stability of the situation, it is necessary to combine the efforts of PJSC Gazprom and Novatek, since the former has expertise in natural resource exploration and production and the latter possesses the advanced LNG technologies and know-how. This highlights the importance of coordinating the development of the country's gas industry. At present, however, the pipeline gas exports from Russia are monopolized by PJSC Gazprom, while the LNG exports are essentially under the control of PJSC Gazprom and Novatek. The latter fact emphasizes the importance of a single governing body on Russia's part for the already established two-sector (pipeline and LNG) external market and the emerging two-sector internal market.

Some experts, however, hold a different view. They argue that PJSC Gazprom came into existence under the influence of natural factors that led to the concentration of capacities in Russia's gas supply systems, ultimately giving rise to a natural monopoly in the gas industry [24]. The main factor is the continuity of the gas production and transportation process.

Thus, there are different opinions on the reform of the Russian gas industry.

To summarize, we can identify the following directions or possible components of the development program for the Russian gas industry in the years to come.

1. Freezing the current state of the gas industry.
 2. Rising significantly gas tariffs for the consumer.
 3. Developing export gas supplies to the East:
 - 1) Through the gas pipelines "Power of Siberia" and pipelines through Kazakhstan to China and Mongolia [17];
 - 2) By tankers transporting liquefied natural gas to Asia-Pacific countries along the Northern Sea Route (by PJSC Novatek and PJSC OC Rosneft) [25].
 4. Using the gas export capacities of the gas transmission system in the west:
 - 1) The Urengoy – Pomary – Uzhgorod pipeline (via Ukraine, now it is fully loaded);
 - 2) The "South Stream" pipeline (30 billion m³) and "Blue Stream" pipeline (16 billion m³) running through Turkey and covering the needs of Turkey itself;
 - 3) The Nord Stream pipelines through Belarus and Poland, as an option for diversifying gas supplies.
 5. Advancing the gas industry within the Russian Federation:
 - 1) Expanding gas infrastructure in various regions of the country [17];
 - 2) Developing gas processing, in particular, the production of liquefied natural gas and the development of the gas chemical industry.
- Most of these measures to support the Russian gas industry require additional investments (except for points 1 and 2, which mean leaving everything as it is and solving the problems of PJSC Gazprom at the expense of the population). The probability of implementing each of the directions is unclear. State support is needed, especially given expert predictions that Western sanctions could last at least 3–5 years.

ACKNOWLEDGEMENT

The work was carried out within the framework of the project under State Assignment No. FWEU-2021-0002 and No. FWEU-2021-0004 of the Program of Fundamental Research of the Russian Federation for 2021–2030.

REFERENCES

- [1] N. A. Grigorieva, E. M. Ovsyannikov, F. G. Zhagfarov, "Problems of the Russian gas industry," *Neftgaz magazine*, no. 10, Oct. 2023. [Online]. Available: <https://magazine.neftgaz.ru/articles/rynok/798477-problemy-rossiyskoy-gazovoy-otrasli/?ysclid=lzca6n3chz103992183> Accessed on: Apr. 05, 2024. (In Russian)

- [2] Annual report of PJSC Gazprom for 2021. [Online]. Available: <https://www.gazprom.ru/f/posts/57/982072/gazprom-annual-report-2021-ru.pdf>. Accessed on: Apr. 05, 2024. (In Russian)
- [3] “PJSC Gazprom published financial results under Russian Accounting standards for the third quarter and 9 months of 2023,” *Economy of the Russian Federation*, Nov. 8, 2023. [Online]. Available: <https://bcs-express.ru/novosti-i-analitika/gazprom-otchitalsia-za-iii-kvartal-rezkii-rost-pribyli-chto-s-nim-ne-tak>. Accessed on: Apr. 05, 2024. (In Russian)
- [4] D. A. Siutin, “Institutional aspects of Russia’s gas industry development,” PhD dissertation, State University of Management, Moscow, Russia, 2006. [Online]. Available: <https://www.disserscat.com/content/institutsionalnye-aspekty-razvitiya-gazovoi-otrasli-rossii>. Accessed on: Jun. 06, 2024. (In Russian)
- [5] S. Kudiyarov, “Gazprom: reboot,” *Monocle*, no. 22, May 27, 2024. [Online]. Available: <https://monocle.ru/monocle/2024/22/gazprom-perezagruzka/>. Accessed on: Jun. 06, 2024. (In Russian)
- [6] N. I. Ilkevich, T. V. Dzyubina, “Modeling the feasible structure of complex gas systems with focus on reliability,” in *Methodological issues studies of reliability of large energy systems: Issue 64. Reliability of energy systems: achievements, problems, prospects*. Irkutsk, Russia, ESI SB RAS, 2014, pp. 405–416. (In Russian)
- [7] E. Aliferova, “PJSC Gazprom will exclude its share of the European gas market from the target indicators of its strategic planning,” *Neftegaz.ru*, Oct. 23, 2023. [Online]. Available: <https://neftegaz.ru/news/companies/784526-gazprom-isklyuchit-iz-tselevykh-pokazateley-svoego-strategicheskogo-planirovaniya-dolyu-na-gazovom-rynke-evropy>. Accessed on: Apr. 05, 2024. (In Russian)
- [8] A. F. Dyakov, V. A. Stennikov, S. M. Senderov et al, *Reliability of energy systems. Problems, models and methods for solving them*, N. I. Voropai, Ed. Novosibirsk, Russia: Nauka, 2014, 284 p. ISBN 978-5-02-019169-3. (In Russian)
- [9] A. M. Belogoriev, “The prospects for Russian gas exports,” *Energy Policy*, Nov. 16, 2023. [Online]. Available: <https://fief.ru/en/media/publications/item/perspektivy-eksporta-rossiyskogo-gaza/>. Accessed on: Apr. 05, 2024.
- [10] E. M. Fazelianov, “The energy crisis in Europe and Russian gas supplies,” *Scientific and analytical bulletin of the Institute of Economics of the Russian Academy of Sciences*, vol. 28, no. 4, pp. 133–142, 2022. DOI: 10.15211/vestnikieran42022133142. (In Russian)
- [11] O. Prokopjeva, “Russia has cut off gas to part of Europe – now what? And who suffers the most?” [Online]. Available: <https://money.onliner.by/2022/06/02/rossiya-perekryla-gaz-dlya-chasti-evropy-chto-teper-i-kto-stradaet-bolshevsex>. Accessed on: Apr. 05, 2024. (In Russian)
- [12] V. Dzhin, “Which countries supply gas to the EU,” *Economy*. [Online]. Available: <https://journal.tinkoff.ru/short/eu-gas-import/>. Accessed on: Apr. 05, 2024. (In Russian)
- [13] How Europe replaced Russian gas. [Online]. Available: <https://journal.tinkoff.ru/short/eu-gas-import/>. Accessed on: Apr. 05, 2024. (In Russian)
- [14] Russia's gas competitor has become the leader in liquefied gas supplies to the EU. [Online]. Available: <https://lenta.ru/news/2023/11/21/gazovyy-konkurent-rossii-stal-liderom-po-postavkam-szhizhennogo-topliva-ves/>. Accessed on: Apr. 05, 2024. (In Russian)
- [15] T. V. Dzyubina, N. I. Ilkevich, N. V. Surmin, “Assessing the structural reliability of the gas transportation system in the East of Russia,” *Information and Mathematical Technologies in Science and Management*, no. 2 (14), pp. 88–100, 2019. DOI: 10.25729/2413-0133-2019-2-08. (In Russian)
- [16] Program for the establishment of a unified system of gas production, transportation and supply in Eastern Siberia and the Far East, considering potential gas exports to the markets of China and other Asia-Pacific countries. [Online]. Available: <https://docs.cntd.ru/document/902059423>. Accessed on: Apr. 05, 2024. (In Russian)
- [17] B. G. Saneev, G. G. Lachkov, “Features of gas infrastructure expansion in Asian regions of Russia,” *Energy Policy*, no. 2(180), pp. 70–77, 2023. DOI: 10.46920/2409-5516_2023_2180_70. (In Russian)
- [18] V. A. Stennikov, V. O. Golovshchikov, E. A. Romanovich, “Modern Russian oil and gas policy and its features in Russian-Chinese cooperation in the gas sector,” *iPolytech Journal*, vol. 25, no.1, pp. 122–137, 2021. DOI: 10.21285/1814-3520-2021-1-122-137. (In Russian)
- [19] “Gazprom's activities. Gazprom expects about RUR 2.2 trillion in pre-tax profit for 2023,” *Kommersant.ru*, Dec. 19, 2023. [Online]. Available: <https://www.kommersant.ru/doc6412011>. Accessed on: Apr. 05, 2024. (In Russian)
- [20] Main risk factors. [Online]. Available: <https://www.gazprom.ru/investos/corporate-governance/risk-factors/>. Accessed on: Jun. 06, 2024. (In Russian)
- [21] Annual report of PJSC Gazprom for 2022. [Online]. Available: <https://www.gazprom.ru/investors/disclosure/reports/2022/>. Accessed on: Apr. 05, 2024. (In Russian)
- [22] Yu. Pronko, “Will the population pay for Gazprom's problems?” 2024. [Online]. Available: https://tsargrad.tv/articles/pronko-problemy-gazproma-oplatit-naselenie_1009450. Accessed on: Jun.06, 2024. (In Russian)
- [23] A. Gromov, S. Kondratyev, A. Shirov, “Domestic gas market at a historical crossroads,” *Energy Policy*, vol. 9, pp. 14–25, 2023. [Online]. Available: <https://energypolicy.ru/wp-content/uploads/2023/09/ep-maket-%E2%84%969-2023-14-25.pdf>. (In Russian)
- [24] N. I. Ilkevich, T. V. Dzyubina, Z. V. Kalinina, *Multilevel modeling of gas supply system development*. Novosibirsk, Russia: Nauka, 2014, 217 p. ISBN 978-5-02-0191877. (In Russian)

- [25] D. I. Borovinsky, "Analysis of the development of pipeline and sea transport of natural gas from the Arctic region," *Information and Mathematical Technologies in Science and Management*, no. 1 (33), pp. 133–145, 2024. DOI: 10.25729/ESI.2024.33.1.012. (In Russian)



Tatyana V. Dzyubina, Ph.D., graduated from Irkutsk Polytechnic Institute. She has worked at Melentiev Energy Systems Institute of the Siberian Branch of the Russian Academy of Sciences since 1976. She is a senior researcher at the Laboratory for the Development of Gas Supply Systems. Her scientific interests are mathematical modeling of reliability of large energy systems, such as electric power and gas systems in the context of their isolated and joint operation and the issues facing calculation of natural gas prices and tariffs.



Zhanna V. Kalinina, Ph.D., graduated from Irkutsk State Technical University. She has worked at Melentiev Energy Systems Institute of the Siberian Branch of the Russian Academy of Sciences since 2004. She is a researcher at the Laboratory for the Development of Gas Supply Systems. Her main research interests are aggregation of design schemes for gas systems, preparation and analysis of technical and economic information on the Unified Gas System facilities.



Nikolay I. Ilkevich, Dr.Sc., graduated from Leningrad Engineering and Economics Institute. He has worked at Melentiev Energy Systems Institute of the Siberian Branch of the Russian Academy of Sciences since 1969. Currently he is the Head of the Laboratory for the Development of Gas Supply Systems. His main research interests are multi-level modeling of the gas system development.