Energy Strategy Reviews 30 (2020) 100511

Contents lists available at ScienceDirect

Energy Strategy Reviews

journal homepage: http://www.elsevier.com/locate/esr

Russian natural gas exports: An analysis of challenges and opportunities

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ARTICLE INFO

Keywords:
Natural gas
Export
Russia
Strategy
Markets

ABSTRACT

This study provides a comprehensive, updated, and refined analysis of the challenges and opportunities for Russian natural gas exports based on recent statistical data, academic publications, and media sources. The paper addresses the lack of continuity in studies within the topic since the recent changes are not reflected well enough in the current peer-reviewed literature. In order to understand the perspectives regarding Russian natural gas export in global natural gas markets, we consequently examine the current layout of the global natural gas markets, and challenges and opportunities for Russian natural gas exports. The analysis shows that the U.S. natural gas market is closed for Russian exports. In the European market, Russia is experiencing difficulties in increasing its export shares, or even maintaining current levels, owing to various macroeconomic and geopolitical challenges. Asian markets such as China, India, Japan, and South Korea, are the most promising destinations for future Russian natural gas exports. Despite strong geopolitical challenges and high competition globally, Russia should seek maintaining current export levels in the European market, while implementing a win-win export strategy, and secure its future export shares on the Asian markets. The results of the study can be used for scenario and planning purposes, and be useful for policy makers and industry practitioners.

1. Introduction

Russia is one of the largest natural gas producers and exporters in the world [1], having a significant influence on natural gas markets globally. However, it is also experiencing high competition [2]. The "silent revolution" of shale gas in the United States has caused the change in export–import routes, and, more significantly, has placed the United States in the position of a net exporter [1]. As a result, competition among natural gas exporters has significantly increased, causing a decline in natural gas prices, and even price wars, specifically in the European natural gas market [3]. The shale gas revolution in the United States has also caused re-orientation of natural gas import–export routes [4], as well as significant expansion of liquefied natural gas (LNG) trade [5], causing gas-to-gas competition. Other suppliers are also increasing their shares in the natural gas markets. For instance, China and Australia account for the significant growth of natural gas exports [6]. Additionally, there is an increasing geopolitical instability in the Middle East and North Africa (MENA) region [7], affecting natural gas export-import routes. As a result, access to the traditional Russian export market – European market – has become increasingly uncertain. Further, the export–import relations are also to a significant extent politically driven, causing concerns about the security of energy supply [8].

At the same time, driven by Asian countries [9], the global energy demand is consistently growing, with the energy mix changing in favor of less carbon-intensive resources [10]. Natural gas is considered a "transition fuel" toward cleaner, more sustainable, and climate-friendly energy supply [11,12]. It is projected that natural gas production and consumption will steadily grow in all the energy scenarios [13–15], while also replacing less "clean" fuels. The continuing growth of natural gas consumption in the Asian markets is projected to remain constant and long-term, and higher demand for natural gas is expected [15], even though the origin of this growth is different from what was envisaged (replacement of coal with natural gas due to environmental and sustainability issues, instead of GDP growth). Natural gas consumption may be adjusted by a further increase of other types of energy as solar, wind, thermal and hydropower.

The changing energy dynamics [16] has a substantial influence on the natural gas markets and the overall layout of natural gas production and trade, affecting the Russian natural gas export. Furthermore, the internal natural gas consumption in Russia may influence the volumes

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https://doi.org/10.1016/j.esr.2020.100511
Received 9 October 2019; Received in revised form 12 May 2020; Accepted 1 June 2020
Available online 15 June 2020

available for exports. Despite the European market has been a traditional and rather stable export destination for Russian natural gas for decades [17], the re-orientation of Russian natural gas exports towards the Asian market has already taken place. Interestingly, the share of Russian export has grown in both European and Asian markets, without causing any visible disruptions or resource scarcity [18,19], while new infrastructural projects have been established in both Europe and Asia [20,21]. However, enhancing the export of natural gas to Asian countries entails dramatic financial and material costs for Russia to create the requisite infrastructure for the production, preparation, and transportation of natural gas from the vast, sparsely populated region of Eastern Siberia and the Far East, as well as considerable geopolitical challenges [22].

Therefore, Russian and international experts have been actively discussing a strategic re-direction toward Asia [23], as well as the feasibility of an active phase of natural gas exports to major Asian countries such as China, India, Japan, and South Korea [24,25]. The renewal of main strategic documents is however not occurring regularly due to the absence of consensus among government and industry on the current state of the global natural gas markets development, future of Russian natural gas exports and potential volumes [26]. This, by turn, also brings ambiguity in the global natural gas markets development. Owing to recent changes such as market liberalization, geopolitical turmoil, and other exogenous factors [27,28], there is a need to examine the current layout of the global natural gas markets, and challenges and opportunities for Russian natural gas exports.

Analytical studies on natural gas export opportunities for Russia approach the issue from different angles, but predominantly focus on the substantial changes in Russian natural gas export strategies [28], or geopolitical and macroeconomic challenges from the global and regional perspective [18]. However, there is a lack of continuity in studies as the recent changes are not reflected well enough in the current peer-reviewed literature, thus providing a misleading view of the global natural gas markets development. To address this gap, this study suggests a qualitative analysis based on recent statistical data, and discusses the challenges for Russia with regard to its natural gas export future based on an analysis of the perspectives of different natural gas markets. The objective is to provide an answer to the following question: "What are the perspectives regarding Russian natural gas export in global natural gas markets?" We predominantly focus on the capacity of markets, growth trends, challenges, and entry barriers to the world's largest natural gas markets, as well as recent macroeconomic and geopolitical changes. Compared with earlier literature, this analytical paper has updated and more refined data on the current state of the largest natural gas markets, as well as Russian natural gas export and export strategies, and underlines the critical challenges.

The remainder of the paper is structured as follows. Section 2 is devoted to methodology. Section 3 suggests an overview of the state of Russian natural gas exports from a global and national perspective and the country's export strategies related to natural gas. Section 4 presents the results – an analysis of the state of the largest natural gas markets, namely the U.S., European, and Asian markets. It is followed by discussion in Section 5, which summarizes the strengths, weaknesses, opportunities, and threats for the Russian natural gas exports on the perspective markets, suggests practical implications of the study, and specifies limitations and future research. The paper sumps up with concluding remarks in Section 6.

2. Methodology

The study has an analytical character and is based on qualitative and quantitative data sources. The main quantitative data source is the open-source online data from BP Statistical Review of World Energy (for details see section 'Data Availability').

The complementary qualitative data has been acquired via an integrative literature review [29,30], addressing the most updated sources and synthesizing the current state of scholarly research on the topic. The authors conducted the search of scholarly literature (academic papers, monographs, and books) in the fields of energy economics and management, energy policy and energy security via the 'Scopus' and 'KTH Primo' databases in English. The keywords included: 'natural gas', 'markets', 'Russia', and 'export'. The time period for publications was limited to 2016–2019 in order to obtain the most recent literature. The search resulted in 311 hits, where only 6 both qualitative and quantitative studies were found of relevance (Table 1). The scarcity of published academic papers on the topic was observed.

Further, the scope of the analysis was enlarged using backward snowballing [31], and included several relevant peer-reviewed papers and reports dated 2013–2015. The data were complemented by media sources. The recent media sources were accessed through 'Google search news' using the same keywords. The recent media sources include newspaper articles, press releases and other relevant types of online publications. The acquired sources were used in the analysis of the current and future position of Russia on the global export natural gas markets.

Due to the analytical nature of this study, the paper integrates results from both qualitative and quantitative research. The quantitative data was processed by the authors and presented in graphical and table

Table 1
The summary of the results of the integrative literature review.

#	Title	Author(s)	Journal/ Publication year	Subject
1	The shifting geopolitics of Russia's natural gas exports and their impact on EU-Russia gas relations	J.D. Sharples	Geopolitics/ 2016	Russia and EU export-import relationships, and potential effects of closer Russia – China export-import cooperation
2	The strategic implications of the second Russia–China gas deal on the European gas market	A. Orlov	Energy Strategy Reviews/2016	Long-term impacts of Russia – China natural gas export agreement on the European market
3	Some future scenarios of Russian natural gas in Europe	T. Mitrova, T. Boersma, A. Galkina	Energy Strategy Reviews/2016	A share of the Russian natural gas in the European natural gas mix
4	Is Russia building too many pipelines? Explaining Russia's oil and gas export strategy	A. Vatansever	Energy Policy/ 2017	Russia's oil and natural gas export network
5	Strategic Development Outlook for the Energy Complex of Russia.	A.A. Makarov, T. A. Mitrova	Studies on Russian Economic Development/ 2018	The long-term development of the Russian energy complex with relation to the draft Energy Strategy of the Russian Federation for the period through to 2035
6	Impact of Climate Changes on the Regional Energy Balances and Energy Exports from Russia	V.V. Klimenko, A. V. Klimenko, A.G. Tereshin, T. A. Mitrova	Thermal Engineering/ 2019	Possible oil and gas export volumes from Russia based on different scenarios of the global energy complex development

forms. At the final stage of the analysis, the authors used Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis as a complementary tool to provide a synthesis of the challenges and opportunities Russia is facing on the global export natural gas markets. Despite some critics, the SWOT tool is acknowledged in academic literature as a good tool for planning purposes including the country level of analysis [32, 33].

3. An overview of the current state: Russian export of natural gas and export strategies

3.1. Russian natural gas export

Russia is the world's second largest producer of natural gas after the United States, and is followed by Iran, Canada, and Qatar. In recent years, global natural gas production hit a new record of 3868 billion cubic metres (bcm), and that of Russia was 669 bcm in 2018 [1]. The presence of huge natural gas resources in Russia gives the possibility to increase gas exports, regardless of the situation on the domestic market. More than 30% of the total natural gas production in Russia is exported (Fig. 1).

Natural gas export occurs via pipeline systems and in the form of LNG. The Russian natural gas export geography for LNG includes Asia Pacific (Japan, South Korea, and Taiwan), Europe, and other countries (including the Middle East and Canada, with minor volumes), and for pipeline gas includes Europe and CIS countries, predominantly Belarus. Besides, Russia imports natural gas from Kazakhstan and Uzbekistan for further re-export [1]. Fig. 2 shows the main destinations of Russian natural gas export in 2018.

During the USSR phase, a vast system for natural gas export was created, including pipelines, pump stations, and other related infrastructure, which was predominantly directed towards European consumers [34]. The capacity of the developed infrastructure still ensures regular delivery of natural gas to the CIS countries[2] and Europe [21], but the pipeline system is not flexible by its nature, and is connected with specific markets or consumers.

The development of the Russian export potential of natural gas will be significantly affected by future LNG projects (Table 2).

In case all the above-mentioned projects will be implemented, the Russian export potential will reach 65 mln t (96 bcm). It encompasses about 39% of the current export volumes. However, the LNG infrastructure in Russia for long-range exports by sea is limited, even though new terminals are being constructed [34]. Another limitation of expanding LNG trade is the lack of LNG tankers ready to operate [36].

The importance of natural gas exports for Russia is hard to overestimate. From 2015 to 2017, the oil and natural gas industry in Russia

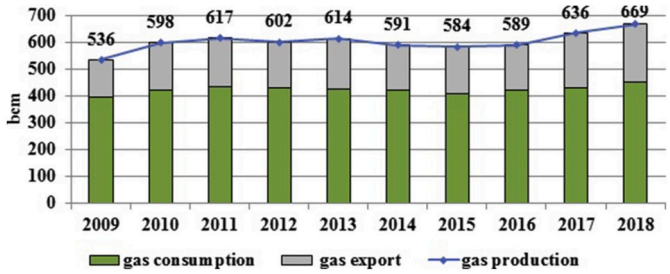

Fig. 1. Russia's natural gas production, consumption, and export [analysis based on 1].

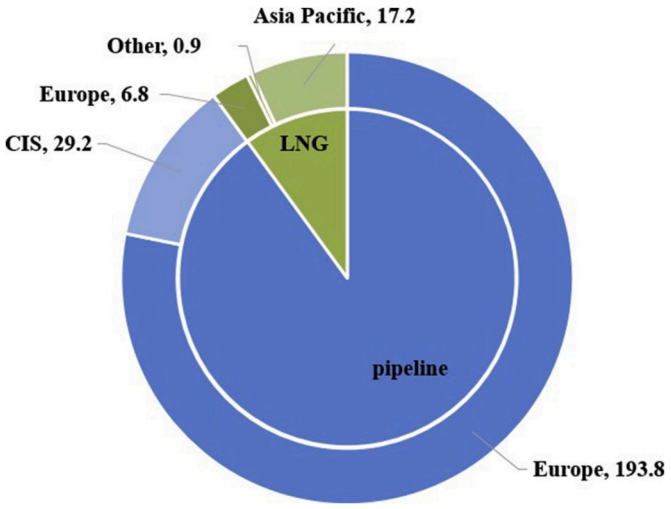

Fig. 2. Russian natural gas export in 2018 by destination, bcm[11] [analysis based on 1].

Table 2
Existing and planned LNG plants in Russia [35].

Project	Location	Capasity, mln t	Shareholders	Status
Yamal LNG	Sabetta, Yamal Peninsula	16.5	Novatek (Russia) – 50.1% Total (France) – 20% CNPC (China) – 20% Silky Way Fond (China) – 9.9%	in operation
Sakhalin 2	Aniva Bay, Sakhalin Island	10	Gazprom – 50% + 1 share Shell – 27.5%-1 share Mitsui (Japan) – 12.5% Mitsubishi (Japan) – 12.5%	in operation
Arctic LNG 2	Gydan Peninsula	18.3	Novatek (Russia) – 100%	planned
Far East LNG	De-Kastri, Khabarovsk region	6.2	Rosneft (Russia) – 20% Exxon Mobil – 30% Sodeco (Japan) – 30% ONGC (India) – 20%	planned
Baltic LNG	Ust-Luga, Leningrad region	10–15	Joint project of Gazprom and Shell	planned

generated up to 40% of federal budget revenues, peaking in 2018 at more than 46% [37], with projections to increase further [38]. A decrease in natural gas export will inevitably lead to decreasing export earnings (up to 70% for producer economies of oil and gas export since 2014) [16], thus affecting the Russian economy. Maintaining the export share and diversifying export routes (both pipeline gas and LNG) are some of the challenges the Russian government and energy companies have to face.

3.2. Russian natural gas export strategy

Russian natural gas exports are historically directed toward Europe, a market on which Russia is both geopolitically and geoeconomically dependent because of the large pipeline transport infrastructure [17]. For many years, natural gas export was mainly determined by the system of contracts with European countries inherited from the USSR [27]. The European market was considered the only and most promising market

[2] CIS, or Commonwealth of Independent States, includes Azerbaijan, Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Uzbekistan, and Ukraine.

even after the collapse of the USSR, when most of the export volume was transported through Ukraine.

Geopolitical issues, including the Russian-Ukrainian gas transit disputes, caused complications [39]. The transit risks were supposed to be mitigated by re-directing European supplies via other routes, avoiding transit countries. These motives, also including the geographical location of main production sites (e.g., Yamal Peninsula), and depreciation of the transmission system of Ukraine, underpinned the construction of the "Nord Stream-1" pipeline [27]. The latter pipeline transportation projects include the "Blue Stream" gas pipeline delivering natural gas to Southeast European consumers via Turkey [40], and "Nord Stream-2" project (currently under construction) [41]. The extensive pipeline system connecting Russia and Europe through several routes is one of the key elements in the Russian natural gas export strategy.

The Energy Strategy of Russia for the period until 2020 (adopted in 2003) [42] directed the markets of CIS countries and Europe, and was primarily targeted towards diversification of export routes in the northern, eastern, and southern directions. Asia-Pacific and the U.S. markets were considered as promising for LNG export. The Energy Strategy of Russia for the period up to 2030 (in force, adopted in 2009) [43] made significant adjustments to the previous version, but assumed that gas export would continue to be based on long-term contracts, and thus allowed for the maintenance of the export volumes to the European market, and significantly increased exports to Asian markets (China, Japan, and South Korea). However, macro-economic and geopolitical challenges (increased competition, globalization of the world market, and shifting demand centers), in line with economic crises and dramatic decline of oil prices led to a deterioration of Russia in the natural gas markets. Further challenges, including the shale gas revolution, Ukrainian crisis, and sanctions against the Russian oil & gas sector made the current Strategy outdated. Despite high turbulence and dramatic changes in the global natural gas markets, the Strategy is not updated yet. The draft Energy Strategy of Russia for the period until 2035 [44] is still under discussion (since 2015 by the current time, April 2020) [45]. The key updates are connected to higher adaptability and innovativeness of the oil and gas industry.

The next document targeting the strategic development of the natural gas industry is "The General Scheme for the Development of the Gas Industry for the period until 2030" (prolonged to 2035 in 2014) [46], which has more specified and detailed plans for the development of the industry. The document in force targets the security of supplies and higher export volumes in 2015 (368.8 bcm, a 33% increase compared to 2018), but also requires updates. In terms of export, the new General Scheme will focus on LNG export liberalization and export diversification toward Asian markets [47]. It is worth mentioning that the General Scheme can come in force only after approval of the Energy Strategy.

Gazprom, a more than 50% state owned company controlling the natural gas pipeline transportation system, also implements its own strategy, which is dependent on the two aforementioned strategic documents. The natural gas exports strategy of Gazprom is based on long-term contracts, the principle of a "single export channel," and further diversification of pipeline and LNG exports [48].

To summarize, currently the key directions of natural gas export strategy for Russia are diversification of transport routes, while increasing export volumes, and intense expansion to Asian markets. These strategic plans, however, have not been for the most part renewed since 2009, despite recent macroeconomic and geopolitical changes.

4. Results: analysis of Russia's export potential for natural gas markets

What are the perspectives regarding Russian natural gas export in global natural gas markets? To answer this question, we analyze the dynamics of the export–import supplies of each of the largest global markets, namely, the U.S., European, and Asian markets.

4.1. Dynamics of the export–import supplies on the global natural gas markets

4.1.1. The U.S. Market

The United States is the largest natural gas producer and consumer [1]. Over the past 10 years, from 2009 to 2018, gas consumption in the United States increased by 199.5 bcm (32%), and domestic production increased by 274.2 bcm (49%). Dynamics of gas production and consumption for the period 2009–2018 are shown in Fig. 3.

A significant increase in domestic production of natural gas in the United States due to the start of commercial production of shale gas dramatically influenced the layout of natural gas export globally. Fig. 4 shows natural gas interregional trade movements in the United States. Since 2017, the United States has turned from an importer into a net exporter of natural gas (net export in 2018 reached 16.6 bcm).

At present the United States is reconstructing LNG regasification terminals into liquefaction ones. There are four already functioning LNG export facilities, and two to come [49]. In the coming years, this will allow the United States to significantly increase the export of LNG to world markets. Currently, LNG export volumes are growing exponentially, and reaching record volumes on a monthly basis [49].

4.1.2. European market

Europe[3] is a net importer of natural gas, where the consumption far exceeds the total proved reserves in the region. Summarized data on natural gas production, consumption, and additional required natural gas volumes in Europe are in Fig. 5.

Stagnating energy consumption in Europe (projected decline in primary energy consumption in the EU is −13% 2017–2040) [50] is one of the factors influencing the decreasing natural gas consumption. Nevertheless, Europe's natural gas imports are increasing, and the ratio is projected to rise from 75% to 88% [50]. Even though energy consumption in Europe is projected to decrease, inter-European production is falling (−1.5% p.a. from 2007 to 2017) [1], opening up space for additional natural gas imports. Another reason is the phasing out trends to less carbon-intensive energy resources such as natural gas.

The structure of natural gas imports in Europe is especially interesting (Fig. 6). The natural gas market in Europe has a more comprehensive export–import structure than the U.S. market does, owing to the presence of a number of exporters (Russia, Central Asian countries, as well as MENA countries), with natural gas being delivered to European consumers through pipeline systems and as LNG. There is also an

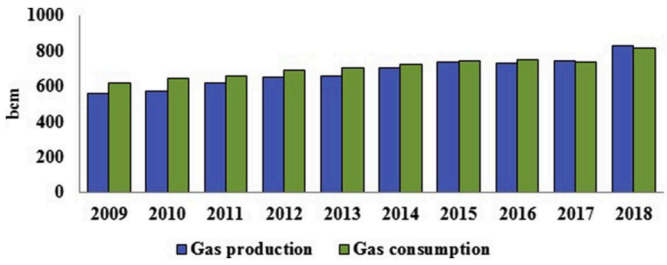

Fig. 3. Dynamics of U.S. gas production and consumption for the period 2009–2018 [analysis based on 1].

[1] Includes re-exports (Kazakhstan and Uzbekistan).

[3] Europe implies European members of the OECD plus Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Gibraltar, Latvia, Lithuania, Malta, Montenegro, North Macedonia, Romania, Serbia, and Ukraine. The definition is according to BP [65].

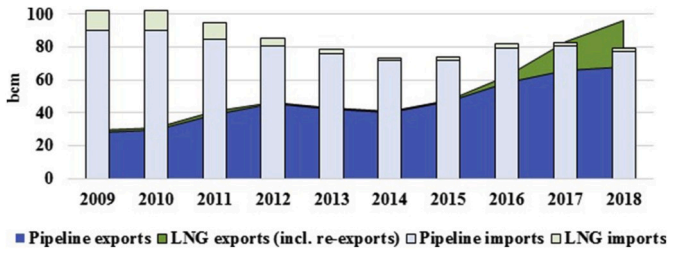

Fig. 4. Natural gas interregional trade movements the United States [analysis based on 1].

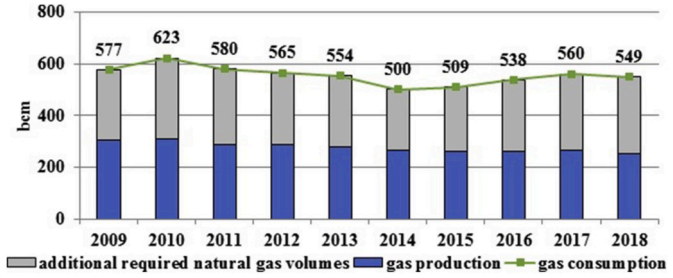

Fig. 5. Natural gas production, consumption, and additional required volumes in Europe [analysis based on 1].

interregional trade movement of natural gas via pipeline systems between European countries, but there are no export flows outside Europe.

The consistently declining trend in Russian natural gas exports to Europe has reversed, and is currently showing slow growth. The share of Russian export of natural gas to Europe constituted more than 35% of the total European import in 2018, with pipeline gas accounting for more than 40% and LNG for approximately 10%. These numbers are, however, valid if import within Europe (from Norway, Netherlands, and other EU countries) is included. In terms of interregional natural gas movement (e.g., only imports from outside the EU), the share of Russian export natural gas in the European market reaches 60% (78% from interregional pipeline imports).

Russian natural gas exports to the European market occur through five main gas pipelines (Table 3). Of these, two main export pipelines (accounting for approximately 45% of the export volume), "Urengoj-Pomary-Uzhgorod" and "Soyuz," which pass through Ukraine, were built in 1983 and 1979, respectively, and require reconstruction [51]. Large export volumes through these two pipelines and technical challenges, along with tense Russian-Ukrainian relations [39], result in a high risk scenario.

To mitigate risks related to infrastructure, Russia initiated two gas pipeline projects, Nord Stream-2 and TurkStream [41,53], with a total volume of 70 m^3. These projects can radically change gas transport flows, making them transit-free, and reduce the risks of natural gas

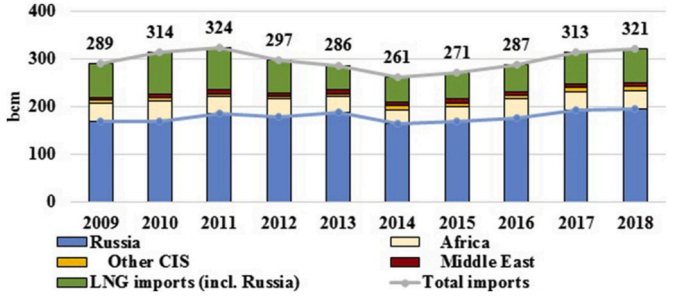

Fig. 6. Natural gas import structure in Europe (interregional movements, excluding within-Europe production) [analysis based on 1].

Table 3
Some natural gas export pipelines from Russia to Europe [52].

Pipeline	Route	Capacity[a], bcm
Urengoj-Pomary-Uzhgorod (including pipeline Progress)	Russia-Ukraine-Slovakia	60.5
Soyuz	Russia-Ukraine-Moldova-Rumania	26
Yamal-Europe	Russia-Belarus-Poland-Germany	32.9
Nord Stream-1	Russia-Germany	55
Blue stream	Russia-Turkey	16

[a] Real export volumes may differ from the projected capacity.

transport to Europe [54].

4.1.3. Asian markets

China, India, Japan, and South Korea are the biggest energy consumers in the Asia Pacific, capable of allocating large volumes of natural gas exports [55]. In 2018, China remained the traditional leader in the world in terms of energy consumption, reaching 3273 million tonnes oil equivalent (mtoe), while India occupied the third place globally at 809 mtoe [1]. Natural gas consumption and import of the four biggest consumers in Asia are presented in Fig. 7 during the period from 2009 to 2018.

Japan, India, and South Korea currently fully satisfy their natural gas consumption through LNG imports under long-term contracts. China is an importer of both LNG and pipeline natural gas (39.5%) [1]. The import of LNG is mainly based on long-term contracts. The main LNG suppliers for these four countries are presented in Table 4.

The main pipeline natural gas suppliers for China are Turkmenistan, Uzbekistan, Kazakhstan, and Myanmar (in accordance to export volumes) [1]. In 2018, Russian natural gas export shares to those countries constituted 8.3% of the total export volumes in Japan, 4.3% in South Korea, and only 1.8% and 1.6% in China and India.

Despite the significant and growing consumption of natural gas, coal is still the basis of energy production in the four above-mentioned countries – China, Japan, India, and South Korea. In 2018, they were collectively responsible for almost 68% of global coal consumption (2564.6 mtoe), of which China accounted for 50.5% (1906.7 mtoe, not including China Hong Kong SAR) [1]. The share of coal in the energy balance of China is 58.2%, in India 55.9%, Japan 25.9%, and South Korea 29.3% [1]. Along with energy transition, these volumes of coal consumption can be substituted by cleaner natural gas [16]. Asian countries pay much attention to the development of renewable energy sources. However, renewables will be able to cover only a small part of their energy consumption [15]. In case all the coal in the above-mentioned countries is substituted by cleaner natural gas, there will be additional market potential for up to 3 trillion cubic metres (tcm) of gas annually (2564.6 mtoe of coal consumption multiplied by the natural gas conversion factor 1.163 [1]).

5. Discussion: global perspectives of Russian natural gas export

This section consequently discusses the main perspectives of the Russian natural gas export. We complemented the market analysis with a SWOT analysis of the potential natural gas export markets.

5.1. U S. Market

From an importing country the United States has turned into a gas exporter, becoming the fourth-largest supplier of LNG in the world after Qatar, Australia, and Malaysia [1]. The U.S. natural gas market analysis (section 4.1.1) shows there is no capacity and demand for Russian natural gas. Therefore, it can be concluded that this market is closed for Russian natural gas exports, at least for the short and mid-term; thus, we

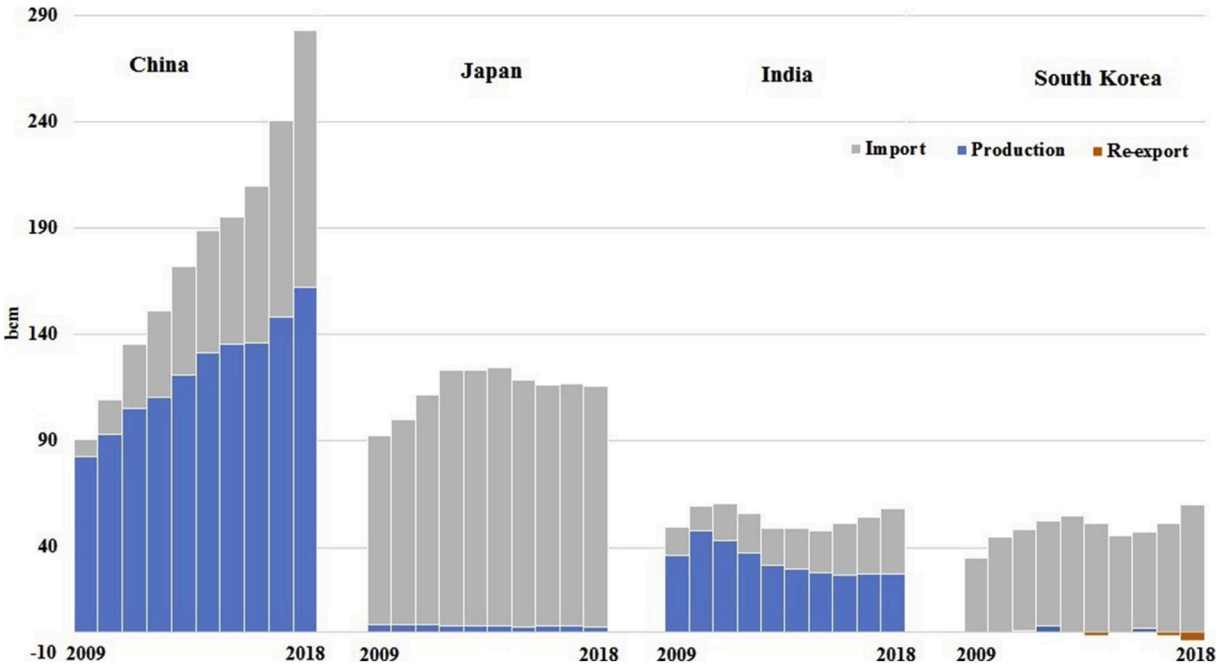

Fig. 7. Natural gas consumption and import of the biggest energy consumers in the Asia Pacific [analysis based on 1].

Table 4
LNG imports of selected countries in 2018, bcm [1].

from	to				
	China	Japan	India	South Korea	Total
Australia	32.1	39.1	2	10.8	84
Qatar	12.7	13.5	14.8	19.6	60.6
Malaysia	7.9	15.1	0.4	5.1	28.5
Indonesia	6.7	7	–	4.7	18.4
Russia	1.3	9.4	0.5	2.6	13.8
Papua New Guinea	3.3	4.3	–	0.1	7.7
Oman	0.7	4.2	1.5	5.8	12.2
Brunei	0.3	5.7	–	1	7
USA	3	3.4	1.3	6.5	14.2
UAE	–	6.8	0.5	–	7.3
Nigeria	1.5	2.1	4	0.6	8.2
Others	4	2.4	5.6	3.4	15.4
Total	**73.5**	**113**	**30.6**	**60.2**	**277.3**

have excluded it from further discussion.

5.2. European market

The European market is an important destination for Russian natural gas exports, as it has been a base for export revenues since the 1970s [27]. Simultaneously, Russia has traditionally been the main natural gas supplier, accounting for the largest share of European imports. Despite long export–import relationships, available natural gas resources, and established infrastructure, which makes natural gas export justified for both parties, Russian natural gas export prospects in the European market are mixed. The SWOT analysis[4] in Table 5 summarizes the main factors that determine the Russian natural gas strategy for the European gas market.

The recent global changes, e.g., the change in export-import flows of natural gas due to the tremendous increase in shale gas production in the United States (see section 4.1.1), and global increase in LNG production [36], are significantly affecting the European gas market, where many more exporters compete for the market access. Therefore, Russia will experience significant difficulties in gaining a higher import share, or even maintaining the current levels, because of higher competition and natural gas oversupply in the European market (e.g., from other LNG producers like Qatar, the countries of North Africa, and the United States). However, it has never been the question of the re-direction of the natural gas volumes from the EU consumers towards Asia [18].

Natural gas prices have continued on a decreasing trend during 2013–2016 due to increased supply. Currently, price wars in natural gas markets are becoming a reality with further expansion of U.S. shale gas, gas-to-gas competition, and deeper restructuring of global energy balance from coal to natural gas [27]. After a slight increase, European gas prices were reaching historical lows because of oversupply and competition, specifically in Russia and the U.S [3]. On the contrary to the analysis provided by Sharples [18] on the price competition, some LNG supplies are redirected from satisfied Asian markets, and compete with cheaper pipeline gas on the European market. Even though Russian pipeline natural gas is considered to be competitive as it is cheaper than that from North America, it has a higher breakeven price than other exporters, e.g., MENA countries [56]. Additionally, seasonal challenges may occur. Warm winters, as of 2019–2020, keep EU gas storages full,

Table 5
SWOT analysis of the European market.

Strengths	**Weaknesses**
Available natural gas resources Existing pipeline infrastructure Stability of supplies Long-term export–import relationships	Volatility of demand Technical challenges related to worn pipeline transportation equipment
Opportunities	**Threats**
New export pipelines Growing LNG exports	Delays in new export pipelines construction Growing competition from other LNG suppliers Limited access to European gas market Oversupply

[4] SWOT Tables 5 and 6 represent the summary of the results based on the conducted analysis made by the authors.

thus lowering the demand for gas, and causing redirection of unnecessary the LNG supplies to other markets.

Besides, other than purely economic and technical factors, e.g., geopolitical issues, may limit Russian access to the European market. The geopolitical factor seems to be more powerful to affect Russian long-term export plans to the European market, than diversification or scarcity of reserves, as suggested by Orlov [19]. One of these are possible political decisions that limit the use of European gas transmission systems for Gazprom (e.g., Opal pipeline, which carries gas from the Nord Stream-1 to customers in Germany and the Czech Republic) [57]. Additionally, at the end of December 2019, the United States President Donald Trump has signed a law that implies sanctions against companies involved in the construction of the Nord Stream-2 gas pipeline, thus hindering diversification of Russian natural gas export routes to Europe [58]. As a consequence, one of the challenges faced by Gazprom may be to complete the construction of the Nord Stream-2 gas pipeline. Currently, the project has been implemented at 94%. More than 2.3 thousand km of pipes have been installed, while another 160 km remain to be installed. Swiss company Allseas recalled its pipe-laying ships to avoid the risk of the U.S. sanctions. However, the Russian ship 'Akademik Tscherski', which belongs to Gazprom, could replace the Swiss ships and complete the installation of the pipeline [59].

The current events and recent data on the volumes of Russian natural gas export to Europe supports the analysis provided by Mitrova et al. [28] on its continuous prominent role in EU natural gas import, despite strong climate agenda [25]. Furthermore, regardless of all threats, the Russian export strategy for the European market should not be directed toward maximization of short-term revenues, but instead, toward securing a share of the European market through the gradual development of a win-win strategy. This implies stable export volumes for Russia as an exporter, and secure and stable supplies for Europe as a consumer. The benefits of such strategy can be exemplified of the positive impact of recently signed agreements between Gazprom and Naftogaz (Ukraine) to continue Russian gas transit through Ukraine until 2024 inclusive [60], which contributes to stabilization and security of the European natural gas market, and also keeps the current export share of Gazprom stable.

5.3. Asian markets

The diversification of Russian natural gas exports is essential from the market perspective (developed from the 1990s) [27], and does not contradict with the European export direction since export volumes to Europe will not be affected by the growing volumes to Asian markets [61] However, successful diversification requires careful planning. The SWOT analysis in Table 6 summarizes the main factors determining the future of Russian exports to Asian markets.

The current export volumes from Russia to Asian markets are modest, but can be significantly increased, both in the form of LNG and pipeline gas, through the development of infrastructure. Further projects to allow higher export volumes to Asian markets are the Sakhalin-3 project (potential resources 1.3 trillion m3 of gas) [62], and an LNG transshipment terminal in Kamchatka Peninsula (21.7 million tons of LNG per year by 2026, delivered from Novatek gas liquefaction plants located in Yamal Peninsula) (Fig. 8). The existing resources and infrastructure allow Russia to compete for higher shares in Asian markets, specifically in Japan, India, and South Korea.

China has the most attractive market potential for Russian natural gas export due to huge volumes and projected growth potential. Both Russia and China have already taken serious steps towards expanding cooperation – Gazprom, and the China National Petroleum and Gas Corporation signed a 30-year contract for 38 billion m^3 of gas annually, starting from 2019 through the gas pipeline "Power of Siberia" which was launched on December 2, 2019 (Fig. 8). The two countries have already committed to more intense long-term export-import relationships, but there is still a significant potential to expand, where the already existing infrastructure can serve as a base for further cooperation. Additionally, another potential gas pipeline – 'Power of Siberia-2' or 'Altai' project – clearly defines the priorities of the Russian natural gas export strategy to expand [63]. These announced constructions and developments of the natural gas export infrastructure contradict with the analysis provided by Orlov [19] on the potential scarcity of natural gas reserves. Further, it should be noted that based on this study and recent events (i.e. prolonged contract with Ukraine and Nord Stream-2 sanctions, section 5.2), additional gas export pipelines and diversification of exports towards Asia does not seem to add to the "bargaining position" [21] of Russia with Ukraine and EU, but are directed to increase access to Asian markets.

Table 6
SWOT analysis for Asian markets.

Strengths	**Weaknesses**
Existing pipeline infrastructure Already contracted natural gas volumes	Long-term contracts with other suppliers
Opportunities	**Threats**
Fast growing energy demand Increasing volumes of pipeline gas and LNG exports New pipelines and natural gas fields in the region	Highly competitive environment Oversupply

Even though Asian markets are highly competitive, and there is a potential threat of oversupply, these markets are capable of accommodating even larger natural gas volumes due to intensive natural gas consumption growth. From a commercial and strategic perspective, Russia has the capabilities to diversify towards Asian markets, and should seek increased access.

5.4. Pricing and natural gas hubs

Pricing is one of the cornerstones for Russian natural gas export, if not always the decisive factor, as geopolitical and strategic issues tend to dominate. Nevertheless, there are some pricing issues to consider, such as natural gas market price wars and price benchmarking. Gas-to-gas competition is a challenge for Russia, both from the external perspective (e.g., shale gas from the U.S.), but also from the internal one. Gazprom, being a monopolist in Russian pipeline natural gas, may be affected by potential market liberalization or competition from other Russian companies [23]. This may change the Russian gas market dramatically [16]. In order to keep its position in the European market while gaining higher shares in Asian markets, Gazprom should choose the right strategy, including a price policy. Another challenge for Russian natural gas export is the creation of a price benchmark in the Asian region. Specifically, this is an issue with regard to natural gas export to China. Since natural gas prices in China have historically been benchmarked with much cheaper coal [64], Russia has difficulties in sustaining its export margin, especially compared to the exports to European markets.

Future LNG projects (Table 2) will open new opportunities for Russia's natural gas export. The list of importing countries may be significantly extended, including the growing import volumes from the partner countries (foreign investors from China, India and Europe). This will also demand higher attention to pricing issues, such as the development of the spot market for natural gas.

The initial step towards mitigating the pricing misbalance is the creation of a gas hub network. The transshipment terminal being built in Kamchatka Peninsula can become the first Russian gas hub in the Asia-Pacific region, but for the reliable and secure operation of the gas pipeline "Power of Siberia," at least one more gas hub is needed. Taking into consideration the location of the main natural gas resources directed for exports, existing and future transportation systems, and export potential to the Asian markets, the most promising areas for gas

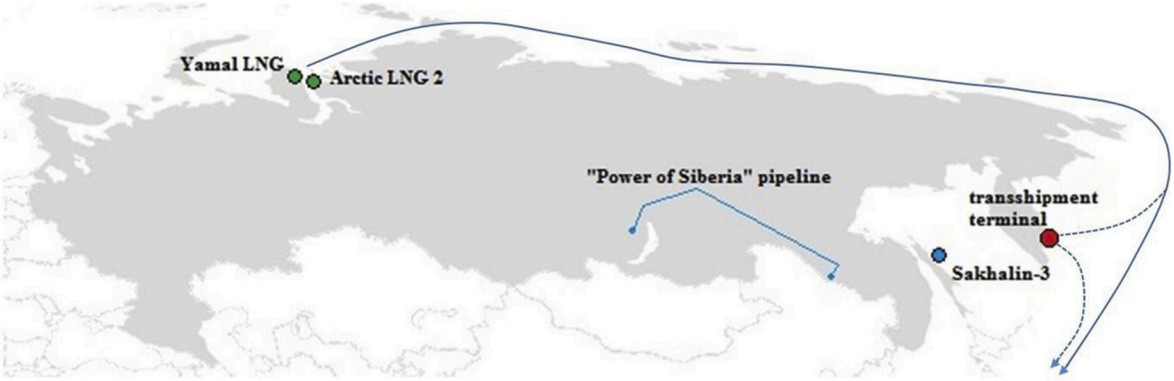

Fig. 8. Scheme of LNG transportation from Yamal Peninsula to the Asian region and the pipeline "Power of Siberia".

hubs are in the East Siberia region (Krasnoyarsk and Irkutsk production centers, Fig. 8).

5.5. Practical implications, limitations and future research

The analysis presented in the paper is built on the most recent data, thus gives the updated and most relevant view on the state of global natural gas markets, and perspectives of Russian natural gas exports, thus useful for policymakers and industry practitioners. The presented analysis, including graphical material and SWOT analysis, can serve as a base for continuing investigations of challenges and opportunities for Russian natural gas exports. Specifically, the study is useful for further development of the Energy Strategy of Russia and the General Scheme. The results of the study can be used for scenario and planning purposes, for example, for the planning of related strategies in the EU, Russia, and Asian countries.

This study is, however, subject to some limitations. First, a different methodology (i.e. literature review) can provide slightly different results. Even though the more complex method can be applied, we found the results reliable and confirmable by the current global natural gas markets' developments.

Second, given the strategical importance of the topic, there is a limited excess to the primary documents, which otherwise could have resulted in a more detailed analysis. For example, in order to analyze how a set of the new agreements between Gazprom and Naftogaz will affect the security of Russian natural gas transportation through the Ukrainian pipeline system, we need to get a full text of these documents. Unfortunately, these documents are not available in open access. Nevertheless, the limited access to the primary documents is compensated by trustworthy and detailed international statistical data sources (i.e., BP).

Third, it may be of use to conduct a more detailed analysis of each of the national markets within the EU and Asia. Such kind of analysis may provide a more detailed understanding of the global natural gas markets' development. Such an analysis may be a subject for a larger investigation.

Finally, given the urgency of the subject, the constantly updating situation on the global natural gas markets, new agreements on e.g. pipelines construction, etc., may require regular updates.

6. Conclusion

Russia is one of the world's largest producers and exporters of natural gas, and experiences significant challenges in maintaining and increasing its natural gas export volumes. At the same time, it is exposed to new opportunities. A decrease in export incomes will inevitably and negatively affect the country's economy; thus, the importance of a natural gas export strategy cannot be underestimated. Nevertheless, Russian natural gas export and energy strategies have not been renewed since 2009, and do not reflect the recent global changes, which significantly influence the positioning of Russian natural gas exports. By focusing on the recent changes on the global natural gas markets, the study addresses the lack of continuity in the analysis of challenges and opportunities for the Russian natural gas exports and provides the most contemporary analysis and overview of the related issues.

The largest natural gas consumption markets are the U.S., European, and Asian markets. The study analyzed the Russian natural gas export potential in all the above, according to the recent macroeconomic and geopolitical changes, and global trends.

The analysis of the U.S. natural gas market showed that there is no capacity for Russian natural gas exports due to increasing internal production of shale gas. Moreover, the United States has become a competitor for Russia in other natural gas markets.

European markets are still the main destination for Russian natural gas exports, but the prospects are mixed. There are contradicting trends in the European market, such as reducing consumption, declining internal production, and others, which blur Russian natural gas export perspectives. Simultaneously, increased competition from other natural gas producers, gas-to-gas competition, price wars, and geopolitical issues add significant challenges for Russia. Nevertheless, the analysis showed that efforts should be directed towards maintaining the current natural gas export shares.

Asian markets, such as China, India, Japan, and South Korea, are the most promising for Russian natural gas export, because of enormous market capacity to accommodate larger volumes of natural gas, dynamics of energy consumption, and the phasing out of coal. Even though there is a risk of high competition and oversupply in Asian markets, Russia should secure its access to these markets and aim for a further increase in natural gas export shares. One of the key issues for expanding the Russian natural gas export specifically towards Asian countries is a development of gas hubs in the East Siberia region.

The paper suggests a structured and gradual analysis of challenges and opportunities for the Russian natural gas exports including graphical material and SWOT analysis, which can serve as a base for future research and planning.

Data Availability

Datasets related to this article can be found at https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html, an open-source online data hosted at BP website, Statistical Review of World Energy.

CRediT authorship contribution statement

Vladimir Kutcherov: Conceptualization, Investigation, Writing - original draft, Supervision. **Maria Morgunova:** Conceptualization, Investigation, Writing - original draft, Methodology. **Valery Bessel:**

Formal analysis, Writing - original draft. **Alexey Lopatin:** Formal analysis, Writing - original draft.

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