REVISTA INCLUSIONES

TRABAJO EN EQUIPO SIN FRONTERAS

Revista de Humanidades y Ciencias Sociales

Volumen 7 . Número Especial
Octubre / Diciembre
2020
ISSN 0719-4706

REVISTA
INCLUSIONES M.R.
REVISTA DE HUMANIDADES
Y CIENCIAS SOCIALES

CUADERNOS DE SOFÍA
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Editorial Cuadernos de Sofía
Santiago – Chile
OBU – C HILE

Indización, Repositorios y Bases de Datos Académicas

Revista Inclusiones, se encuentra indizada en:

CATÁLOGO

BIBLIOTECA UNIVERSIDAD DE CONCEPCIÓN

REVISTA INCLUSIONES M.R.
REVISTA DE HUMANIDADES Y CIENCIAS SOCIALES

CUADERNOS DE SOFÍA EDITORIAL

ISSN 0719-4706 - Volumen 7 / Número Especial / Octubre – Diciembre 2020 pp. 632-647

NORTHERN SEA ROUTE AS A FACTOR BEHIND THE IMPLEMENTATION OF RUSSIAN ARCTIC LNG-PROJECTS

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Fecha de Recepción: 10 de junio de 2020 – **Fecha Revisión**: 19 de junio de 2020

Fecha de Aceptación: 27 de septiembre 2020 – **Fecha de Publicación**: 01 de octubre de 2020

Abstract

Developing and improving the sector of liquefied natural gas production is one of the most promising directions for the nearest future of the Russian gas industry. The major resource areas of natural gas are located in the Northern areas of the country (the Yamal Peninsula and other areas of Arctic zone). Therefore, a logistic component of delivering liquefied natural gas to a consumer is a task of a top priority. The use of emerging opportunities of the Northern Sea Route for solving this problem enables to naturally reduce immediacy and delivery hardships. The major purpose of the conducted study was to identify a variety of issues, arising from the implementation of Arctic projects aimed at producing and consuming liquefied natural gas. The research was intended to define the entire complex of urgent solution-required problems and to assess them in economic terms to enhance the competitiveness of this type of Russian product on the global markets. Thus, the paper analyzes the promising projects of producing and consuming liquefied natural gas in the Russian Arctic sector, as well as exploiting associated Northern Sea Route potential.

Keywords

Liquefied natural gas (LNG) – The Northern Sea Route – Nuclear icebreaking fleet – LNG-tanker

Para Citar este Artículo:

Tatarenko, Valeriy I.; Usikova, Oksana V. y Lyapina, Olga P. Northern Sea Route as a factor behind the implementation of Russian Arctic LNG-projects. Revista Inclusiones Vol: 7 num Especial (2020): 632-647.

Introduction

The Northern Sea Route (NSR) is the most important communication structure in the Arctic zone of the Russian Federation; this shipping route links the districts of Northern European, Northern Siberian, and Far East regions of Russia and ensures the interconnection of the Arctic territories with developed regions of the country.

Nowadays, as well as before, the NSR fulfills several important functions:

- The NSR ensures the country's defense capacity form the North;
- The NSR ensures life-sustaining activities of the residents of the western part of the Arctic Ocean (AO) coast and functioning of Norilsk Mining Centre;
- The NSR itself represent an attempt to establish a back-to-back transit sea route from Europe to Southeast Asia[1].

However, in the immediate future, the most important NSR function will include transportation and logistics services for the development of natural resources of the Russian continental shelf and the related terrestrial area.

Hence, a major priority is given to the implementation of the Russian Arctic projects of producing and consuming liquefied natural gas (LNG-projects)[2].

In this regard, the relevance of the study is due to the economic circumstances in the oil and gas sector in the context of the emerging sanctions regime, changes in the market for traditional sales of hydrocarbons and the call to diversify the methods of delivering the gas product to the end user.

The study is aimed at identifying a range of issues associated with the implementation of Arctic LNG projects by defining the entire complex of the solution-required problems and assessing them in economic terms to enhance the competitiveness of this type of the Russian products on the global markets. The established goal specifies a need for solving the following problems:

- generalization of the available information on the conditions and perspectives of creating LNG sector in the Russian Federation, as well as on the optimal ways and trends in the realization of output, and on the natural resource base that secures the solved tasks;
- assessment of the LNG consumer market with respect to the unfolding conditions;
- identification of the problems obstructing the sought outcome, namely, a market extension and maximization of profit from selling Russian crude hydrocarbons;
- evaluation of probable ways for solving the identified problems and assessment of the degree, to which they affect meeting the specified objectives.

[1] E. Voronina, "Transport development of Arctic territories: strategic tasks and analysis of risks", Arctic: ecology and economy, num 3 (2017): 61-68 y Problems of the Northern Sea Route. Under editorship of A.G. Granberg and V.I. Peresypkin (Moscow: Nauka, 2008).

[2] K.V. Voronov, "Arctic horizons of the Russian strategy: modern dynamics", World economy and international affairs, num 9 (2010): 54-65; E. Ogorodnikov, "Liquefy in the Russian style", Expert, num 40 (2016) y Russia in Arctic. Challenges and perspectives of development. Under editorship of M.V. Remizov (Moscow: Knizhniy mir, 2015).

Materials and methods

Statistical and information data reflecting the development of the LNG sector in the Russian Arctic and the dynamics of cargo transportation via NSR published in public sources constitute an informational basis for the presented publication. To obtain the desired result the authors used the methods of comparison, balance, and mathematical modeling. The conducted study has the nature of actual economic assessment with the purpose of enhancing the competitiveness of the Russian gas industry.

Thus, the research plan was drawn up as follows:

- Evaluation of the information realm in the area of producing and consuming LNG and subsequent retrospective analysis of the acquired information;
- Assessment of the time input (including the estimation of an economic component) for the LNG products transportation using conventional ways to European and Asian markets via traditional routes and the NSR;
- Identification of the major problems of developing Russian LNG according to the study results with the assessment of possible solutions.

The results of the conducted review of the information realm (including available statistical and other analytical information on the problem as well) suggested the hereinafter contained conclusions on the current state and perspectives of the Russian LNG-projects.

Having come to believe in a permanent dominance of giant main gas pipelines, Russia has approached 'dividing a pie' of the global demand for LNG when its most tempting pieces were already taken apart. Russia had not started to supply LNG until March 29, 2009, when the first lot was shipped to Japan under the Sakhalin-2 project. Russian LNG supplies were mostly oriented towards the North-American market, which later proved to be wrong.

As a result of these miscounts and irremissible underestimation of US 'shale gale', current Russia (even launching the first stage of Yamal-LNG project) still rates only 8th by the volume of capacities for liquefying gas, being way below Qatar, Australia, Indonesia, Algeria[3].

As is often the case, Russians were slow starters. Will they go fast? Under certain conditions, it is possible. However, competitors will not idle too. And thus Russian underrun might remain for long.

Until December 2017 (the very launching of Yamal-LNG), Russia had only one LNG plant under the Sakhalin-2 project with two stages of the total rated capacity of 9.6 mln.t/year. However, this plant, as the entire project, in no way can be considered as Russian. Moreover, the project was commenced as an entirely foreign, owned by Shell, Mitsui, and Mitsubishi. In the framework of division of natural resources in the middle of 2000s, the specific special op was undertaken for Gazprom to enter this project when Russian authorities canceled the previously issued positive environmental impact assessment. Thus, shortly after, Gazprom had become an owner of the strategic stake of the company-operator of the project which, however, didn't enable the company to become a leading partner in constructing LNG plant on Sakhalin Island.

[3] Zapolyarny, "Liquefied, reduced-fare", Expert, num 50 (2017).

As per the General Scheme for Gas Industry Development for the period through to 2030 elaborated by PJSC Gazprom, LNG supplies from the Shtokman field were due to be commenced in 2014, and from the South-Tambeyskoye gas field (Tambey fileds) – near 2024-2027. The first project was not destined to be implemented: development of the Shtokman field was postponed for some uncertain period of time. However, the Tambey fields' exploitation was commenced along with the Yamal-LNG plant as recently as 2017.

According to the General Scheme, LNG supplies were targeted towards Pacific Rim countries (which proved to be cost-effective) and USA (which turned out to be completely); Europe was not considered a priority for exporting Russian LNG. The latter trend might be referred to the fact that EU terminals were fully loaded with supplies from Algeria, Qatar, and Nigeria.

The new gas strategy designated among priorities the development of gas resources of Eastern Russia, introduction of natural gas liquefaction technologies, and entry and upholds the positions in the Asian and Pacific markets of liquefied gas. Shtokman gas and condensate field on Sakhalin Island (which fell short of expectation) and South-Tambeyskoye field (pursuant to the newest data, it is the entire group considered as the Tambey fields[4] since they have common Jurassic lower horizons identified in the course of geological survey) were assumed to be the resource base for creation and further LNG production increase in Russia. The following projects on constructing the plants for liquefied gas and export terminals were at the outset of developing LNG industry in Russia:

- Ust-Luga LNG-plant and LNG terminal for exporting gas, supplied via the North European Gas Pipeline (the Gulf of Finland);
- The project of the LNG-plant and terminal for exporting gas of Shtokman field (Barents Sea);
- The project of the LNG plant and terminal for exporting gas of Kharasaveisky field (Yamal Peninsula);
- Preliminary plan for constructing LNG-terminal in Arkhangelsk for exploiting gas reserves supplied via Nuksenitsa-Arkhangelsk pipeline (building of the latter is already underway).
- LNG plant and LNG exporting terminal in a coastal town of Primorsk area (the Gulf of Finland).

LNG supply from European Russia is possible via Black, Baltic, and Arctic seas. LNG terminals may be placed near Tuapse, Kaliningrad, Primorsk, Arkhangelsk, Murmansk, and on the Yamal peninsula as well[5].

The LNG-producing Sakhalin-2 project is the largest one implemented using foreign investments. The Production Sharing Agreement (PSA) within the Sakhalin-2 project became the first of this type signed in Russia - and the very first actually working one.

In 2004, Sakhalin Energy and Tokyo Gas signed the 24-year agreement on supplying LNG to Japan in the volume of up to 1.1 mln t/year. Also in 2007, a 22-year deal was signed with Tokyo Electric, a major power company, which is ready to purchase about 1.2 mln. tons of LNG annually.

[4] Yu. Barsukov, "Gazprom" stocks up a revelation", Kommersant, num 22 (2018): 7.
[5] R. G. Kasatkin, A system of sea transportation of liquefied natural gas from Arctic (Moscow: LKI publishing house, 2009).

This project involved the development of Piltun-Astokhskoye (largely consisted of oil) and Lunsky (mostly gas) fields. The total industrial reserves of hydrocarbons of both fields amounted to more than 1 bln. barrels (150 mln.t) of oil and more than 500 bln. m^3 of gas. LNG plant was built in the vicinity of Prigorodnoye settlement in the south of Sakhalin Island (built in 2006, launched on 18.02.2009). On March 29, 2009, the first batch of the Russian liquefied gas, produced under the Sakhalin-2 project, was successfully shipped from LNG plant by the special Energy Frontier LNG-tanker. This batch of gas was delivered to the two main buyers of Sakhalin gas: Tokyo Gas and Tokyo Electric companies. Eventually, the plant reached the designed capacity of 9.6 mln. tons per year in 2010, which is equivalent to 13 bln. m^3 of natural gas.

LNG production plant built by Sakhalin Energy Company is the most geographically adjacent source for growing Asian and Pacific LNG markets; it is also the first one to supply the regional consumers with Russian gas. It should be noted that due to development of shelf fields of oil and gas, Sakhalin became the most dynamically developing district of the Far East and reached about 80 % of self-sufficiency; it well may become the first district in the Far East that doesn't need further subsidies. Prior to implementing Yamal-LNG project, all the other projects of developing gas resources using LNG technology fell under the category of 'the planned'[6].

Kaliningrad

The great advantage of placing the LNG-terminal in the vicinity of the city of Kaliningrad is the status of a free economic zone that enables to reduce tax payments; and favorable climate conditions that allow using non-ice class vessels, rather than employing ice-breaking fleet.

Among the advantages of locating LNG-terminal near Kaliningrad are:

- The proximity to the main gas pipeline;
- Free economic zone status and available reliefs;
- The absence of sea ice, which denotes the potential use of non-ice class vessels;
- Sufficient navigable depth for using heavy transport vessels.

Disadvantages of this alternative are represented by the following factors:

- Designation of Baltic region as an area of special environmental protection;
- Possible opposition from governments and other structures of neighboring states during the construction of hazardous facilities in the region.
- Possible restrictions on the passage of the Danish straits;
- The necessary transit of crude products through neighboring states via Minsk-Vilnius-Kaunas-Kaliningrad pipeline.

In the course of Strategy 2020 regional forum held in Kaliningrad, the region was called a site for implementing one of the most large-scale projects to develop low-tonnage LNG production in the framework of the PJSC Gazprom gasification program for the Russian regions.

Pursuant to the Program, Gas Oil LLC had planned to build the first facility in Kaliningrad Region to produce LNG with the capacity of 3 ton/hour; it seemed quite possible

[6] V. V. Imshenetskiy, LNG technology – a perspective alternative to develop Yamal peninsula gas resources. Retrieved from: http://www.gasforum.ru/wpcontent/uploads/2007/09/lng.pdf

to build the first gas station in the territory of the district and start switching transportation to the use of natural gas. However, the large-scale Kaliningrad project was canceled due to the known economic circumstances.

Shtokman project

By any name, at the turn of the centuries, Shtokman was a major disappointment of Russian gas producers. Shtokman gas and condensate field is an enormous field of gas in the Barents Sea with the estimated reserves at the level of 3.8 bln. m^3 and up to 37 mln. tons of gas condensate; it was discovered in the late 1980s. Since it is located 300-330 m deep and 555 km away from the Arctic coast, its development was considered highly sophisticated and extremely capital-intensive. The field covers 1400 km^2 area; its exploitation is also challenging due to dangerous icebergs of 1mln. tons weight, drifting with up to 0.25m/sec speed; and brash ice up to 1.2m thick, moving with up to 1m/sec speed. The field has four main formations that might be developed individually; the reservoir depth is 1900 – 2300 m. There are some necessary prerequisites for successful implementation of the exploitation of Shtokman gas and condensate field development, such as:

- Availability of huge amounts of gas that assure stable long-term supplies;
- Availability of possible diversification of supplies through parallel pipelines and the NSR;
- Availability of potential substantial extension in gas production according to the market demand;
- A favorable composition of crude products, enabling to minimize expenses associated with gas treatment and purification;
- Annual temperatures over the region at low altitude, which allow reducing expenditures of energy for gas liquefaction;
- The absence of the transit countries on the way of Shtokman gas to Germany enhances the competitiveness of the project; well-developed infrastructure on the Kola Peninsula also creates favorable conditions for the project implementation;
- Passable distances from crude products' base to the sales markets;
- The absence of the icing and permanent frost layer as a favorable factor for developing the field as compared to the other fields of the Arctic shelf.

Shtokman field development project provided for about 70 bln. m^3 of annually produced natural gas. It is comparable to annual gas production of Norway, one of the largest European suppliers.

Also, an increase in the production level was possible after implementing the first stages of developing the field, providing a favorable economic environment and the relevant demand on the target markets.

A two-phase flow was approved as a technological concept for production, which implied delivery of gas and gas condensate from the field to the coast with their further separation ashore. The two-phase flow enables to minimize marine operations and avoid storing and shipping of gas condensate in the severe Arctic conditions.

To ensure the planned volume of gas production, the following installations were intended:

- two ice-resistant deepwater offshore platforms (IDOPs) with 60 connected wells each;
- underwater production module (UPM) in the wells cluster;

- underwater infield pipeline and cable;
- platform condensate storage system;
- 635 km long main underwater gas pipeline (reaching the Kola Peninsula coast).

Several more sufficiently large fields were identified and surveyed on the Barents and Kara Sea shelves.

However, by late 2010s, Gazprom, having realized enormous challenges of developing Shtokman field that can hardly be overcome, postponed making the final investment decision on constructing LNG production complex. Officially, the Federal Legislation of the Russian Federation on Special Economic Zones Law (SEZ) might have served a reason for it, because it was in contradiction with the established arrangements with the foreign partners-shareholders of Total S.A. and Statoil ASA.

As per the project, the liquefaction plant was supposed to be built by 2016 in Teriberka settlement in Murmansk Oblast. However, Gazprom turned out to be unprepared to take part in the special economic zone of industrial type. The Law on Special Economic Zones grants permission to reprocess local natural resources; the maximum term for SEZ duration is 20 years. However, the SEZ residents shall be the companies registered in Teriberka settlement.

Operator of Shtokman LNG-enterprise, established in 2008 by Shtokman Development AG Company, is an alliance of three shareholders: Russia – PJSC Gazprom with 51 %, France – Total S.A with 25 % and 24 % belongs to Statoil ASA of Norway; the operating company is registered in Switzerland, and its operating term was set for 25 years. The latter fact represents an obvious inconsistency, therefore, the construction of gas liquefaction complex within the Shtokman field could, most likely, require the introduction of changes into the acting legislation.

The reality turned out to be much harder. Due to various reasons, i.e. general economic situation, financial difficulties, Anti-Russian sanctions, etc., the most promising Shtokman project was postponed for some uncertain (however, obviously quite a long) term.

Yamal-LNG

Yamal-LNG is an integrated pluriannual project for producing, liquefying, and selling gas; the first stage of the project has already been commissioned[7].

According to the PricewaterhouseCoopers experts, a share of LNG in the global energy balance may rise from the current 23% to 65% by 2020.

Yamal-LNG Project has the following competitive advantages:

- traditional inland reserves of high-concentration gas;
- well-proven technology of development;
- sufficient geological survey;
- low level of expenses for production due to its high volume;
- high efficiency of the liquefaction process due to low average annual temperature;
- potential delivery of LNG to both European, and Asian/Pacific counties.

[7] Zapolyarny, “Liquefied, reduced-fare”. Expert, num 50 (2017).

Russia, whose involvement in the development of the new technology is long overdue, is trying to compensate it in a truly Russian scale. Large independent domestic company NOVATEK with the support of federal government and authorities of Yamalo-Nenets Autonomous Region (YNAO) had completed construction of gas liquefaction plant on the Yamal Peninsula (to date, the first of the three planned stages of 5.5 mln.t/year capacity has been commissioned). The total amount of investments, taking into account the creation of transport infrastructure, is estimated at around one billion rubles.

Incredible difficulties were overcome by engineers and builders during the plant construction: frost, strong breeze, polar night, ice desert, and ever-frozen soil. Nevertheless, the giant project was implemented. To assure effectiveness and environmental compatibility of constructing wells on the South- Tambeyskoye field, new technologies had to be employed, namely, the construction of horizontal wells with up to 5 km of horizontal displacement; utilization of slurry and drilling sludge; and pit-free drilling. Furthermore, methanol, as one of the necessary components for effective development of the field, is to be produced directly on-site; the electricity is also generated on-site through co-generation turbine power plants.

There are two main reasons for implementing this project, particularly, on Yamal. The first one involves existing enormous reserves. South- Tambeyskoye field, located in the north-east of the peninsula on the shore of the Gulf of Ob, was initially specified as the project resource base. The proved reserves were estimated to be 926 bln.m^3 of gas and 30 bln.t of liquid hydrocarbons. The projected level of annual production amounts to about 27 bln.m^3 of gas for a term of at least 20 years[8].

The second reason involves the project logistics. LNG-tanker may move from Yamal both to European and Asian/Pacific countries as well. According to Dmitry Kobylkin, the governor of Yamalo-Nenets Autonomous Region, 'the unique location of Yamal allows creating flexible, competitive logistic model ensuring all-the-year-round supplies of LNG to European and Asian/Pacific markets via Northern Sea Route'.

That's why the leading foreign oil and gas companies expressed a great interest in the project. However, the French Total S.A., which acquired a share in NOVATEK with authorized 20.5% in Yamal-LPG project already in 2012, was ahead of all the others.

As per the agreement, Total S.A. added to the project its own experience in introducing cutting-edge technologies in the sphere of liquefying natural gas, its storing and transporting means; the company also intended to assure financial stability and economic effectiveness of the project. Total S.A. has enough experience: they have already been dealing with LNG problem for more than half a century. The company is actively participating in LNG productions in effect and under construction in many countries of the world.During 2013-2017, intensive actions were taken on placing and fulfilling orders, attracting advanced productions, improving staff qualifications, building up experience in solving technical and technological problems, and operating in severe Arctic conditions. Within the same time period, a new Arctic port was built in Sabetta settlement on the basis of state unitary enterprise (SUE); the port is capable of accommodating LNG-tankers of 140-160 thsd. m^3 gas volume capacity and self-powered tanker fleet of up to 20 vessels[9].

[8] Yu. Barsukov, "Gazprom" stocks up a revelation". Kommersant, num 22 (2018): 7.
[9] E. Voronina, "Transport development of Arctic territories: strategic tasks and analysis of risks", Arctic: ecology and economy, num 3 (2017): 61-68.

It should be especially noted that 'Arctica' drilling rig systems were designed and manufactured specifically for the project. They are fully protected from winds, which assures fundamentally different conditions of labor for staff, and permanency of drilling with no regard to weather conditions.

In addition to the natural and climatic obstacles, economic and political barriers were also experienced in the course of implementing Yamal-LNG project: NOVATEK and its 12 subsidiaries faced the US sanctions.

Therefore, it is difficult to share the buoyant and optimistic assessment of sanctions and their consequences, given by Minister of Industry and Trade Denis Manturov: 'That portion of sanctions we have encountered within the last three years has brought only benefits'.[10] Indeed, sanctions affect not only supplies of equipment, the increase in production of which is stipulated by the state documents. The most important issue involves the financing of the project.

The funds of about 14bln. USD were obtained from Chinese banks and Chinese governmental Silk Road Fund that entered the project. Assistance from the Russian National Wealth Fund was much less and amounted to 15bln. rubles. And despite the fact that more than 600 Russian companies were involved as the suppliers of equipment, they hardly accounted for 20% of all expenditures in monetary terms.

After all the obstacles had been removed, the first processing train of Yamal-LNG plant terminal of natural gas liquefaction was put into operation early in December of 2017[11]. As early as December 8, the first batch of LNG was loaded into the specially built LNG-tanker Christophe de Margerie (named in commemoration of the outstanding leader, main executive director of Total S.A., who died in the absurd airplane crash in Vnukovo airport in October 2014). This batch was to be sent to China, however, out of the blue, the Russian liquefied gas has come to … the US, which earlier promised to literally inundate all Europe with gas; first of all, that promise was referred to Poland and Lithuania. As Boris Yeltsin used to say: "What a curlicue, you know, happened!"

However, in all seriousness, there is no any service on the part of Russian Gazprom; the reason for all that happened is in the sudden frosts in America, which forced the country to buy gas at the extremely high price (up to 3500 USD/1000m^3) [12].

Today, Russian Arctic LNG-projects may have hope for encouraging perspectives. Launching the 2nd and the 3rd stages of the Yamal-LNG plant are planned for 2018 and 2019 years, respectively. After the 3rd stage commissioning, Russia might rank in the top five of the largest LNG producers (although, Qatar, Australia, Indonesia will remain well ahead of others since these countries and other competitors obviously won't idle). Relying on the most optimistic forecasts, the following indicators might be achieved: Arctic LNG-2 project – 16.5 mln. tons by 2024 (NovaTEK), Vladivostok LNG (5 mln. tons by 2020), and Baltic LNG (10 mln. tons by 2021 Gazprom), Pechera LNG (2.6 mln. tons by 2023) and Dalnevostochny LNG (5 mln. tons after 2023 Rosneft)[13].

[10] I. Chernykh "Interview with D. Manturov", Arguments and facts, num 3 (2018).
[11] N. Ul'yanov, "Overcoming", Expert, num 1-2 (2018).
[12] A. Kotz, "USA started to buy the Russian gas", KP (in Novosibirsk), num 2 (2018) y Why USA decided to buy gas from Russia?, Arguments and facts, num 3 (2018).
[13] Zapolyarny, "Liquefied, reduced-fare", Expert, num 50 (2017).

Results

The study and comprehensive analysis of the information realm in the area of producing and consuming crude hydrocarbons provided for the following important conclusions:

1. Specific examples of the projects may differ; however, they have one common feature: the consumption of products is impossible without properly elaborated transportation system, which, under the Russian Arctic conditions is reduced to exploiting and developing the Northern Sea Route. According to the Minister of Natural Resources and Environment, '…any Far North project is a huge and complex project in terms of creating logistic infrastructure'[14].

2. Transport communications passing through Suez and Panama Canals constitute an alternative to the NSR. But, if the distance the vessel passes, for instance, from Murmansk to Yokohama through Suez Canal amounts to 12840 sea miles, the same vessel will have to pass only 5770 sea miles via NSR. The distance from Saint-Petersburg to Vladivostok via NSR amounts to over 14thsd.km, and extra 8thsd. will have to be passed through Suez Canal. Thus, the benefits of transporting cargo even with the employment of ice-breaking fleet are obvious.

3. The major advantage of LNG lies in the potential transcontinental transportation using large-capacity cryogenic super-tankers. Interest in LNG is also accounted for a pressing need for diversification of the sources and forms of a power supply of economies of many countries under the conditions of unstable supplies of imported oil. A growth in producing and consuming LNG is underway at a rapid pace that is impossible without proper development of the most important chain – logistic support for LNG projects[15].

4. Sea transportation of LNG holds a special place in global gas supply. It develops as a specific sector of the transportation industry, aimed at delivering gas to the markets located far from extraction places since supplies via pipelines would have been extremely expensive or just impossible. As far as the Russian Arctic regions are concerned, the problem involves two interrelated parts: ice-breaker ships, where dominating positions of Russia is are commonly recognized and indisputable, and methanol tankers, where there is not only nothing to boast about for Russia, but there are no competitive alternatives to offer at all.

Discussion

Good thoughts first. Analysis of plans of the Russian oil and gas companies proves that in the nearest twenty years the volume of auxiliary cargo and of oil and LNG, extracted on the shelf of the Arctic Seas and ashore, may exceed 50 mln. tons. Safe functioning of the NSR and development of oil and gas and other natural resources of aquatic areas is impossible without a powerful ice-breaking fleet. The important moment in developing Arctic navigation involved putting the first in the world nuclear ice-breaker Lenin of 28.4MW capacity into operation in 1959. More powerful Arctica type ice-breaker and two shallow-draught nuclear ice-breakers of Taymyr type were then put into operation. Ice-breakers of such class have a high icebreaking capability and good maneuverability in complex ice conditions, along with unlimited independence in terms of fuel reserves.

[14] M. Kutuzova, "Now the value of Arctic is particularly high" (interview with S. Donskoy), Kommersant, num 53 ("Oil and gas" annex) (2018): 22.
[15] V. Fokeeva, "Where Sovkomflot compass points", Expert, num 30-33 (2017).

However, almost the entire active nuclear ice-breaking fleet will be taken out of service soon, with the exception of nuclear ice-breaker '50 years of Victory', the service time of which may be prolonged to 2025-2030. New powerful nuclear LK-60 (project 22220) ice-breakers shall replace the old ones. In November 2013, the new Arctica ice-breaker was laid down at the Baltic plant; the keel-laying ceremony for new Siberia ice-breaker was held in May 2015; Siberia is to be put to sea in 2019. Also, a decision was made on a building of its sister ship (Ural) that will be put into operation in 2020-2022. These ice-breakers shall provide an escort of large tankers. They facilitate efficient work both in deep and shallow water and at the Siberian rivers' estuaries as well.

Nowadays, Russia has the whole range of technologies to design and manufacture ice-breakers of all types, from superpower nuclear to linear diesel-electric ships and other auxiliary ice-breakers for working in port areas. As per projections available, in 2020-2030, the NSR will annually deliver up to 20 mln. tons of various cargoes. Liquid cargoes will amount to more than 70% of the total transit volume.

The Director General of FSUE Atomflot Vyacheslav Ruksha stated during 'Arctic: the present and the future' Forum in December 2017 that the all-the-year-round use of the Eastern NSR route requires extra two or three superpower 120MW ice-breakers of Lider class (in addition to the three universal nuclear ice-breakers - Arctica, Siberia, and Ural with the total cost of 121.4 bln. rubles). The models of such ice-breakers have already undergone necessary testing; new ice-breakers will be 5m wider, which will assure high speed of escorting vessels. Today, with an ice thickness of 1.5m, ice-breaker of Christophe de Margerie type will be capable of following LK-60 with the speed of 4.5-5 knots; larger sizes will allow increasing the speed to 6 knots[16].

In the nearest time, the Government should take a decision on building ice-breakers of the entirely new Lider class capable of breaking ice more than 4m deep, which will ensure year-round navigation via NSR; construction should be carried out in Russian shipyards. Also noteworthy is the fact that great interest in the NSR and its ice-breakers is expressed by non-Arctic countries, first of all, by China. The Chinese had already built MV Xue Long (Snow Dragon) ice-breaker that had passed through NSR and demonstrated good dynamic performance. Thus, ice-breakers and ice-breaking vessels are the major driving force of the Russian Arctic. Increasing their capacity, ice-breaking capability, cargo carrying capacity, and environmental compatibility will allow attaining great successes in development and proper use of a natural wealth of the region.

Time for the sad news

The problem of transporting LNG goes way beyond ice-breaker's assistance; the availability of gas tankers fleet is of no less importance. Technical and economic computations have shown that when the annual volume of gas transport reaches up to 10 bln. m^3 and a distance for transportation is more than 1500km, the delivery of liquefied gas in sea tankers is becoming more profitable than its transportation via pipelines with a complex transition through the Mediterranean Sea[17].

[16] A. Vedeneeva; Yu. Barsukov; G. Kostrinskiy & I. Safronov, "There cannot be too many icebreakers", Kommersant, num 227 (2017): 9.

[17] R. G. Kasatkin, A system of sea transportation of liquefied natural gas from Arctic (Moscow: LKI publishing house, 2009) y Russia in Arctic. Challenges and perspectives of development. Under editorship of M.V. Remizov (Moscow: Knizhniy mir, 2015.)

Methanol tankers are actually the floating reservoirs-storages of LNG.

In Russia, transportation of natural gas in a liquefied state from the Arctic shelf fields represents the most economically viable way. Unfortunately, there is no any opportunity for Russia now to manufacture large-capacity tankers of VL class (up to 32 thsd. tons of oil), DL supertankers (up to 50 thsd. tons) and gas tankers due to lack of shipyards that correspond to their size.

The NOVATEK company, which implements Yamal-LNG project, summed up the results of the 2014 tender procedure for building 16 membrane gas-tankers of Arc 7 ice-class of the total cost of about 5bln.USD for transporting LNG from Yamal. This tender was won by the South-Korean Daewoo Shipbuilding & Marine Engineering Co (DSME). In this case, the shipping company-carrier had become an employer of building the gas tanker. The vessel is designed to work in conditions of extremely low temperatures (up to -50° C) and to be capable of passing through 2.1m deep ice with no ice-breaker's assistance.

All major Russian gas fields of the future development are located in extremely complicated areas (such as the Barents Sea, the Kara Sea shelf, and Sakhalin Island), which that specify the need for building a number of large factories for producing LNG where the most promising fields are located.

The emerged demand for gas tankers caused the decision to accelerate the construction of the ship-building dock Zvezda (Star), located in the Far East town of Bolshoy Kamen' settlement; the dock was to be completed as early as 2018. Ship-building dock Zvezda was intended to ensure construction of super-tankers of any size, and, thus eliminate the basic shortcoming of the Russian shipbuilding. However, there is also a genuine concern for the clear definition of the prospective demand for vessels to develop shelf and a schedule of their building.

Also noteworthy is the emergence of the new technological ideas of combining a tanker and a plant for degasifying LNG; due to the latter feature, the tanker may approach any place where a device for receiving gas is available. Thus, a principle of 'door to door' delivery widely used in commercial shipping may be implemented in this industry as well. It is anticipated that a fleet of methanol tankers will double in 20 years (2000-2020), and tonnage of new vessels will amount to 250-270 mln. m^3.[18]

Prior to the introduction of economic sanctions, the Central Scientific Research Institute of Shipbuilding Technology (CSRIST) in Saint-Petersburg purchased from the French Company the equipment required to build GTT tankers-vessels storing LNG; the Institute also was ready to commence their construction. The technology of building GTT tanker is based upon applying invar-alloy with a high content of Nickel, from which the 1st and the 2nd sections of the tanker vessel are manufactured. However, current Russia does not have any tankers, manufactured using GTT technology.

At this time, FSUE Atomflot is considering the alternatives that involve Arc 5 class tankers. The tankers of the highest Arc 7 class have already been used for Yamal-LNG project; these vessels are capable of independently ran through winter conditions towards Western Europe. However, now Atomflot is willing to consider an alternative of using tankers

[18] A. Uglanov, "A battle for Arctic (interview with V. Shtyrov)", Arguments of the week, num 1 (2018). Retrieved from: http://argumenti.ru/society/2018/01/560342

of a lesser ice class, escorted by the new ice-breakers with LNG assumed to be a probable fuel. It may as well happen that it will be more advantageous to send less expensive Arc 5 class tankers towards Europe. When LNG-complex capacity on Yamal will reach 100mln.t/year - not less than four-five gas tankers per day will be required in only 10-15 years, and an issue of convoy escorts will affect the project economics and the prices for the Russian LNG on European and Asian markets[19].

Nowadays, there is an obvious positive tendency for the growth of cargo traffic via NSR observed. Navigation in 2010 is considered a starting date in the new history of the NSR; the Arctic way has been restored for commercial shipping and international cargo transit.

An important objective of passing through the Arctic is to revive the NSR and to use it for exporting Russian crude products to the Asian market. Today, the NSR is again in the focus of attention of cargo carriers in both Russia and foreign states, mostly for transporting mineral raw materials from the Arctic area. Export of LNG from the Yamal Peninsula will become the NSR priority if the state undertakes a commitment to equip the Sabetta port and build an ice-class tanker fleet.

Benefits of using the NSR for transit transportation include fuel savings, a decrease in the time of the trip, reduction of staff labor expenses and vessel freight costs, no payments for ship passage, no queue and no risk of pirate attacks.

A potential for transporting cargoes and the already existing possibilities for using the NSR are far more than their actual volume. The problem lies in the absence of the respective vessels of ice class and a recently observed tendency for methanol tankers to go up in price.

Growth in the volumes of producing LNG gets clearly obvious with the implementation of the Arctic project. The capacity of the Russian ice-breaking fleet, including nuclear vessels, is currently on the rise. Intense measures are taken to create the national industry of building gas tankers, to increase production of domestic equipment for the entire complex of works (from geological survey to the final production). The volume of cargo traffic via the NSR (mostly hydrocarbons) is also substantially increased.

The dynamics of producing LNG and transporting via the NSR is unidirectional; this dynamics manifest quite a close interrelationship.

Transportation of Yamal LNG is to be carried out via the NSR all the year in the western direction, and from July to December in the eastern direction. The NOVATEK supposes that commissioning of LNG plant will enable gas tankers to run across the Arctic Ocean all-year-round. Transportation of other cargoes of the Russian and foreign companies, for which Yamal-LNG project will open up the NSR, will become common for this route; however, the expenses for creating this system may be repaid only in case of intense commercial use. Hence, it is necessary to look for some new points of forming cargoes and sources of cargo traffic.

[19] A. Vedeneeva; Yu. Barsukov & G. Kostrinskiy, “Cheaper gas tankers are searched for Yamal”, Kommersant, num 18 (2018): 9.

So far, NOVATEK has been considering an opportunity for constructing a huge trans-loading terminal for liquefied gas in Kamchatka with up to 20 mln. tons/year capacity. It is supposed that it will enable the company to save money on transporting gas from Yamal to Asia by reducing the number of ice-class tankers, which are more expensive than the conventional ones. Besides, in perspective, the terminal may become a hub for spot sales of LNG[20].

Yamal-LNG exercises the following scheme: gas tankers in western direction run till Zeebrugge port in Belgium, where LNG is reloaded to common tankers, which may be sent further to Asia.

Will it be possible to repeat the same in the East? In any case, NOVATEK considers such an option. According to Lev Feodosiev, the Deputy Chairman of the Board of Directors, NOVATEK in cooperation with Atomflot of Rosatom, GT Mosstroy and a number of international engineering companies from Japan, Korea, and France have been inspecting the sites on the eastern coast of Kamchatka. There are no yet any designated terms for commissioning of the terminal; however, they are likely to be coordinated with the time for commissioning of the first line of Arctic LNG (the end of 2022).

The new terminal will enable NOVATEK to develop spot sales of LNG on FOB terms, which is impossible on Yamal since the buyers do not have ice-breaking tankers.

The cost of Arc 7 class gas tanker is approximately twice higher than of a conventional one (about 400 mln. USD against 200). Ice-breaking tankers have higher fuel expenses as well.

Yamal-LNG will pay in Zeebrugge 1.1 bln. euros in transshipment fees for up to 8 mln.t throughputs within 20 years. The costs in Kamchatka will be higher since only one LNG-storage needed to be built in Zeebrugge, and in Kamchatka, the entire terminal needs to be raised from the ground; however, it may become the largest in the world. Implementation of the plans on creating LNG-hub in Kamchatka depends on the readiness of Total, CNPC, and other companies to sell their gas at the new terminal. Thus, with the beginning of Arctic fields' development, the value of NSR considerably increased. The problem of economic development of the Arctic region is currently being solved (provided the condition of preserving the unique Arctic natural environment). At the present stage, the Northern Sea Route has been gradually converted into a commercial route with global perspectives, creating transport-logistical support for the Russian LNG-projects. Thus, the successful implementation of LNG-projects requires an all-the-year-round escort of gas tankers via the NSR; equipping the logistics with domestically manufactured vessels; and conducting an extensive search for ways to reduce the cost of transporting liquefied natural gas.

Conclusion

The economic research of the ways for developing one of the most important sectors of the Russian economy allowed overviewing the perspectives of creating a new direction of the gas industry development, namely, the LNG production development. The authors are entitled to the opinion that it is of particular importance for developing the industry itself and the Russian economy at large.

[20] Yu. Barsukov, "Novatek" changes to Kamchatka", Kommersant, num 139 (2017): 7.

The analysis of the perspective base for LNG production development (Russian Far North), the economic background, and realities of the emergence of the newly evolved LNG product for the Russian Federation, presented in the paper, enable the concerned experts to form a more comprehensive opinion on the current status and development perspectives of this exploration trend. In this regard, the practical application of the obtained research results is based on their use in the formation of the new business climate with respect to modern realities, as well as on widening possibilities and perspectives of meeting consumers' demands due to diversification of the ways and methods for delivering gas products, and, thus, increasing export potential of the Russian Federation gas industry.

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