

PART I

PATTERNS OF ARCTIC INVESTMENT

2. Offshore Petroleum and Maritime Infrastructure¹

Arild Moe and Svein Vigeland Rottem

Despite the considerable attention given to Arctic offshore petroleum resources in recent years, actual industrial activity remains limited. In fact, only two fields are in production on the Arctic continental shelf—one in Norway and one in Russia. The main activity is exploration, but here also the activity level is lower than commonly portrayed in the media. The purpose of this paper is to provide an overview of commercially relevant Arctic investment projects related to offshore petroleum and maritime infrastructure, in order to understand likely developments and to comment on the relationship of public vs. private investments. For these purposes, the Arctic is loosely defined as ocean areas north of the Arctic Circle and the adjacent coasts. Figures are scarce and usually not comparable, thus the assessments are mainly made on a qualitative basis.

OFFSHORE PETROLEUM ACTIVITIES AND MARITIME INFRASTRUCTURE

There are big variations in the intensity as well as organization of offshore petroleum activity among Arctic coastal states (Russia, Canada, United States (Alaska), Denmark (Greenland), and Norway). The various states will be discussed along the following lines: petroleum activities, maritime infrastructure and future prospects.

Canada – Promising but Uncertain

In offshore Arctic Canada, the Beaufort Sea is considered the most promising. From 1972 until 1989, a total of 86 wells were drilled offshore in the Beaufort Sea. From the mid-80s, however, the Arctic offshore was mostly abandoned due to falling oil prices, the end of government exploration incentives and lack of infrastructure.² Since 1991, only one offshore well has been drilled in Canada's Arctic, in 2005/2006, but it was

abandoned in March 2006.³ In 2002 and 2004, lease sale rounds were conducted by the Canadian federal government. In 2007, Imperial Oil won the bid for a large area offshore in the Beaufort Sea. BP followed in 2008 and Chevron in 2010. In the aftermath of the Deepwater Horizon incident in the Gulf of Mexico in 2010, however, Canadian authorities imposed a moratorium on all Arctic drilling. The National Energy Board (NEB) then conducted an Arctic Offshore Drilling Review, introducing new operating standards, released in December 2011. Currently, there is no drilling taking place in Canada's offshore Arctic.⁴ However, a number of companies hold exploration licenses for areas in the Beaufort Sea, and six new exploration licenses were issued in 2012.⁵ A joint project owned by BP, ExxonMobil and Imperial Oil seems to have the most developed plans for an exploratory drilling program.⁶ Still, drilling is not likely to take place before late this decade.

Looking at maritime infrastructure in the Canadian Arctic, many infrastructure proposals have been presented with the aim of connecting the coastal regions with the provinces further south.⁷ There is also the "Northern Marine Transportation Corridors Initiative," which entails a program for improving maritime infrastructure in the Canadian Arctic. These initiatives are in their early stages, though, and no formal investments, let alone plans for cost sharing, have been announced. However, there appears to be a somewhat higher expectation for the Northwest Passage's economic potential than earlier, after the successful transit of *Nordic Orion* in 2013.

Moreover, in Canada's Northern Strategy from 2009, we find a strong commitment to promote social and economic development in Canada's North, and the Canadian government encourages future exploration of oil and gas.⁸ Formally, the federal government controls the development of offshore oil and gas in the Canadian Arctic. However, there is an ongoing process of "devolution," the transfer of governance of resources to the Territories.⁹ It is completed in Yukon, is under negotiation with the Northwest Territories, and talks have started with Nunavut.¹⁰ Ceding new powers to the Territories will give the territorial governments additional responsibility for approving resource development.¹¹ This may not affect offshore exploration and production directly, but it will have indirect effects since most offshore projects require onshore infrastructure. The National Energy Board will continue to have regulatory responsibilities for oil and gas exploration and production activities offshore.¹² But there are some uncertainties regarding the future political framework.

At the regional level, interest in the offshore development of the Beaufort Sea on the part of the Northwest Territories (NWT) is not strong. Current onshore production levels are low. Thus, the region is not heavily dependent on revenues from oil and gas, and local communities tend to favor mineral extraction. Developing mineral deposits is perceived as giving more direct benefits (revenues and labor), and mining is often perceived as the future economic driver of Canada's North.¹³ Thus, the decision to open for petroleum activity, including lease sales and exploratory drilling, is more closely linked to federal interests. Furthermore, Canada is not dependent on these resources for domestic energy supply. The presence of oil sands in Alberta and petroleum production in New Brunswick and Newfoundland has made Canada a significant producer. Canada is the fifth-largest energy producer in the world.¹⁴ Arctic offshore energy development is not a high priority. Much uncertainty remains about the resource potential in offshore Arctic Canada, however, and the discovery of a large oil or gas field could change this outlook.

The boom in domestic shale gas production has made the United States self-sufficient in natural gas, and prices have dropped. This development also has consequences for the commercial attractiveness of Canadian gas projects in the Arctic. The development of the Canadian Arctic offshore is price sensitive. The size of discoveries is crucial. Only the discovery of large natural gas and oil fields will allow the development of infrastructure. But if infrastructure is established, it could also serve smaller fields.¹⁵

Furthermore, environmental concerns are high on the Canadian political agenda. This shows in the Review of Offshore Drilling in the Canadian Arctic, where an emphasis is put on environmental issues and the involvement of native communities.¹⁶ The NEB's Arctic offshore drilling review concluded that any company wishing to drill in the Arctic must have plans that are safe for the public, workers, and the environment.¹⁷ A main goal in this review was to get a better understanding of Northern residents' perspectives on offshore drilling activities. Meeting aboriginal concerns is integral to any new offshore development. Consequently, the deficiency of infrastructure, price levels, a lack of regional and local interest, and uncertainties regarding the future political framework must be taken into account when considering oil and gas exploration in the Canadian Arctic.

Alaska – Large Undiscovered Resources and Environmental Mobilization

The Alaska Outer Continental Shelf (OCS) may be one of the world's largest untapped oil and gas basins. Offshore Arctic Alaska is made up of two areas: the Beaufort OCS and the Chukchi OCS.¹⁸ In the 1970s, 1980s and early 1990s, the U.S. government encouraged exploration drilling offshore in the Beaufort Sea and the Chukchi Sea, but drilling stopped due to falling prices.¹⁹ The next lease sale took place in 2008, but indigenous groups and environmental NGOs mobilized and appealed to the U.S. District Court in Alaska, which halted drilling in 2009. In the aftermath of the Macondo incident in April 2010, the Obama Administration imposed a six-month moratorium on all new offshore drilling in U.S. waters. Only in 2012 did Shell complete top-hole drilling on two wells in the Beaufort and Chukchi Seas.²⁰ However, on December 31, 2012, one of Shell's drilling rigs (the Kulluk) was damaged because of strong weather and stranded on an uninhabited island.²¹ Moreover, in September 2012, the company announced, after a containment dome designed for a potential oil spill in Arctic waters was damaged, that it was cancelling its drilling program for 2013. In November 2013, Shell filed a new exploration plan for the Chukchi Sea,²² but by January 2014, the company announced that it had postponed drilling for another year.²³ Both ConocoPhillips and Statoil also have postponed plans for drilling in the offshore Alaskan Arctic.²⁴ Nevertheless, expectations are that drilling will start in few years and that the first oil from the Beaufort and Chukchi Seas could come on stream in the early 2020s.²⁵

Currently, there are no Arctic deep-water ports in Alaska, but a study of the possibility of constructing such a port has been launched. The United States has two icebreakers operated by the Coast Guard, both of which are ageing. Planning for new icebreakers, which could enter service in the early 2020s, has started. Costs are estimated to be up to 1 billion USD. A report from the Government Accountability Office observes that "Less than one percent of navigationally significant waters in the U.S. Arctic have been surveyed with modern technology."²⁶ Generally, "economic opportunities in the U.S. Arctic are considered to be key drivers for the development of Arctic maritime transportation infrastructure." Currently, there is limited activity and limited plans.²⁷

Existing oil production accounts for approximately 90% of Alaska's

unrestricted general fund revenues.²⁸ For this reason,, the regional interest in development is strong. But the State of Alaska lacks the decision-making authority to allow offshore drilling. The federal interest has been closely related to energy security and reducing dependence on foreign oil imports. However, the unconventional gas and oil revolution has lowered the federal urgency of Arctic energy development, and may make policy more susceptible to environmental concerns. Indigenous groups and environmental NGOs have mobilized against offshore development both at the U.S. federal and state level, emphasizing the lack of environmental considerations and the nonexistence of technology to clean up oil spills under ice in the harsh Arctic environment.

On the other hand, the potential for substantial discoveries is considered to be high. While lack of infrastructure is a challenge in every Arctic region, access to existing infrastructure is, given the Trans-Alaska Pipeline, rather favorable in Alaska.²⁹ However, offshore activity is still limited. The regulatory framework is still in the making, and harsh weather conditions, a short drilling season and environmental risks must be taken into account when assessing further development.

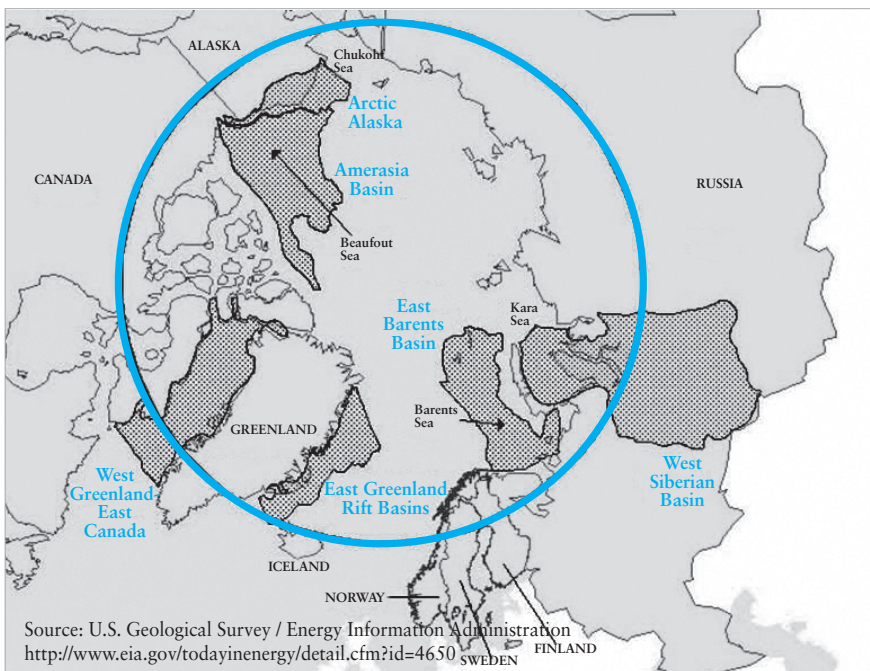


Figure I-1. Major petroleum basins in the Arctic

Greenland – Seeking Independence but Lacking Capacity

Oil and gas are expected to be found both on the east and west coasts of Greenland,³⁰ but exploration has been limited, and resource estimates vary. Test drilling started in 1976, but all wells, five in total, were considered dry.³¹ In 2000, a sixth dry well was drilled by Statoil. In 2002 and 2004, parts of the sea west of Greenland were opened for petroleum exploration, but the result was only minor bids by small companies. In 2006, however, two licensing rounds resulted in a total of seven licenses awarded to major companies, including Chevron, ExxonMobil, Cairn Energy, and Statoil. In the last years, several licensing rounds have followed, and in the summers of 2010 and 2011, Cairn Energy conducted eight exploratory drillings offshore in Greenland. No big discoveries were reported, but hydrocarbons were found in Greenland for the first time.³² In 2012 and 2013, seismic studies further north along the west coast were conducted, and major companies like Shell and Statoil are showing interest in future exploratory drilling in the area. Two successive licensing rounds for an area on the east coast of Greenland have been carried out. By the end of 2013, licenses had been awarded to bidding groups involving several leading international oil companies.³³ They have indicated that development is long-term and will be stepwise.³⁴

This is evident also when looking at Greenland's maritime infrastructure, which is limited. But a decision to expand and modernize the port in Nuuk on the southwestern coast of Greenland so that it can handle larger ships and more traffic was made in 2012. It is estimated to cost some 109 million USD, to be paid with state money and to be ready in 2016.³⁵

Greenlandic governments have been actively promoting petroleum development, in order to reduce dependence on Denmark and eventually provide an economic basis for full independence.³⁶ There is no oil or gas transportation infrastructure in the country, and the lack of administrative capacity (Greenland has only 57,000 inhabitants) is also vital to recognize when discussing the future of oil and gas development in Greenland. Moreover, the cost of accessing reserves in waters that are icebound most of the year are high,³⁷ and due to the harsh environmental conditions insurance requirements are high and strict liability provisions apply.³⁸ Greenland's location, however, provides easy access to both North American and European markets for oil. The lack of infrastructure and current market prices for LNG thus suggest that potential oil discoveries

seem most likely to be developed.³⁹

A key question is whether Greenland has the capacity (infrastructure, human resources, administrative capacity, etc.) to be both a mineral and hydrocarbon nation. In 2013, the newly elected government lifted a uranium mining ban, underscoring that this could be a big step towards both economic and political independence from Denmark.⁴⁰ The upshot is that a successful mining development could reduce the political interest in petroleum exploration. Yet the mining issue remains controversial in Greenland, as exemplified in the hard fought November 2014 election.

Norway – Dynamic and Petroleum Dependent

Norwegian oil and gas production takes place solely offshore, with activity in the North Sea, the Norwegian Sea, and the Barents Sea. The Norwegian part of the Barents Sea, the only area defined as Arctic, is ice free and thus different from many other Arctic areas.

In 2001, oil production peaked on the Norwegian continental shelf (NCS). To stimulate exploration, the government produced a scheme making it more attractive for new companies to become involved in oil and gas activity. Only around 40% of the total expected resources of the NCS have been produced. Furthermore, increasing gas production could lead to growth in total petroleum production.

In 1980, the first exploration well in the Barents Sea was spudded, and in 1984, Statoil discovered the Snøhvit (“Snow White”) gas field, with recoverable reserves of 193 billion cubic meters of natural gas, 113 million barrels (17.9 million cubic meters) of condensate, and 5.1 million tons of natural gas liquids (NGL).⁴¹ Production started in 2007. In 2000, the Goliat oil discovery was made, and it will start producing in 2015 with Eni as operator.⁴² Estimates from 2013 indicate that total investments (actual and expected) for these two projects amount to some 12 billion USD.⁴³ For comparison, ca. 28 billion USD was invested in the NCS in 2013 alone, excluding exploration.⁴⁴

In recent years, several significant discoveries have been made, notably the Johan Castberg (formerly called Skrugard) and Havis fields, with recoverable reserves estimated between 400 and 600 million barrels.⁴⁵ Moreover, a license round completed in 2013 allocated 20 new exploration and development licenses, and licensing in the Norwegian part of the previously disputed area with Russia is expected soon. However, by summer

2014 only 109 exploration wells had been drilled in the Norwegian part of the Barents Sea. The Norwegian Petroleum Directorate estimates that 8 billion barrels of oil equivalents of undiscovered resources are located in the Norwegian Barents Sea.⁴⁶

In terms of maritime infrastructure, Norway has a string of ports along its northern coast, but none of them is large. Proposals for expansion in anticipation of increased traffic on the Northern Sea Route (NSR), with an accompanying need for reloading capacity, have been put forward by some of them. The port in Kirkenes, near the border with Russia, includes an undeveloped deep-water harbor area that would have room for extensive reloading facilities or an offshore base. It is controlled by Tschudi, a Norwegian investor.⁴⁷ Whereas several ports in the northernmost county of Finnmark can be used as service ports and bases for offshore petroleum projects, the government has concluded that only Kirkenes is relevant for larger petroleum-related facilities.⁴⁸ Extension of the port in Tromsø, further south, is going on, mainly with a view to petroleum activities, but also cargo handling for the NSR.

The Norwegian state participates in petroleum development in several ways. It is the dominant shareholder in Statoil, and it is also a big direct investor through its own economic interest in licenses, administered by the state company Petoro. Because of the companies' deduction of investment costs from their revenues, the state is covering 78% of their exploration costs.

By adopting legislation the Norwegian Parliament sets the framework for petroleum activities on the NCS. Moreover, major development projects must be considered by the parliament. A major goal is to optimize project developments by coordinating the infrastructure development and the establishment of offshore bases. Sometimes, disputes between business preferences and regional expectations emerge. The broader infrastructure issue in the Barents Sea involves the construction of gas pipelines vs. LNG transport. So far, all Norwegian Barents Sea gas is liquefied, and no decision on a pipeline, which would require the coordination of several fields, has been made. Inclusion of Russian gas in a Norwegian pipeline has also been discussed.

The High North is often portrayed as Norway's principal foreign policy concern. This strategic interest is apparent not least in Norway's relations with Russia, in the management of marine resources and of the Barents Sea as an important area in terms of shipping and oil and gas reserves.

Development in the area must be considered in light of this political priority.

Norway has over 40 years of experience as an oil and gas producer. The sector is the most important industry in Norway, directly or indirectly employing 250,000 people. About 50 Norwegian and foreign companies are active on the NCS. Moreover, the petroleum sector's share of state revenues is 30%, and it accounts for 52% of total exports, respectively. Thus, Norway is heavily dependent on revenues from the oil and gas sector, and the future development of petroleum is of paramount importance to the Norwegian economy.

Nevertheless, there are currently strong voices in the parliament mobilizing against further offshore development, particularly in the northern part of the Barents Sea, arguing that Norway has to prepare for a less carbon-intensive economy and the need to develop more renewable energy. Climate change in the region and its consequences for Norway are high on the political agenda. The lack of capacity to handle major oil spills in the region is also a major issue. More recently, concern over the commercial viability of Arctic offshore development has become more pronounced. An almost saturated gas market has reduced the attractiveness of gas developments, as is the case also in other parts of the Arctic offshore. The cost increase in the petroleum industry is also casting a shadow over Arctic oil, creating uncertainty regarding the development of the large Johan Castberg field.⁴⁹ Despite all the exploration licenses that have been awarded, rapid industrial development in the Norwegian Barents Sea is not a given.

Russia's Arctic – A Resource Base for the 21st Century?

Russia has the largest continental shelf of all the Arctic states and has high ambitions for Arctic petroleum exploration and development. Russian estimates put initial resources on the continental shelf, discovered and undiscovered, at 70 billion tons of oil equivalents. Of this, 13.5 billion tons (85 billion barrels) are estimated to be oil, and 73 trillion m³ natural gas.⁵⁰ That means gas makes up 80% of the total. Most of the resources are expected to be found in the Barents and Kara Seas, altogether 53 billion tons oil equivalent. These numbers are very preliminary and include mainly undiscovered resources, but they are reference points in the Russian debate and say something about Russian expectations. As of 2012, only 10% of

Russia's total offshore resources had actually been discovered. Huge areas are unexplored.⁵¹

Only one field, Prirazlomnoe, is under development in shallow waters with severe drifting ice in the Pechora Sea (the southeastern part of the Barents Sea). It started producing in 2014, and the plan is to reach a level of 5 to 5.5 million tons by 2021.⁵² Capital expenditures for the project have been estimated at 5.7 billion USD.⁵³ The project is fully owned by Gazprom through the offshore subsidiary Gazprom Neft Shelf, which holds the license, whereas actual oil production from the field is taken care of by the larger oil subsidiary Gazprom Neft. Plans by Gazprom, Total, and Statoil for development of the giant Shtokman gas and condensate field were advanced, but the project was, for all practical purposes, abandoned in 2012, mainly because of the changed gas market situation.

Russian authorities have issued licenses for exploration drilling in the Arctic offshore since 1992, but the scale of activities has been small. This changed in 2011-2012 when Rosneft was given huge acreage in the Kara Sea and the Barents Sea and signed agreements with ExxonMobil, Eni and Statoil for exploration and development of these areas. In 2013, more acreage in the Kara Sea and in the Laptev and East Siberian Sea were added to the Rosneft-ExxonMobil cooperation, altogether covering some 760,000 square kilometers. Seismic surveys in the Kara Sea were carried out in 2012-13, and first exploratory drilling took place in August-September 2014. The project with Eni covering the southern part of the previously disputed area with Norway stipulates first drilling before 2020, similar to Statoil's project with Rosneft in the northern part of this area.

Furthermore, Rosneft has agreed to cooperate with the Chinese National Petroleum Company to study three structures in the Barents Sea.⁵⁴ In September 2014, it entered into a partnership with Petro Vietnam for the exploration and development of two smaller blocks in the Barents Sea.⁵⁵ Some exploration activity on smaller structures is also carried out by other companies in the Pechora Sea, the largest of which is Dolginskoe (Gazprom Neft), with estimated recoverable reserves of some 200 million tons of oil. A new series of exploration drillings there started in 2014.⁵⁶

Exploration of the Arctic areas further east is expected to start later. The Arctic offshore has enjoyed high priority in Russian public documents and official statements for the last 10 years due to increased knowledge about the resource potential, but also because of problems with renewal of the onshore resource base, increasingly dominated by less-developed,

complex and remotely located deposits. The Russian Arctic, which also includes the northern rim of land, has been called the country's resource base for the 21st century.

The surge in offshore licensing since 2010—particularly to Rosneft—clearly heralds more activity. However, even with the partnerships with foreign companies there will be limits as to how much the company can handle. Reorganization of the offshore activities cannot be ruled out. Until then, engagement on Russia's Arctic continental shelf will have to go through Rosneft and Gazprom and the joint ventures they establish.

The deals that have been concluded between Rosneft and the foreign companies, ExxonMobil, Eni and Statoil, call for the foreign companies to cover all of the high initial exploration costs, seismic and first exploration wells. The first well in the Kara Sea would reportedly cost between 0.5 and 1 billion USD.⁵⁷ Thus, Rosneft's exposure in the first years is modest. Only later will Rosneft be required to come up with investment funds, but they will be enormous. According to Rosneft's president, investments in the company's program for the Arctic continental shelf will amount to 400 billion USD over the next 20 years.⁵⁸

Russia's Arctic offshore development depends on participation by leading foreign companies, as witnessed in the deals signed by Rosneft. The sanctions following the crisis in Ukraine in 2014 definitely complicate the outlook. By September 2014, it became clear that ExxonMobil would be required to abandon the drilling campaign in the Kara Sea before the scheduled end of season.⁵⁹ As long as the sanctions stand, development of the larger Arctic offshore projects will remain frozen. Replacing Western companies with Chinese ones is unrealistic, since the latter do not possess the necessary experience and competence to operate in remote areas. Even when the sanctions are lifted, effects will linger. A new sort of risk has been introduced for investors. Could new crises emerge? This will add to the already high commercial risk associated with the projects.

Despite the long Arctic coastline, Russia has only a few large Arctic ports open for use by foreign ships. Murmansk, which is ice free, is the major port in the Russian Arctic, home to the nuclear icebreaker fleet and set to be the main offshore petroleum base for the western part of the Russian Arctic. It is also a significant oil export terminal for oil products brought there by rail; a reloading terminal for crude oil is situated in Kola Bay near the city. The port is already overloaded (17 million tons handled in 2013,⁶⁰ and a large share of which was oil) and plans for extension have

been underway for many years. A major complication is that segments of the port are controlled by different agencies and companies, which cannot reach agreements. The port of Arkhangelsk is, unlike Murmansk, dependent on icebreakers in the winter season. It is still a significant port, but reportedly only 1.5 million tons were handled in 2013.⁶¹ It has depth limitations, and plans for a new deep-water section have been presented, but not financed. Dudinka, at the mouth of the Yenisey River, was given the right to receive foreign ships in 2012. The port serves the mining complex in Norilsk, but is also a significant reloading point for goods up and down the river, reaching into the heart of Siberia. The port of Sabetta on the Yamal Peninsula is currently under development and will, in addition to Yamal LNG, serve other petroleum projects in the region. The Russian government has pledged substantial contributions to the financing of the port. Tiksi, at the mouth of the Lena River, has an important strategic location connecting the huge Sakha Republic to the sea. It has also been used for oil exports, but its condition is unclear. The port of Pevek on the Chukotka Peninsula was opened for foreign ships in 2012. It is an important port in the operational management of the NSR and also serves the mining industry on the peninsula.

Management of Russian ports is the responsibility of the regional administrations of the Federal Agency for Ocean and River Transport (Rosmorrechflot). Ownership of Russian ports varies, and is often divided between different owners, both state bodies and private companies. This may in itself complicate development. But the most import constraint is financing. All the ports are in serious need of upgrading, and many smaller ports are hardly functional.

The most important part of Russia's Arctic shipping infrastructure remains the icebreaker fleet.⁶² As of 2014, four nuclear icebreakers were in operation. The official plan is to construct three new 60-megawatt icebreakers, to be delivered in 2018, 2020 and 2021, at a cost of about 1.3 billion USD each. A critical period between 2017 and 2020 is approaching when the capacity of old icebreakers with extended service life can be increasingly questioned, at the same time as the new ones may not be available yet. Russia is in need of rapid renewal of its icebreaker fleet if it intends to continue the present level of icebreaker services.

By 2012, there were four diesel-electric icebreakers operating on the NSR. In addition, there were five on the White Sea and four in the Far East Basin.⁶³ Most of these ships were built in the 1970s and are in need

of replacement. A program for building new diesel-electric icebreakers has been launched, and the construction of the first in the LK-25 series started at the Baltiyskiy Zavod yard in St. Petersburg in October 2012, to be finished at the end of 2015, at a cost of some 8 billion roubles. With 25 megawatts, it will be the strongest non-nuclear icebreaker ever built. It will be operated by Rosmorport, a state enterprise set up to develop Russian sea transport infrastructure, and is a multipurpose vessel designed for escort service along the NSR as well as other functions, with a capacity to cut two meters of ice.⁶⁴ Construction of one 18 MW and three 16 MW icebreakers also seems to be underway. The diesel icebreakers currently in use for longer hauls are 15 megawatt. If the renewal of the diesel-electric icebreaker fleet is fully implemented, it will increase capacity for destination traffic and transit in the summer season. It will not contribute to an extended sailing season, however.

The Russian government has gone a long way toward making foreign investments in offshore activities attractive. The fiscal framework for individual projects prioritized by the government seems negotiable. In addition to the economic interest in offshore energy, the government also sees offshore development as a vehicle for modernization. There is some uncertainty, though, about how far and for how long the new tax conditions can be extended, since they imply low government revenue in a period when state income from traditional sources is likely to fall. Competition to a vigorous offshore effort can emerge from non-traditional oil onshore, which may promise a better payoff.

To sum up, the Arctic offshore has enjoyed a high priority in Russian public documents and official statements for the last 10 years due to increased knowledge about the resource potential, but also because of problems with the renewal of the onshore resource base, increasingly dominated by less-developed, complex and remotely located deposits. The Russian Arctic, which also includes the northern rim of land, has been called the country's resource base for the 21st century. There is little opposition to Arctic drilling for environmental reasons.

CONCLUDING REMARKS

There are big differences in the scale as well as the organization of offshore petroleum activity in various Arctic coastal states. In the United

States, Canada and Greenland, the initiative is clearly in private hands. In Norway and Russia, the state is more directly involved through ownership in dominant companies as well as state development priorities. However, each major investment project has its own character. The speed and force of Arctic offshore petroleum development seem to have abated somewhat in recent years. This is especially true for Alaska, but also in other parts of the Arctic there are concerns over costs—partly caused by stronger attention to environmental protection. Rising costs are a general problem for the petroleum industry, but particularly painful in areas that are already high cost, and perhaps marginal, like the Arctic. The gas market revolution, has made Arctic offshore gas much less commercially attractive. Furthermore, there is considerable public resistance to offshore petroleum activity in Alaska, Canada and Norway. The strongest public support for increased activity seems to be in Greenland, but there also a debate on the merits of offshore expansion is taking place. In Russia, the opposition to Arctic drilling is minimal.

In terms of maritime infrastructure, the overall conclusion is that not much is going on. There is an abundance of plans, but not much firm investment. This goes for all parts of the Arctic. But unlike Alaska, Canada and Greenland, where there is little infrastructure to begin with, Russia benefits from enormous investments in ports as well as icebreakers in the Soviet period. However, the need for new investment there is also urgent. Norway's Arctic coast is more developed than most other parts of the Arctic coastline, but ports must be extended if they are going to play a role in future Arctic development.

The development of port infrastructure seems to be a logical area for private-public partnerships since the major ports discussed will ultimately have several users, even if one particular project may be decisive for starting the development, as in the case of the port of Sabetta and Yamal LNG. The interest in controlling costs gives a strong impulse to develop dual-use facilities, and there is hardly any example of authorities claiming sole responsibility for infrastructure investment. Illustratively, in the new Russian Arctic strategy document from 2013, the idea of private-public partnership is repeatedly stressed as a solution to Arctic investment needs. But what it means in practice exactly is unclear. This can only be clarified via negotiations on a case-by-case basis.

Notes

1. This paper builds on research from a project commissioned by DNV-GL.
2. Østhagen A. (2013). Arctic Oil and Gas. The role of regions. IFS Insights 2/2013 SEP, Ernst & Young (2012) URL: [http://www.ey.com/Publication/vwLUAssets/Arctic_oil_and_gas/\\$FILE/Arctic_oil_and_gas.pdf](http://www.ey.com/Publication/vwLUAssets/Arctic_oil_and_gas/$FILE/Arctic_oil_and_gas.pdf), Pembina institute (2011) Comparing the Offshore Drilling Regulatory Regimes of the Canadian Arctic, the U.S., the U.K., Greenland, and Norway. URL: <http://www.pembina.org/pub/2227>
3. Ernst & Young (2012). op. cit.
4. Northern Oil and Gas Annual Report (2012). URL: <http://www.aadnc-aandc.gc.ca/eng/1367341676920/1367341870731>
5. Ibid.
6. Petroleum News September 2013. Providing coverage of Alaska and northern Canada's oil and gas industry. URL: <http://www.petroleumnews.com/pntruncate/194159153.shtml>
7. The Northwest Territories and Arctic Development in the Beaufort Area, Center for International Governance Innovation, Policy Brief No. 40, May 2014.
8. Government of Canada (2010). Canada's Northern Strategy: Our North, Our Heritage, Our Future. URL: <http://www.northernstrategy.gc.ca/cns/cns-eng.asp>
9. Østhagen, A (2013): 11, op. cit., National Energy Board Update (2013). URL: <http://www.neb-one.gc.ca/clf-nsi/rpblctn/spchsndprsnsttn/2103/nbpdtnvkptrlmshw/nbpdtnvkptrlmshw-eng.pdf>
10. Financial Post (2012). Nunavut sees devolution light after long Arctic winter. http://business.financialpost.com/2012/07/20/nunavut-sees-devolution-light-after-long-arctic-winter/?__lsa=62ab-8179Nunavut sees devolution light after long Arctic winterNunavut sees devolution light after long Arctic winterNunavut sees devolution light after long Arctic winter
11. Ibbitson, J. (2013). Ottawa ready to cede new powers to NWT. The Globe and Mail. URL: <http://www.theglobeandmail.com/news/politics/ottawa-ready-to-cede-new-powers-to-northwest-territories/article7997607/>
12. National Energy Board Update (2013). op. cit.
13. Ibid.
14. For a broad overview of Canada's upstream oil and gas industry see Canadian Association of Petroleum Producers (undated). URL: <http://www.capp.ca/library/statistics/basic/Pages/default.aspx>
15. Ernst & Young (2012). op. cit.
16. Review of Offshore Drilling in the Canadian Arctic (2011). URL: <http://>

- www.neb-one.gc.ca/clf-nsi/rthnb/pplctnsbfrthnb/rctcfffshdrllngrvw/rctcfffshdrllngrvw-eng.html
17. Ibid.
 18. Ernst & Young (2013). Global Oil and Gas Tax Guide. URL: [http://www.ey.com/Publication/vwLUAssets/2013_global_oil_and_gas_tax_guide/\\$FILE/EY_Oil_and_Gas_2013.pdf](http://www.ey.com/Publication/vwLUAssets/2013_global_oil_and_gas_tax_guide/$FILE/EY_Oil_and_Gas_2013.pdf)
 19. Østhagen A. (2013): 9. op. cit.
 20. Shell, press release 27/02/2013. URL: <http://www.shell.com/global/aboutshell/media/news-and-media-releases/2013/shell-announces-pause-in-alaska-drilling-programme.html>
 21. Bloomberg (2013). Shell Sends Alaskan Rigs for Repairs, Clouding Work Outlook. URL: <http://www.bloomberg.com/news/2013-02-12/shell-sends-alaska-rigs-to-asia-yards-clouding-drilling-outlook.html>
 22. Shell, press release 11/06/2013. URL: <http://www.shell.us/aboutshell/projects-locations/alaska/events-news/shell-submits-chukchi-sea-ep.html> Financial Times. Oil and Gas. URL: <http://www.ft.com/cms/s/0/c3189f7e-46f8-11e3-9c1b-00144feabdc0.html#axzz2k39QLJsQ> , Drilling in 2014 will focus on the Chukchi Sea rather than the Beaufort, which is shallower. Royal Dutch Shell plc (2013) URL: <http://royaldutchshellplc.com/2013/11/01/shells-arctic-costs-spiral-as-it-admits-damaged-kulluk-rig-may-be-written-off/>
 23. WWF (2013). “Shell Announces No Drilling in Alaska’s Beaufort and Chukchi Seas this Summer”. URL: <http://www.worldwildlife.org/stories/shell-announces-no-drilling-in-alaska-s-beaufort-and-chukchi-seas-this-summer>
 24. Reuters (2012). Statoil pushes back offshore Alaska drill schedule. URL: <http://www.reuters.com/article/2012/09/07/us-alaska-statoil-idUSBRE8861BF20120907>
 25. Ernst and Young (2013). op. cit.
 26. Maritime Infrastructure – Key Issues Related to Commercial Activity in the U.S. Arctic over the Next Decade. United States Government Accountability Office, GAO-14-299, March 2014.
 27. Ibid.
 28. Resource Development Council (undated). op. cit.
 29. Ernst and Young (2013). op. cit.
 30. USGS (2008). URL: <http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf>
 31. Later studies indicated that these wells had been abandoned prematurely. Østhagen, A. (2013) op. cit.
 32. Ernst & Young (2013). op. cit.

33. The Arctic Institute (2014). Greenland's New Frontier: Oil and Gas Licenses Issued, Though Development Likely Years Off. URL: <http://www.thearcticinstitute.org/2014/01/greenlands-new-frontier-oil-and-gas.html>
34. Statoil press release 20/12/2013. Statoil awarded Greenland licence. URL: <http://www.statoil.com/en/NewsAndMedia/News/2013/Pages/Dec20Greenland.aspx>; and The Guardian (2014). URL: <http://www.theguardian.com/business/2014/jan/03/bp-wins-first-greenland-drilling-deepwater-horizon>
35. The Arctic Journal, September 24, 2013. <http://arcticjournal.com/business/123/expansion-greenlands-main-port-would-pay-itself-consultants-say>
36. Østhagen (2013). op. cit.
37. Ernst & Young (2013). op. cit.
38. Delacour (undated). URL: <http://en.delacour.dk/news/2013/june/legal-framework-for-oil-gas-and-mining-in-greenland/>
39. Østhagen (2013). op. cit.
40. "Greenland looks forward..." *Financial Times*, October 31, 2013
41. Statoil (2009), Snøhvit. URL: <http://www.statoil.com/en/EnvironmentSociety/Sustainability/2007/Environment/GoingNorth/BarentSee/Pages/SnC3%B8hvit.aspx>
42. ENINorge (undated). URL: <http://www.eninorge.com/no/Feltutbygging/Goliat/Framdrift-2/>
43. Facts 2013–The Norwegian Petroleum Sector, Oslo: Ministry of Petroleum and Energy.
44. Facts 2014–The Norwegian Petroleum Sector, Oslo: Ministry of Petroleum and Energy.
45. Offshore-technology.com (undated). URL: <http://www.offshore-technology.com/projects/skrugard-field-development-project-norway/>
46. Facts 2014–The Norwegian Petroleum Sector. op. cit.
47. Tschudi (undated). Kirkenes Industrial Logistics Area (kila). URL: http://www.tschudiarctic.com/page/256/Kirkenes_Industrial_Logistics_Area_KILA
48. Norwegian Government White Paper No. 7 (2011–2012). "The High North."
49. See, e.g., "Need more time for Castberg," Statoil press release, 30 June 2014. http://www.statoil.com/en/NewsAndMedia/News/2014/Pages/30Jun_JCmelding.aspx
50. This includes the Okhotsk Sea in the Far East, which is geographically not an Arctic area, but which has Arctic conditions. It is expected to hold some 6.2 mtoe.
51. See also Moe, Arild, 'Potential Arctic Oil and Gas Development: What Are

- Realistic Expectations?’ In Oran Young, Jong Deog Kim and Yoon Hyung Kim (eds), *The Arctic in World Affairs: A North Pacific Dialogue on Arctic Marine Issues*. Seoul/Honolulu, Korea Maritime Institute/East-West Center, 2012, pp. 227-250.
52. “Gazprom Neft doesn’t see sanctions causing major problems for Prirazlomnoye,” quotations from Gazprom Neft First Deputy CEO Vadim Yakovlev, Interfax Russia & CIS Oil and Gas Weekly, 11-17 September 2014. Gazprom Neft reports that 120 billion roubles had been invested in the project by the end of 2013 (which would correspond to 3 billion USD at the current exchange rate), and that 11 billion roubles would be invested each year in 2014 and 2015. “Gazprom Neft doesn’t...” op. cit.
 53. Lars Petter Lunden and Daniel Fjaertoft: “Government Support to Upstream Oil & Gas in Russia - How Subsidies Influence the Yamal LNG and Prirazlomnoe Projects,” published by the International Institute for Sustainable Development, July 2014.
 54. <http://www.kommersant.ru/doc/2153997>
 55. Rosneft press release, 5 September 2014. URL: http://rosneft.ru/news/news_in_press/050920142.html
 56. Press release from Gazprom Neft, 30 June, 2014. URL: http://www.gazprom-neft.ru/press-center/news/1102430/?sphrase_id=84189
 57. “Rosneft Exploration Well in Kara Sea to Cost 1 billion, Take Two Seasons to Drill”, *Russia & CIS Business and Financial Newswire*, April 15, 2014. URL: <http://business.highbeam.com/407705/article-1G1-365086769/rosneft-exploration-well-kara-sea-cost-1-bln-take-two>
 58. Rosneft CEO Igor Sechin in meeting on the efficient and safe development of the Arctic, June 5, 2014. URL: <http://eng.kremlin.ru/news/22446>
 59. “ExxonMobil Statement on Treasury Department Sanctions on Russia,” 19 September, 2014. URL: <http://news.exxonmobil.com/press-release/exxonmobil-statement-treasury-department-sanctions-russia>
 60. Murmanskii Vestnik, 31 January 2014. URL: <http://www.mvestnik.ru/shwpgn.asp?pid=201401314>
 61. Ibid.
 62. See also Moe, Arild, “Comments on Chapter 2: Russian perspective,” in Oran R. Young, Jong Deog Kim, Yoon Hyung Kim (eds), *The Arctic in World Affairs - A North Pacific Dialogue on the Future of the Arctic*. Seoul / Honolulu, Korea Maritime Institute / East-West Center, 2013, pp. 74-75.
 63. Vitaly Chernov, “Cutting a Path in the Ice,” *Portnews*, October 11, 2012.
 64. Press release from Baltiyskiy zavod, August 7, 2013. URL: http://www.bz.ru/ru/news*1,134.html

3. Patterns of Investment in the Russian Onshore Arctic: An Area of Stable Growth?

Valeriy A. Kryukov

INTRODUCTION

In recent years, when speaking of the Arctic, we usually refer to economic activity in the framework of new projects, new opportunities, and new development thrusts. But this approach can be applied only partially to Russia, as the country has been undertaking economic activities for a long time in this region. Moreover, Russia's economic development is largely determined by the development of the Arctic, its conditions and dynamics—it was true before, it is still true now, and it definitely will be true in the future. According to a credible estimate, products manufactured in this area provide 11% of the country's national income and 22% of the export turnover. The region contains considerable reserves of natural gas, diamonds, gold, silver, copper, and other mineral resources.¹

It is difficult to provide a comprehensive estimate of investment needs to realize resource development and improve infrastructure, but scattered data indicate that they are enormous. In particular, the Russian Federal State Statistics Service (Rosstat) is conducting a project that would update the Federal Plan of Statistical Operations and incorporate a new section for official statistical data.²

These remarks (or, rather, first-step reflections) are essential when analyzing the problems of investment activity in land areas of Russia's Arctic zone. The main principles are as follows:

1. The Arctic's economic development (which is impossible without investment activity and various social projects) is the most important component of social and economic development of Russia as a whole.
2. Economic activities in the land territories of Russia's Arctic zone have their own history that should not be ignored when analyzing investment activity. In other words, one cannot consider investment activity in the land territories of Russia's Arctic outside

the modernization or, rather, adaptation of previously created production, technological and social systems to the modern, more open economy and to a new Russian economic system currently under development.

3. It is quite difficult to present complete and comprehensive data on the current state and dynamics of investment activity in the land territories of Russia's Arctic zone. Still, it is possible to present main trends.

We should introduce the analysis of investment trends in the land territories of Russia's Arctic zone with the following consideration: the main economic goal in the Arctic has always been and still is to explore sources of mineral and natural resources with exceptional geological characteristics and mining potential. Nonetheless, the sources explored and then involved in the economy were not only unique due to their rare and valuable minerals. Those characteristics were able to provide economies of scale to the full extent. This can be applied to the apatite ore deposits on the Kola Peninsula (explored in the 1930s); copper-nickel and polymetal deposits in the Norilsk District on the Taymyr Peninsula (in the 1930s-40s); gold, zinc and lead deposits in the northeastern part of Russia (in the 1940s-50s); kimberlite pipes deposits in the Republic of Sakha (Yakutia) (in the 1950s-60s); and unique gas fields in the Nadym Pur Taz District in the north of Tyumen Oblast (in the 1970s-80s). These sources of raw materials were explored exceptionally effectively because of considerable mineral reserves (all the deposits above are among the largest in the world in their categories) and engineering solutions aimed at fast extraction of mineral resources which did not pay much regard to their consequences for the environment.

New sources of minerals are characterized less by reserves/resources potential than by more-complicated regional/geological conditions. Among their features: complex structures of minerals and hydrocarbons (solid, liquid and gaseous ones), great stratification depth (e.g., the exploration of diamond deposits in Arkhangelsk Oblast requires overburden removal), a large distance from previously constructed objects of industrial and social infrastructure, and big environmental risks. As a result, their development requires much higher per capita investments and also new technical, technologic, organizational and economic solutions.

The last important feature is the open character of all the projects,

whether previously executed or still pending. The majority of projects exceed the demands and capabilities of the Russian domestic market, by their size and by investment requirements. This is one of the reasons why a significant number of these projects are pursued as joint projects with companies from abroad (especially those that have experience, know-how, technology or investment potential).

We illustrate these arguments on project-to-project basis, starting from the west and finishing north of Russia's Arctic zone.

EUROPEAN LAND AREA OF RUSSIA'S ARCTIC ZONE

We should note that it is necessary to examine ore mining and energy projects separately. The main reason for this distinction is the different in-service dates for the objects and different schemes of delivery for extracted products. Consequently, investment projects are effective in different ways and have different aims.

The following trends are typical of the European part of Russia:

- a) Stagnation in the mining industry, and
- b) development in the oil-and-gas sector (especially resulting from creating a "window" to the north of the Komi Republic and the shelf area of the Pechora Sea).

Mining Industry

Existing apatite projects. JSC Apatit (a subsidiary of JSC PhosAgro) is a company primarily directed to support the current apatite ore and raw materials base, processing facilities and infrastructure objects, to increase production, to decrease net cost, and to provide industrial, environmental and fire safety. A major portion of investment goes to underground mines, mainly the Kirov phosphate mine.³ The combined Kirov apatite mine was founded in 1989 from two underground mines, the Kirov mine, exploring the Kukisvumchorr apatite deposit since 1929, and the Yukspor mine, exploring the same deposit since 1954.

New apatite projects. JSC Akron is a company building a mining and concentration plant named Oleniy Ruchei, which would be the first large investment green-field project in the northwestern part of the country. It is

completely financed with private funds. This project is the only one that is aimed to recover production of phosphate-bearing raw materials in Russia. The first phase was completed in the middle of 2012, and it has capacity of 1 million tons of apatite concentrate per year. Investments amounted to 430 million USD. The second phase will be completed in 2017, and it will have the same capacity.⁴

Polymetals. JSC Norilsk Nickel plays the main role in this sphere. According to the company's documents describing its development strategy for the next few years, Kola Mine & Metallurgical Company (MMC) (one of its operational divisions) is problematic for the parent company and will not be actively developed. The company intends to decide the future of the assets resulting from business activities in 2015 and reconfiguration of its manufacture. Norilsk Nickel is going to restructure its process chains. All the processes connected to the smelting of nickel will take place at the Polar Division on the Taymyr Peninsula, whereas refining will be in the Kola MMC.⁵

Diamonds. Arkhangelsk Oblast is one of the three most northern regions with diamond mines (along with Yakutia and Canada). OJSC Severalmaz, the youngest mining company in Russia, was founded in 1992 in order to explore the Lomonosov diamond deposit; 95% of its shares belong to the Alrosa Corporation. The company started producing in 2006, and since then production levels have stayed at about 500,000 carats per year. In March 2014, Severalmaz established a second processing plant in the Lomonosov MCP to process 3 million tons of ore per year, which would help significantly increase processing and, as a consequence, the output of diamonds. In 2014, JSC Lukoil (a Russian oil company) will launch another diamond deposit, the Grib diamond pipe.⁶

Nevertheless, new projects, such as Oleniy Ruchei MCP or launching diamond mines in Arkhangelsk Oblast, cannot compensate for the loss of total mining production in the region. Modernization of previously launched mining companies in the European part of Russia's Arctic zone is leading to a significant reduction in employment.

JSC PhosAgro, the parent company of JSC Apatit on the Kola Peninsula, is undergoing the same process. In 2013, the company is reported to have started mass dismissals in the Apatit area. The number of the redundant may reach up to 3,500 people, i.e., up to one third of the total staff.

Currently, the main efforts of all industrial enterprises in the region are intended to maintain production at a constant level. Except for the Komi

Republic, after 2011, all the regions in the European part of Russia's Arctic zone have demonstrated a decrease in industrial output.⁷

Energy Resources

Coal. Over the past 20 years the annual production of JSC Vorkutaugol and Intaугol has decreased by 46.6%. In 1990, total output was near 30 million tons; from 1990 to 2002 it has fallen to 12.9 million tons. The decrease is attributable mainly to unfavorable circumstances in the Russian coal market. In 2002, domestic coal markets fell, which made restructuring of the industry unavoidable. As a result, a significant number of mines in the Pechora Coal Basin were shut down, and production fell to half the level of the 1990s. In 2013, the turnover of coal in the port of Murmansk increased by 12% and reached 13 million tons. A major part of it was produced in the Komi Republic.⁸

Oil and gas. In the Kharyaga oil field, Total S.A. is currently exploring the Haryaginsk deposit, with 97 million tons of oil in the licensing area, under production sharing agreement conditions signed in 1999. The participants of the PSA are as follows: Total S.A. (40%, the executor), Norwegian Statoil ASA (30%), JSC Zarubezhneft (20%) and Nenets Oil Company (10%) belonging to the administration of Nenets Autonomous Okrug. Over 33 years of the project, it is expected to produce 45 million tons of oil. The highest production level will be 1.9-2.0 million tons of oil, and may be reached in 2017-18. As of 2011, the project expected 389 cluster pads to be constructed (about 3,000 individual boreholes) and nearly 10 billion USD to be funded in total.⁹

Varandey and a cluster of fields. Varandey is a unique transport project by Lukoil aimed to build and launch an Arctic oil export terminal. The terminal is a fixed offshore ice-resistant offloading terminal (FOIROT) with capacity of 12 million tons of oil per year. Departing from Varandey in small shuttle tankers, oil is transported to the port of Murmansk and loaded onto the estuarial barge "Belokamenka" for further exporting. The FOIROT was set in operation in 2008. All the objects of the Varandey terminal cost 78 billion rubles (2.6 billion USD).

Initially, the mineral owner was a joint venture founded by JSC Lukoil and ConocoPhillips and named LLC Naryanmarneftegaz (NMNG). In January 2014, the licenses that this company had acquired to exploit deposits in the areas of Medyn, Myadsey and Toboy fields were reissued

to a new owner, LLC Lukoil-Komi. It was estimated that the production-sharing project will extract up to 10 billion barrels of oil. According to the assumptions, the participants should have been extracting 10 million tons of oil per year by 2008. However, due to a mistake made by the geologists who worked in Yuzhnoye Khylochuyu, the main deposit, production levels began to fall drastically. Thus, in 2009-2010, less than 7 million tons of oil were extracted, and only 3.3 million tons by 2011. In 2012, ConocoPhillips sold its share (30%) in NMNG to Lukoil for about 600 million USD, so Lukoil obtained 100% of the company. Naryanmarneftegaz now has seven licenses to exploit deposits in the Nenets Autonomous Okrug: Yuzhnoye Khylochuyu, Yareyu, Varandey, Toravey, Zapadnyy Lekeyagin, Severnyy Saremboy, Varandey-Adzvin structure zones with Perevozhnoye, Mezhdurechensk and the Sedyagin deposits inside.¹⁰

Trebs and Titov oil field. A development project for the Trebs and Titov oil fields, one of the largest unexploited deposits in Russia (total reserves for ABC1 categories exceed 210 million tons), is being executed by JSC Bashneft and JSC Lukoil. This can significantly decrease costs and minimize project risks by using existing infrastructure and work experience in the region. The total project implementation cost is about 180 billion rubles (or about 5 billion USD).¹¹

Prirazlomnoye field. In December 2013, JSC GazpromNeft started oil production from a field with an offshore ice-resistant stationary platform, Prirazlomnaya. In April 2014, the first oil tanker left the station with cargo weight of 70,000 tons. In 2014, it is planned to ship more than 300,000 tons of oil. A new oil grade from the Prirazlomnoye field is called ARCO (Arctic Oil). After increasing production, part of the oil will be sold on the basis of long-term contracts. The Prirazlomnoye oil field is in the Pechora Sea 60 km off the coast. The planned production is about 6 million tons per year (which will be executed after 2020).¹²

The Prirazlomnoye field was discovered in 1989. At first, Gazprom planned to start exploring it 10 years ago, in 2004. The company estimated the exploration costs as 200 billion rubles (6-7 billion USD). This sum includes the cost of the platform Prirazlomnaya (60-65 billion rubles), infrastructure, two service ships and two ice class tankers.¹³

As exemplified by the European part of the land Arctic zone, we can see clearly that projects in the oil-and-gas sector are developing dynamically (taking account of a rather limited chance to increase the resource base), modernization processes are facing more difficulties, and the Russian

mining industry is renewing its assets. In the latter case, the growth is “destroyed” by the increasing complexity of processes and inefficiency of deposits long under development and production. One of the reasons is the notorious insider’s dilemma: major owners of metallurgical and mining companies do not want to lose their dominance when making decisions and receiving income from their assets (despite their declining profitability), as well as severe employment conditions for redundant workers in northern monotowns, whose economy is dominated by a single industry or company. Economies of scale have practically disappeared (especially in the case of long-developing fields).

NORTHWESTERN SIBERIA–THE YAMALO-NENETS AUTONOMOUS OKRUG

All the trends mentioned above are also common in this area. Although its land territories and internal waters (the estuaries of the Ob River and Taz River) have immense reserves of natural gas (the size of fields is over 1 trillion cubic meters), the trend is practically the same.

Supergiant Gas Fields Brought into Development in the 1970s-80s and 2000s

This type of deposit comprises (the licenses to develop the fields belong to Gazprom subsidiaries)¹⁴:

- Medvezhye: 4.7 tcm, brought into development in 1972 (capacity is 70 bcmpa).¹⁵
- Urengoy: 16.5 tcm, brought into development in 1978 (capacity is 280 bcmpa).¹⁶
- Yamburg: 8.2 tcm, brought into development in 1982 (capacity is 160 bcmpa);
- Zapolyaroye: 3.5 tcm, brought into development in 2001 (capacity is 105 bcmpa); since 1994, investments in its development have accounted for about 140 billion rubles (about 4.5 billion USD excluding transport infrastructure).¹⁷
- These fields have the following development process characteristics:
- the first step is to develop the so-called Cenomanian deposits (at

- a depth of 1100-1700 m, with a stratum width of 200-300 m) containing almost pure methane with a certain percent of ethane;
- gas is shipped using mostly a system of cross-country pipelines to deliver it to the European part of Russia and Europe; and
- the economies of scale factor has a pronounced effect: due to low unit costs, they could transport gas over large distances and generate substantial gains.
- While production levels in these giant fields are declining, costs are rising fairly fast. In 2013, the annual costs increase exceeded 10%. The average gas production cost of 2013 is reported to be 1232 rubles/mcm (38.72 USD/mcm or 1.2 USD/MMBtu) compared with 1085 rubles/mcm (34.92 USD/mcm or 1.1 USD/MMBtu) in 2012.¹⁸

Eventually, the advantages stated above will be lost, making room for rather complicated issues:

- enormous spending made to renew key assets, as well as dispose of and close certain manufacturing units (which is currently happening in the Medvezhye gas field);
- a need to maintain decreasing pressure in order to deliver gas over large distances; and
- the growing importance of exploring more complex and less homogeneous deposits (first of all, in hydrocarbon content), because of increased production of gas condensate and even oil.
- The main result of these trends is that the proportion of so-called “low-pressure gas” in these deposits is rapidly increasing. LP gas is economically unprofitable and ineffective to be extracted for further transportation.

New Project in an Old Place

The projects mentioned above depend not only on how the LP gas problem is solved but also on the exploration and development of smaller, deeper and more complex fields (in terms of hydrocarbon composition). In 1997, commercial production of oil started in the Urengoy field. Since 2008, there has been gas and gas condensate output from the Achimov layers, and the next step is to exploit Jurassic sediments. The Achimov formation has low

productive capacity, so the project includes construction of 200–300 meter-long horizontal wells and hydraulic fracturing.

More complex and deeper deposits provide a basis for collaboration with technologically advanced companies. Therefore, in July 2003, Russian JSC Gazprom and German company Wintershall Holding GmbH (BASF's wholly owned subsidiary) founded a joint venture, JSC Achimgaz, on the principle of parity (50:50) to exploit Achimov deposits at the first test site in the Urengoy gas field. In 2008, Achimgaz brought the site into pilot production and into commercial production at the end of 2011.^{19, 20}

Another successful co-project between Gazprom and Wintershall Holding GmbH is the Yuzhno-Russkoye oil/gas/condensate field in Yamalo-Nenets Autonomous Okrug (YaNAO). The field was brought into production in 2007 and has capacity of 25 bcm.

Yamal mega-project. Besides extracting natural gas, gas condensate and oil from the deposits described above, Northwestern Siberia offers an opportunity to develop new large projects, although they are smaller than the previously mentioned sites. These kinds of fields are situated within the Nadym Pur Taz District, in the Yamal, Taz and Gydan Peninsulas, in the Gulf of Ob and the Taz Estuary.

The most important area is the Yamal Peninsula, where the Yamal mega-project is located. According to various estimates, the amount of investment necessary to implement the project fluctuates between 75 and 125 billion USD. In January 2002, the Gazprom Board of Directors named the Yamal Peninsula a region of strategic interest to the company. By 2030, the commercial exploitation of fields on the peninsula and the nearest offshore areas will have increased gas production to 360 billion cu m per year. A new large gas producing region is growing in Yamal that will replace traditional deposits in Nadym Pur Taz. There are 32 sites located on the Yamal Peninsula and adjacent waters, with total reserves amounting to 26.5 trillion cu m of natural gas and nearly 1.64 billion tons of oil and gas condensate. In terms of gas reserves, the Bovanenkovskoye field is the most significant one on the Yamal Peninsula, with 4.9 tcm.

Between 2007 and 2012, Gazprom's capital expenditures (including those of its subsidiaries) on projects in YaNAO and the Yamal Peninsula accounted for about 1.6 trillion rubles (about 500 billion USD). The investments were spent on the following ventures: the Bovanenkovskoye field development and the Bovanenkovo–Ukhta gas trunkline system; the Obkaya–Bovanenkovo railroad line; infrastructure development in the

Zapolyarnoye, Urengoy and Yamburg fields; expansion of the Urengoy gas transmission center, and the Zapolyarnoye–Urengoy gas pipeline.²¹

Bovanenkovskoye field. Production at the Bovanenkovskoye field is up to 140 bcmpa.

To deliver gas from the deposit, Gazprom has built a new 2451-km-long pipeline system, namely the Bovanenkovo–Ukhta and the Ukhta–Torzhok pipelines. The first start-up complex brought into production at the end of 2012 has a complex gas treatment plant with a capacity of 30 bcmpa and 60 wells.²²

Yuzhno-Tambeyskoye field. Another significant project is development of the Yuzhno-Tambeyskoye field, with reserves amounting to 1.3 tcm of natural gas. Unlike the Bovanenkovskoye field development, this project does not deliver gas to the long-distance pipeline, but relies on a liquefied natural gas (LNG) plant. It is planned to build three production lines, each with capacity of 5.5 million tons. The first line is to be officially launched in 2017. The project's total cost is estimated at 26.9 billion USD, provided that loan proceeds are about 70% (18-19 billion USD).²³

The main feature of the project is that it is not implemented by Gazprom, but by Novatek (formally an independent member of the Russian gas market, although Gazprom owns 19.9% of its shares). To produce LNG, a new company has been founded named Yamal LNG, shares of which belong to Novatek (60%), Total (20%) and China National Petroleum Corporation, or CNPC (20%).

It is worth mentioning that the cost of Yamal LNG construction has increased by 50-60% from the initial estimates and reached that of the Shtokman oil/gas/condensate field development, which Gazprom has postponed indefinitely. The project cost has risen from the original estimate of 18-20 billion USD to 27 billion USD, with 2.6 billion USD already invested. The participants in the project have received tax deductions for investments and have thereby transferred a part of the expenditures to the state. The government will pay 47 billion rubles (about 1.5 billion USD) to build a port at Sabetta to take delivery of construction supplies for the plant and then to ship LNG.²⁴

Novoportovskoye oil and gas field. Overall production from the Novoportovskoye field (developing by JSC GazpromNeft) is estimated to be 220 million tons of oil and 260 bcm of natural gas. A year-round oil export terminal near Mys Kamenny on the Gulf of Ob will be launched in 2014, and the field will be brought into production in 2015. Mys

Kamennyy is approximately 400 km to the south of the Port of Sabetta, where Novatek plans to build Yamal LNG.²⁵ Between 2013 and 2015, JSC GazpromNeft expects to invest 91.7 billion rubles (nearly 2.5 billion USD) in the Novoportovskoye field development and 17 billion rubles (nearly 0.5 billion USD) on the Messoyakha gas field in YaNAO.²⁶

The port of Sabetta and its infrastructure. The oil and gas resources of the Yamal Peninsula open the door to creating a maritime infrastructure. The port of Sabetta is a good example. Construction of the port began in July 2012 within the framework of the Yamal LNG project. In terms of bottom dredging at Sabetta, it is estimated that the total amount of subsoil will amount to 70 million cubic meters. Starting from 2013, the port can take Cape size vessels, including icebreakers.²⁷

It is notable that certain players in Russia strongly support the intention to make the port universal and accessible in order to develop navigation along the Northern Sea Route (NSR) and expand foreign economic relations with the Asia-Pacific region. It was elaborated on the initiative of the three Russian regions (YaNAO, Khanty-Mansi Autonomous Okrug, and Tyumen Oblast) with the assistance of the Russian Union of Industrialists and Entrepreneurs.²⁸

EASTERN AND NORTHEASTERN SIBERIA

The projects executed in the mineral resource sector of the land areas within Russia's Arctic in Eastern Siberia and the Far East show vividly how two types of projects can combine and interact: one related to the modernization and reconstruction of previously created assets and another related to an opportunity to execute new projects. We should also emphasize that issues of modernization (as we described earlier for the mining industry in the European part of Russia's Arctic zone and for gas fields of land territories in Western Siberia) are not limited to attracting investment and obtaining access to new technologies. The fact of the matter is that the government should also change the institutional environment for implementing such costly projects.

Taymyr Peninsula

Norilsk Nickel: too late to modernize? JSC Norilsk Nickel is one of

the world's largest producers of copper, nickel and rare metals (such as platinum and palladium). Its major mining assets are mines and smelters located in the Kola and Taymyr peninsulas, which work together closely and represent a single process chain. The NSR facilitates collaboration between these territorial units, the Kola and Polar Divisions, respectively. Norilsk Nickel is currently both the main carrier and customer using the NSR to ship and receive cargo. The company possesses ice class vessels, a seaport at Dudinka, and terminals at Murmansk and Kandalaksha; it annually transports over 1 million tons of cargo, including equipment and concentrate for further processing. Apart from that, Norilsk Nickel provides the largest number of jobs in Norilsk, which is the largest city above the Arctic Circle in this region with a population of 178,000 people in 2013, and some monotowns on the Kola Peninsula.

In 2014, Norilsk Nickel announced the company's intention to reconfigure its process chains. Smelting will take place at the Polar Division, whereas refining will be in the Kola MMC. The company also wants to upgrade and expand the Talnakh facilities (Polar Division). As the new strategy states, the project requires 950 million USD in investments and will improve the quality of concentrate.²⁹ All the changes require Norilsk Nickel to attract significant funds, so the company counts on the government's assistance.

The main environmental problem of the old metallurgical plants at Norilsk Nickel's Polar Division is airborne emissions. According to a study on the most polluted places in the world conducted by Green Cross Switzerland in collaboration with the Blacksmith Institute, the annual amount of emissions into the atmosphere in Norilsk amounts to about 500 tons of copper and nickel oxides, and 2 million tons of sulfur dioxide. The whole modernization program of the Norilsk Industrial District will cost 70 billion rubles (about 2 billion USD). The nickel plant was launched in 1942 and is currently located within the city of Norilsk.

JSC Norilsk Nickel is an example of the consequences resulting from the monopoly of a company on unique mineral resources, which is true not only within the land territories of Russia's Arctic. The nickel and copper deposits of Norilsk District are exceptional in terms of ore structure, so they ensure stable high income for a long time, despite market fluctuations, due to the fact that major capital expenditures took place in Soviet times. Although nonferrous metals production is an economically efficient field, Norilsk Nickel has not paid much attention to technical upgrading and

modernization due to the company's monopoly position on the Russian market, private as opposed to public ownership of assets—the company's major shareholders are the leading Russian financial and industrial groups that also have great influence outside of the country (Interros (30.3%), United Company RUSAL (27.8%), Millhouse Capital (5.87%), Metalloinvest Management Company LLC (-4%)), and ineffective state regulation of the subsoil users' operations.

Norilsk-1—Is Russian Platinum LLC an alternative? In 2012, one of the attempts to change the monopoly situation in an important region of the land territories of the Arctic was to hold an auction/competition to find out who will have the right to exploit and produce copper-nickel ores in the southern part of the Norilsk-1 field. The winner of the auction was the mining company Russian Platinum (Russkaya Platina) due to its proposal meeting all the requirements of the competition for a deposit of federal significance. It is assumed that a new enterprise, the Chernogorskaya Mining Company LLC, founded to explore the southern part of Norilsk-1 will provide more than 3,000 jobs in Krasnoyarsk Oblast. The mine will be in operation for about 60 years. The work will be conducted in close collaboration with the Chernogorskaya Mining Company LLC, acquired by Russian Platinum and located in the same region. Capital investments will amount to 58 billion rubles (about 1.7 billion USD) in the first step and 78 billion rubles (about 2.2 billion USD) overall.

EASTERN TAYMYR (KHATANGA), NORTHWESTERN SAKHA REPUBLIC (YAKUTIA), AND THE FAR EAST

The eastern sector of the land territories at Russia's Arctic zone has not been explored in detail economically. The main mineral resources are diamonds (both traditional and found in meteorites), gold, and polymetals. So far, oil and gas resources have been found in the continental shelf of the Sea of Okhotsk; the shelf of other seas of the Arctic remains to be explored.

A distinctive feature of the mineral potential in the eastern area is its focus on and intention to satisfy the growing needs of a modern high-tech economy. Diamonds (especially meteoritic origin ones which have outstanding characteristics) can serve as raw material to produce high-strength and precision tools. As for rare earth elements, they are now in higher and higher demand in many sectors of modern industry.

The explored deposits have two main characteristics: their exceptional combination of between large scale and good quality of mineral resources, and their location in poorly developed areas, both economy- and transportation-wise.

Almazy Anabara

In the northwestern part of Yakutia, in Anabarsky and Olenyoksky Districts, the mining industry is rapidly developing. The Anabarsky mining and concentration complex ALROSA, OJSC Almazy Anabara, and OJSC Nizhne-Lenskoye are working in the alluvial diamond deposits, and Nordvik LLC is operating in the Yuzhno-Tigynskoye oil field.

The main focus is the development of alluvial diamond deposits. Almazy Anabara (ALROSA's wholly owned subsidiary) conducts mining operations in the Mayat and Morgogor alluvial diamond deposits.

In 2102, the company produced 2,408 thousand carats of diamonds worth 161.8 million USD (the share of the company from the total diamond production of the ALROSA group in 2012 amounted to 7%). By early 2012, the company had accumulated 45.7 million tons of ore or 36.5 million carats of diamonds.³⁰

Rare Earth Metals of the Tomtor Field

One of the largest deposits of rare earth metals is the Tomtor field, which is located in the northwestern part of the Sakha Republic (Yakutia). The field is distinctive in its high concentration of minerals. There are 18 types of them, starting from conventional minerals (iron, phosphorus, titanium, vanadium) and ending with rather exotic elements (holmium, ytterbium, and lutetium). The State Register of Reserves lists 10 elements in the Tomtor field, each of which forms an industrial concentration. This deposit in Yakutia is a world leader in the number of unique compounds of niobium with rare earth elements.³¹ The Tomtor field is known for its rare elements: niobium, yttrium, scandium and lanthanide group. At current demand levels, reserves of rare elements in the deposit can satisfy the needs of Russia (and those of the world, under certain conditions) for hundreds of years.³²

On May 28, 2014, a joint venture of the state corporation Rostech (formerly known as Rostekhnologya) and the EAST Group won a tender to

develop the Tomtor field in Yakutia, one of the world's largest deposits of rare earth metals. Rostech and the EAST Group agreed to invest 1 billion USD in rare earth metal production in the next five years (until 2018). The Tomtor field is one of the largest ore deposits in the world, with estimated resources of 154 million tons.³³

Impact (Meteorite Origin) Diamonds of the Popigai Crater

Recent decades have seen the discovery of previously unknown types of diamond bedrock. In the early 1970s in the northern part of the Siberian platform, geologists discovered impactites occurring within the Popigai astrobleme lying in the eastern part of the Taymyr Peninsula and the northwestern part of Yakutia. Reserves of impact diamonds there greatly exceed those of the world's best-known diamondiferous deposits. In the bedrock of the Popigai crater, alluvial deposits of micropolycrystal diamonds also have been found. Impact diamonds, or lonsdaleites, belong to a new, previously unknown type of technical rough diamonds which are not well enough known for industrial development or use.

Gold and Polymetals of Northeastern Russia

The northwestern part of Russia's Arctic land territories, namely Magadan Oblast and Chukotka Autonomous Okrug, possesses significant resources of precious (primarily gold) and nonferrous metals. A distinctive feature of the region is a high degree of resource base development.

Magadan Oblast. The most successful projects in gold mining are those executed by the Kinross Gold Corporation of Canada. The company has been operating in Russia since 1995. It is the leading foreign investor in the gold mining industry, the leading Canadian investor in the Russian economy, and one of the largest taxpayers in the Russian Far East. Kinross Gold holds 100% of shares of the OJSC Chukotskaya Mining and Geological Company, which is developing the Kupol mine in Chukotka Autonomous Okrug. Since the company launched production in 2008, total production levels have reached about 3 million gold equivalent ounces. In 2010, the company acquired 100% ownership of Severnoye Zoloto LLC and Regionruda LLC, which are developing the Dvoynoye deposit and the Vodorazdelnaya property located 100 km to the north of the Kupol mine. The total investment amount exceeded 3 billion USD.³⁴

Companies in Magadan Oblast are considering cooperating with the companies of other countries, including China. In September 2013, the Administration of Magadan Oblast and China Nonferrous Metal Industry's Foreign Engineering and Construction Co., Ltd. (NFC in short) signed a co-investment agreement.

The agreement stipulates the terms and conditions of cooperation within an investment project on the Kunarev mine development in the Srednekansky District in Kolyma. Its resources are estimated to be 14,200 tons of silver, 4,200 tons of zinc, 605,000 tons of lead and 1.3 million tons of copper.³⁵

As we can see from the examples above, Russia's Arctic zone shows relatively high levels of investment activity. The companies of the region implement projects aimed to upgrade previously launched oil and gas objects and projects intended to explore new sources of raw materials and energy.

GENERAL CONSIDERATIONS

Since the late 1980s, Russia has been working on establishing a new institutional system for subsurface resources management, including the exploration of mineral resources in the Arctic. Apart from laws and regulations dealing specifically with subsurface resources, we surely need to mention legislative acts related to denationalization and privatization in resource industries, to taxation and pricing issues, and to problems of regulating certain activities (especially naturally monopolized ones).

The following characteristics are the most important features of the institutional environment in the mineral resources sector of the Russian economy (which fully applies to the Arctic case):

- a contradictory and ambiguous set of priorities regulating the formation and modification of the system;
- weak coordination and interdependence of different parts of the system (e.g., the one forming rules and standards of mineral resource use and the one defining conditions of mineral resource use) and a general trend for subsoil users to “localize” their economic activities in those regions where mineral resources are extracted;
- insufficient attention to questions related to conflict resolution,

adaptation of socially oriented solutions in the sphere of subsoil use (which would not only be designed to satisfy the specific needs of indigenous ethnic groups' economic life, but would also respect the concerns of the whole population of the Arctic);

- fiscal orientation of the main set of rules aimed to control subsoil users (to receive the most federal revenue, to the extent reasonably practical), which have led to an ongoing situation where the stress is not on socially determined production rates, but on achieving maximum development and production capacities, which is encouraged by commercial goals; and
- lack of inter-determination and correlation among different units of the institutional system (e.g., contradictions between the subsoil and forest legislations of the Russian Federation).

Before 2008, all companies (private and state) could become investors entitled to develop mineral resource deposits. In addition, the proportion of foreign capital in the assets of private companies was not restricted. In 2008, however, the government defined the status of “subsoil plots of federal significance.” These deposits were included in the reserve fund, and the right to distribute them was strictly assigned to the government of the Russian Federation. These amendments significantly slowed the development of new subsoil plots. Between 2008 and 2014, starting from the foundation of an independent legal institution on subsoil plots of federal significance, only eight licenses to develop deposits of gold, diamonds and platinum group metals have been issued. March 2014 saw amendments to the Subsoil Law that excluded alluvial deposits and occurrences of precious metals and stones from the list of strategic subsoil plots, and aimed at simplifying the procedure for granting the right of subsoil use.

Therefore, we can divide all the projects of the mineral sector executed in the land territories of Russia's Arctic into two big groups:

- a) projects implemented in “subsoil plots of federal significance” where the foreign investor's share in the assets of an applicant cannot exceed 51%, and if a licensee company sells 10% to foreign agents, it should be approved by the government; and
- b) other projects in which both Russian companies and Russian companies with predominantly foreign capital can participate.

It needs to be emphasized that the dependence of the Russian economy on the mining sector in general and the mining sector in the land territories of the Arctic in particular influences the need to enforce strict laws flexibly.

All the main infrastructure projects in the land territory of Russia's Arctic are implemented in connection with the development of certain mineral deposits. This includes the Varandey terminal, a railway within the Yamal mega-project, the port of Sabetta, and the reconstruction and modernization of social infrastructure in the city of Norilsk.

In the final analysis, a combination of the following factors will define future growth areas for investment and business in the land territories of the Arctic:

- a) the intention to open "new reserves" of traditional types and sources of minerals; a slow path is to search and implement super-efficient projects that would produce economies of scale;
- b) conditions to develop new and more complicated southern deposits, as well as the fields that were under development for a long time, requiring technological upgrades; and
- c) increasing demand for new, unique types of minerals, e.g., the rare earth elements of the Tomtor field and impact diamonds of the Popigai crater.

Business activity in the Arctic will not grow significantly due to public investment. Government assistance will be aimed to obtain the highest effects for the domestic economy by regulating subsoil use. Having experienced a boost in the technological development of the oil-and-gas industry, Norway and Canada demonstrate how necessary it is to have a consistent policy for science and technology; to strengthen the role of the government as a regulator controlling technological development and as a customer who encourages new technological solutions and innovative products; to stick to pragmatic protectionism towards local industrial, service and innovation companies; and to regulate monopolies and to make the government control the design and technological activities of the companies that execute new projects in cooperation. A key trend in assessing the feasibility of oil and gas development projects in the Arctic is to satisfy the long-term social, environmental and economic interests of Russia as a whole, as well as its eastern and Arctic regions.

Notes

1. “Арктика заявляет о себе” - “Российская Газета” [“The Arctic makes a statement,” Rossiyskaya Gazeta] - <http://www.rg.ru/2005/04/05/arktika.html>
2. “Российская Арктика может стать объектом сбора статистики” [“Russia’s Arctic may become an object for statistics collection”], May 29, 2014 - http://www.arctic-info.ru/News/Page/rossiiskaa-arktika-mojet-stat_ob_ektom-sbora-statistiki
3. “В 2013 г. «Фосагро» направит 9,5 млрд руб. на развитие «Апатита»” - “Ведомости” [“In 2013 PhosAgro is to invest 9.5 billion rubles into development of Apatit,” Vedomosti], July 4, 2013 - <http://www.vedomosti.ru/companies/news/13816901/v-2013-g-fosagro-napravit-95-mlrd-rub-na-razvitie-apatita#ixzz3412QItDL>
4. Atle Staalesen «Акрон» запускает ГОК «Олений Ручей», [“Akron builds a mining and concentration plant Oleniy Ruchei” by Atle Staalesen], 30 July, 2012- <http://barentsobserver.com/ru/biznes/akron-zapuskaet-gok-oleniy-ruchey-30-07> -
5. Виталий Петлевой «Норникель» обновляет стратегию” - “Ведомости” [“Norilsk Nickel renovates its strategy” by Vitaliy Petlevoy, Vedomosti], May 19, 2014 - <http://www.vedomosti.ru/companies/news/26647191/nornikel-obnovlyayet-strategiyu#ixzz34138Mwq0>
6. Елизавета Васильева “Алмазы из Баренцрегиона привлекают огромный интерес” [“Diamonds of the Barents Region are attracting much attention” by Elizaveta Vasilieva], June 5, 2014 - <http://barentsobserver.com/ru/biznes/2014/06/almazy-iz-barencregiona-privlekayut-ogromnyy-interes-05-06>
7. Atle Staalesen “Спад горной добычи на фоне нарастающих проблем в российской промышленности” [“Decrease in mining output against the background of aggravating problems of the Russian industry” by Atle Staalesen], June 5, 2014 - <http://barentsobserver.com/ru/biznes/2014/06/spad-gornoy-dobychi-na-fone-narastayushchih-problem-v-rossiyskoy-promyshlennosti-05>
8. Елизавета Васильева “С угледобывающим сектором в Коми не связывают больших ожиданий” [“The coal mining sector in the Komi Republic does not create high expectation” by Elizaveta Vasilieva], May 29, 2014 - <http://barentsobserver.com/ru/biznes/2014/05/s-ugledobyvayushchim-sektorem-v-komi-ne-svyazyvayut-bolshih-ozhidaniy-29-05>
9. <http://ria.ru/money/20121026/907015609.html#ixzz34PbsI0eO>
10. “ЛУКОЙЛ” переформил три лицензии с бывшего ConocoPhillips на “ЛУКОЙЛ-Коми” [“LUKOIL reissues three licenses from ConocoPhillips to LUKOIL-Komi”], February 12, 2014 - http://lukoil-komi.lukoil.com/main/content.asp?art_id=16344
11. Новые месторождения компании Башнефть в Ненецком АО [New Bashneft deposits in Nenets Autonomous Okrug]. - <http://www.bashneft.ru/production/>

production/new/

12. Интерфакс “«Газпром нефть» купила недропользователя Приразломного за 2,7 млрд рублей” [“Gazpromneft buys Prirazlomnoye’s subsoil user for 2.7 billion rubles”, Interfax], April 25, 2014 -
<http://www.vedomosti.ru/companies/news/26877361/gazprom-neft-kupila-neдрopolzovatelya-prirazlomnogo-za-27#ixzz34QIQwCkH>
13. Михаил Серов “«Газпром» начал добычу нефти в Арктике” - “Ведомости” [“Gazprom starts extracting oil in the Arctic” by Mikhail Serov, Vedomosti], December 23, 2014 - <http://www.vedomosti.ru/companies/news/20597421/gazprom-otkryl-arktiku#ixzz34QLBTskQ>
14. Vadim Eskine, Thane Gustafson, and Matthew Sagers. Outlook for Gas Production from Gasprom’s ”Big Three” Fields. What Will Be the Rate of Decline? - CERA Advisory Service. Decision Brief. Russian Energy. 2002. - 15 p.
15. Топчев Ю. И. Шаги газового исполина [Yu.I. Topchev. Steps of the Gas Giant]. Sverdlovsk: Sredne-Uralskoye publisher, 1984. 128 p.
16. Скрылев С. А. Тюменские проекты Большого Уренгоя (рус.) [S.A. Skrylev. Tyumen Projects of Bolshoy Urengoy]. Energeticheskaya strategiya, 2012. No. 2 (20).
17. Скрылев С. А. ТюменНИИгипрогаз: надежное партнерство – залог успехов (рус.) [S.A. Skrylev. TyumenNIIGiprogaz: Reliable Partnership is a Ticket to Success]. Trendy. Sobytiya. Rynki, 2011. No. 4 (51). p. 66–67
18. http://www.eegas.com/rep2013q4-cost_e.htm
19. <http://www.gazprom.ru/about/production/projects/deposits/achimovskie-deposit/>
20. И. Нойберг (Зам. генерального директора ЗАО “Ачимгаз”) “Российско-немецкое партнерство” - Презентация доклада на конференции [“Russian-German partnership” by I. Noiberg (OJSC Achimgaz First Deputy CEO), report presentation at a conference], October 18, 2013, Tomsk State University. 46 p.
21. <http://www.gazprom.ru/about/production/projects/deposits/bm/>
22. Ксения Докукина, Ирина Кезик “Газпром” открыл Арктику” - “Ведомости” [“Gazprom discovers the Arctic” by Kseniya Dokunina and Irina Kezik, Vedomosti], October 25, 2012 - http://www.vedomosti.ru/newspaper/article/332931/gazprom_otkryl_arktiku#ixzz2AnJbeF5E
23. Михаил Серов “«Новатэк» готов продать 10% в «Ямал СПГ» фонду РФПИ и китайской CIC” - “Ведомости” [“Novatek is ready to sell 10% of Yamal LNG to RDIF and Chinese CIC” by Mikhail Serov, Vedomosti], February 21, 2014 - <http://www.vedomosti.ru/companies/news/23104601/partner-s-dengami#ixzz34WXA0o4v>
24. Светлана Кристаллинская “Игра на опережение - «Ямал СПГ»” - “Ведомости”

- [“Proactive approach. Yamal LNG” by Svetlana Kristalinskaya, Vedomosti], April 20, 2014 - <http://www.vedomosti.ru/companies/news/26955431/poslednyaya-partiya-dostalas-gazpromu#ixzz32mPOdp1I>
25. Aatle Staalsen. Новопортовское месторождение подстегнёт арктические перевозки нефти [“The Novoportovskoye field is to increase oil traffic in the Arctic” by Aatle Staalsen]. - <http://barentsobserver.com/ru/energiya/2013/02/novoportovskoe-mestorozhdenie-podstegnyot-arkticheskie-perevozki-nefti-13-02>
26. “Планы Газпромнефти” - “Ведомости” [“Plans of Gazprom Neft”, Vedomosti], September 16, 2013 - <http://www.vedomosti.ru/newspaper/article/530041/vkratce#ixzz34WiRqjXh>
27. <http://www.arctic-info.ru/ArcticPath/News/Page/dnoyglybienie-v-sabette-prodoljit-kompania--mordraga>
28. <http://www.arctic-info.ru/ArcticPath/About> - June 6, 2014
29. 2014 Strategy Update Focus on Delivery - Norilsk Nickel - London/May 19, 2014. - <http://www.nornik.ru/investoram/vyistupleniya-i-presentaczii>
30. <http://www.alrosa.ru/corporate-structure/> - дата просмотра 12 июня 2014 года
31. А.В. Толстов, Н.П. Похиленко. Перспективы освоения Томторского месторождения комплексных ниобий=редкоземельных руд // ЭКО. – 2012. – № 11. – С.17–27. [A.V. Tovstov, N.P. Pokhilenko. Prospective on the Exploration of the Tomtor Field with Complex Niobium and Rare Earth Ores. EKO scientific journal. 2012, No. 11. P. 17–27]
32. В.А. Крюков, Н.Ю. Самсонов, А.В. Толстов. Стратегическое значение редкоземельных металлов в мире и в России // ЭКО. – 2012. – № 11. – С. 5–16. [V.A. Kryukov, N.Yu. Samsonov, A.V. Tovstov. Strategic Significance of Rare Earth Metals in Russia and the World. EKO scientific journal. 2012, No. 11. P. 5–16]
33. “Ростех” и группа ИСТ выиграли тендер на разработку месторождения Томтор [Rostec and ICT Group win a tender to develop the Tomtor field], May 28, 2014 - <http://itar-tass.com/ekonomika/1220627>
34. <http://www.kinrossgold.ru/kinross/history/>
35. Владимир Печеный “Магаданская область и китайская NFC вместе освоят месторождения цветных металлов” - “Ведомости” [“Magadan Oblast and Chinese NFC are to develop deposits of non-ferrous metals” by Vladimir Pecheny, Vedomosti], September 16, 2013 - <http://www.vedomosti.ru/companies/news/16387431/magadanskaya-oblast-i-kitajskaya-nfc-vmeste-osvoyat#ixzz2f4SobU9y>

Commentary

Tatiana Mitrova

GLOBAL ROLE OF ARCTIC OIL AND GAS

The Arctic is often presented as the new frontier of global oil and gas production, the “next Gulf” with incredible resources of hydrocarbons (though our knowledge about their size is quite low). Many of the political disputes concerning the Arctic are motivated by these resource expectations, and nearly all major oil and gas companies are expressing their interest in Arctic projects.

The situation is quite different for Arctic offshore and onshore oil and gas production. Onshore projects are in a better position; they are already providing considerable volumes of hydrocarbons to global markets (Alaska, Canada, Norway, Russian Yamal-Nenets AO) and they can be regarded as conventional, though their higher costs make them less competitive in periods of oversupply and low prices. Problems faced recently by the Alaska gas pipeline and Russian gas supplies from Yamal due to the shale gas revolution clearly demonstrate that if the new, cheaper sources of oil and gas appear, expensive projects in the Arctic are immediately squeezed out from the supply curve.

Arctic offshore projects find themselves in a much worse position. In fact, as Moe and Rottem fairly mention, “despite the considerable attention given to Arctic offshore petroleum resources in recent years, actual industrial activity is still very limited.” There are just a few million tonnes of oil equivalent produced in the Arctic offshore, with enormous efforts and extremely high environmental risks.

Of course, there is huge potential in the Arctic continental shelf, but the main issue is whether there are commercially relevant Arctic investment projects related to offshore petroleum and gas production, and also whether these operations are environmentally acceptable. Numerous unsuccessful attempts and disappointments in the Alaska Outer Continental Shelf (in the Beaufort Sea and the Chukchi Sea), and in Greenland demonstrate the high vulnerability of Arctic offshore projects to the price movements. Each time oil prices increase, a strong interest in Arctic hydrocarbons rises, and when the prices drop, the activity stops. Shell’s recent announcements of

postponement of their Arctic project are probably the best demonstration of the fact that the majority of the Arctic hydrocarbon projects are marginal and extremely risky. They are on the edge of modern technologies and companies' managerial skills (and sometimes even beyond them). The need to organize complicated processes in the short two- to three-month ice-free window is still a challenge, even for the most experienced and well-managed oil companies.

THE ROLE OF ARCTIC HYDROCARBONS FOR RUSSIA

Russia is a key Arctic country, holding about 76.3 billion tonnes of oil equivalent, with recoverable reserves estimated to be 9.6 billion tonnes of oil. The gas reserves, estimated at 21.4 tcm, greatly exceed the oil reserves estimated in the region. According to Rosnedra, reserves in the Barents Basin include 2.2 billion tons of oil and 1.2 tcm of natural gas. Nonetheless, oil reserves, especially in the Kara Sea, are likely to have the priority, as they require less-expensive infrastructure to be developed and exported.

The energy sector is traditionally a crucial part of the Russian economy, providing for the bulk of export revenues, budget incomes and GDP. In 2012 oil, oil products and natural gas accounted for nearly 70% of exports, while customs duties and mineral extraction taxes on oil and gas provided more than half of federal revenues. So far, the share of revenues from the new Arctic oil and gas projects is not high (just a few of them are operational,¹ and some of them are at the moment receiving tax breaks or even direct investments from the state). Nevertheless, the Russian government (as well as state-controlled oil and gas companies, which are mainly holding these resources) is demonstrating enormous enthusiasm concerning future Arctic hydrocarbons development.

The reason is obvious: depletion of the Soviet-legacy oil and gas fields, together with all the strategic and social considerations and regional economic policies, stimulate a huge interest by the government in the reserves located in the Arctic, on the Yamal Peninsula, Arctic continental shelf, and so on. Oil and gas investments also have a huge multiplier effect, as they create an additional domestic demand for other industries' products and ensure the infrastructure development required for economic growth. Proceeds from hydrocarbon exports have an impact on the financial resources of manufacturers and service providers, and therefore on business

activity in the country, and thereby on its economic development prospects.

Not surprisingly, according to the “Energy Strategy of the Russian Federation up to 2030,”² which is the basic document setting out Russian energy policy, one of the most important strategic initiatives of the State in the energy industry is “Exploration of the Arctic continental shelf and northern regions (which should help stabilize oil and gas production after a possible downturn in the traditional oil-producing areas of Western Siberia in 2015-2030).”

Despite all declarations and intentions, however, the fate of the Russia Arctic oil and gas projects is not clear. Some of them have been postponed for an indefinite period (e.g. Shtokman), while others have taken several decades longer than expected for their implementation (e.g. Prirazlomnoe, the Yamal mega-project).

RUSSIAN ARCTIC OIL AND GAS INVESTMENT PROJECTS

The magnitude of investment in the Russian Arctic projects is impressive: 10 billion USD for the Kharyaga oil field, 5 billion USD for the Trebs and Titov oil fields, 6 billion USD for the Prirazlomnoye field, 75-130 billion USD for the Yamal mega-project, 30 billion USD for Yamal-LNG, 3 billion USD for the Novoportovskoye and Messoyakha fields development – totaling 130-185 billion USD. These are probably the most costly and largest projects in the entire Russian energy sector, with long lead times, high risks and an unclear period of investment return. Most of these investments were made with significant delays compared to the initial plans and schedules, which seems to be a common trend in this complicated and challenging area.

Several of these projects have huge infrastructure components, which is understandable: operators have to develop their production in remote frontier areas where no infrastructure exists at all, so once they decide to engage in a project, they have also to take the responsibility to build all the infrastructure necessary for its implementation. Prime examples are the Varandey terminal, a railway within the Yamal mega-project, and the Port of Sabetta.

The major investors in Russian Arctic oil and gas projects are large national state-controlled companies such as Gazprom and Rosneft,

influential private companies (like Novatek) and a few foreign majors cooperating with the state giants, such as Total, and until recently ExxonMobil, Statoil and ENI (See Table I-1).

Table I-1. Key offshore exploration projects linking Gazprom and Rosneft with foreign companies

Foreign Partner	Number of license areas	Offshore blocks	Comment/structure of the deal
Gazprom			
Total	1	Shtokman	Discovered in 1988 and located about 600 km offshore from Murmansk, the Shtokman gas and condensate field is believed to hold 3.8 tcm of gas and 53.4 Mt of gas condensate. In 2013, the project's development was postponed to after 2020 or even later, as initial partners Gazprom, Total and Statoil didn't make a final investment decision over challenges related to project design and costs. Statoil then left the project. According to Gazprom, field development would be divided into three phases. Phase 1 and Phase 2 would allow for respective annual production of 23.7 and 47.4 bcm of gas. The field is to reach its design capacity of 71.1 bcm /year through implementing Phase 3 at a later stage. ³
Rosneft			
ExxonMobil	11	The license blocks include Severo-Vrangelevsky-1, Severo-Vrangelevsky-2 and Yuzhno-Chukotsky blocks in Chukchi Sea, Ust' Oleneksky, Ust' Lensky and Anisinsko-Novosibirsky blocks in Laptev Sea and Severo-Karsky block in the Kara Sea	In return for obtaining the right to conduct exploration activities in these areas (agreements have different legal status and validity, though, at this stage and may not all be firm), ExxonMobil envisions that Neftegaz America Shelf LP (Neftegaz), an indirect independent subsidiary of Rosneft, acquires a 30% interest in 20 deep-water exploration blocks in the Gulf of Mexico held by ExxonMobil. In a separate Heads of Agreement, Rosneft (or its affiliate) have an opportunity to acquire a 25% interest in the Point Thomson Unit, which covers the project of developing a remote natural gas and condensate field on Alaska's North Slope. It is estimated that Point Thomson contains approximately 25% of the known gas resource base in Alaska's North Slope.
Statoil	4	The Kashevarovsky, Lisyansky and Magadan-1 licenses are in the Sea of Okhotsk north of Sakhalin Island, and the Perseevsky licence is in the Central Barents Sea.	The license requirements include drilling of six exploration wells in the period from 2016 to 2021. Statoil will carry the expenses of exploration activities required to determine the commercial value of the licenses. The three Arctic license areas cover a territory of 79,000 km ² .

Table I-1. Key offshore exploration projects linking Gazprom and Rosneft with foreign companies (continued)

Foreign Partner	Number of license areas	Offshore blocks	Comment/structure of the deal
ENI	3	The Fedynsky block (38,000 km ²) is located in the ice-free part of the Barents Sea. The Central Barents block (16,000 km ²) borders Fedynsky from the North; and the Western Chernomorsky block in the Black Sea.	Eni has reportedly started 2D seismic surveys and a first well.
Inpex	2	Offshore blocks Magadan-2 and Magadan-3 in the Russian section of the Sea of Okhotsk.	An MOU was signed in May 2013: INPEX was granted exclusive rights to negotiate toward a final agreement, expected by the end of 2013. INPEX would reimburse the development expenses for the licensed blocks incurred by Rosneft, as well as 33.3% of a one-off payment made by the Russian company during the course of license acquisition. Furthermore, the agreement provides for non-recurrent bonuses to be paid by INPEX to Rosneft for each commercial oil and gas discovery proportionally with its stake in the project. Both firms plan to set up a joint venture to explore the offshore blocks.
CNPC	3	These blocks are located in the Barents and Pechora Seas (West Prinovozemelsky, Yuzhno-Russky and Medynsko-Varandeisky) as well as onshore blocks in the Irkutsk Region, Krasnoyarsk Territory and YNAA.	Preliminary agreements were signed in March 2013. Some of these areas have never been explored before and are thus quite unknown.
Petrovietnam		Blocks would be located in the Pechora Sea.	The parties also signed an MOU over Rosneft's potential acquisition of a stake in the production sharing agreement (PSA) for Block 15-1/05 offshore Vietnam.

Source: IEA Russian Energy Policy Review 2014.

While a Russian company typically holds the license, these agreements generally involve a shareholder agreement of 33.33% for the foreign

company in the joint venture, and a commitment by the foreign company to finance exploration activities in line with license obligations and to develop joint technologies. IOCs teaming up with these two Russian state-controlled companies have to operate on a risk-service basis and cannot own any equity, i.e., the license and reserves. Indeed, under the current schemes developed for exploration works in the Arctic shelf, they are minority shareholders in foreign registered joint ventures in which Russian state companies Rosneft and Gazprom are majority shareholders. Foreign companies have insisted that foreign joint ventures be established to benefit from greater legal security and have established complex contractual frameworks to overcome gaps and uncertainties in the Russian legislation. As such, there is room to further clarify and make more precise the Russian legislation and regulatory framework to facilitate these partnerships between foreign and Russian companies.

Should gas or oil finds be made and the decision taken to move to a production phase, the Russian partner would generally reimburse its share of exploration costs. These agreements also involve a reciprocal equity agreement for some projects that these IOCs develop abroad, so far in North America, North Africa and the North Sea, allowing Rosneft to gain expertise and develop internationally, while also giving foreign partners an opportunity to gauge this cooperation. Such asset-swap type agreements are supported by the Russian government, and others could follow.

Rosneft and ExxonMobil started first exploratory drillings in August 2014 in the Kara Sea, but with the rapid deterioration of the relationship between Russia and the West and the “war of sanctions,” they had to stop the operations and suspend a well, losing significant investments made. In the current geopolitical climate, the future involvement of the international majors in the Russian Arctic is becoming increasingly questionable, as all technologies for Arctic offshore drilling and production are on the sanction lists of the United States and the European Union.

The number of smaller, independent Russian companies active in this area is negligible. Huge costs, together with the law on “strategic fields” in significantly limit the number of potential participants in the Arctic development “business of the big guys.” It is difficult to disagree with Kryukov that the institutional environment for Arctic oil and gas projects in Russia during the last two decades has been contradictory and ambiguous.

In the future, the potential growth areas for investment in the Russian Arctic are first the Yamal Peninsula, where the major infrastructure has

already been created, and the Kara Sea (with all Rosneft exploratory activities). But these investments are at the moment also significantly limited by the financial sanctions.

The situation is quite different for oil and for gas: Gazprom already produces Yamal gas (at the Bovanenkovo gas field on Yamal, though at rather small volumes due to a lack of demand), and the transportation system has been built, so there are no serious obstacles for further expansion of gas production in this area. Conversely, the new Arctic oil projects, led by Rosneft, are mainly focused on exploration. Here the uncertainty and risks are high. The uncertainty is associated with the geology, as many geologists predict that the Kara Sea might hold not oil but gas deposits, and that the lifting costs are going to be high. According to different estimates, even if the exploratory activity is successful and if large oil reserves are discovered, Russia would be able to start producing them no earlier than in one decade, reaching about 10-15 million tonnes per annum by 2025-2030 in the most optimistic case. The IEA's World Energy Outlook 2013 projection of Russian Arctic oil production is also modest – just 0.11 mb/d, or 1.1% of total production by 2035.

As Arctic projects are extremely expensive, taxation will be one of the key factors defining their success. The government has already provided a number of fiscal incentives to foster exploration activities in the offshore Arctic, including unlimited MET exemptions, export tax exemption (yet limited in time, for example on 250 bcm of gas for the Yamal LNG project and up until 2042 for Arctic resources), and property tax and amortization holidays. Yet more incentives are likely to be necessary in order to attain higher investment levels given the very high anticipated production costs.

Resource access and the number of players is the key factor in the success of Russian Arctic offshore development. So far, only companies with over 50% state ownership and more than five years of experience in marine exploration are allowed to participate in auctions for licences on the continental shelf in Russia's Arctic regions. This means that no private companies are given access to these areas, in spite of Lukoil, for example, having extensive offshore experience (in the Korchanginskoe field in the Caspian Sea for example) and conducting exploration activities in the Norwegian Barents Sea. Consequently, 80% of licences have already been given to Gazprom and Rosneft. However, even with partnerships with foreign companies there will be limits to how much they can handle.

Clear and strict environmental policy is also an essential condition for

the Russian Arctic projects' success. Developing possible Arctic resources will bring key environmental and technological challenges given the harsh environment, with offshore drilling from platforms surrounded by ice and low temperatures. Any accident could have a devastating impact on sensitive Arctic ecosystems. Any misstep by industry could postpone Arctic resource development for decades. Thus is why developing a robust security and environmental protection framework is key along with ensuring that the most advanced and relevant technologies are employed.

Another issue that is becoming critical for the future of the Russian Arctic in the current geopolitical and economic situation is the ability of the companies to attract credit finance, which implies that banks are confident that risks, especially those taken by foreign partners, are reasonable and addressed in the contractual and regulatory framework, and there are no restrictions or sanctions. Now, it seems that only companies with internal financial resources, loans from Russian financial institutions and also from Chinese banks will be the major sources of financing for the Russian Arctic projects.

Access to offshore drilling technologies and LNG equipment is also important. Without Western technologies, Russia would have to postpone the development of the projects until domestic Russian technologies are developed. The state would also need to ensure the development of a vibrant and competitive service industry in Russia capable of providing state-of-the art drilling technologies at reasonable and competitive prices.

Further exploration and research activity is needed in the Arctic in the coming decades in order to prepare for hydrocarbon production in a safe, sustainable and commercially efficient way, and it seems that the oil and gas companies still have a long way to go in ensuring that resource extraction can be viable economically and occur safely while protecting sensitive Arctic ecosystems.

Notes

1. Whether the Nadym-Pur-Taz area in Yamal-Nenetz Okrug is included or not mainly depends on the definition.
2. The last edition was accepted in 2009 and currently the new, updated Energy Strategy up to 2035 is in development.
3. <http://www.gazprom.com/about/production/projects/deposits/shp/>

Commentary

Nam Yll Kim

ARCTIC RESOURCE INVESTMENT RISKS AND LNG PROJECTS

Status of Arctic Area Resources

The Arctic Ocean is currently thought to have 22% of the world’s undiscovered energy resources, estimated to be composed of 13% oil (90 BB), 30% gas (1,679 Tcf) and 20% NGL (44 BB).¹ About 60% of these resources are concentrated in Russia.

Arctic Resource Investment Risks and Cost Comparisons among Transportation Modes

There are lots of risks to confront for an Arctic energyresources investment project. The first would be the geological risk. The fact that the estimated value of resources announced by the USGS is based on an educated guess and not based on thorough, widespread exploratory drilling must be noted. The second risk comes from harsh weather conditions. Because of

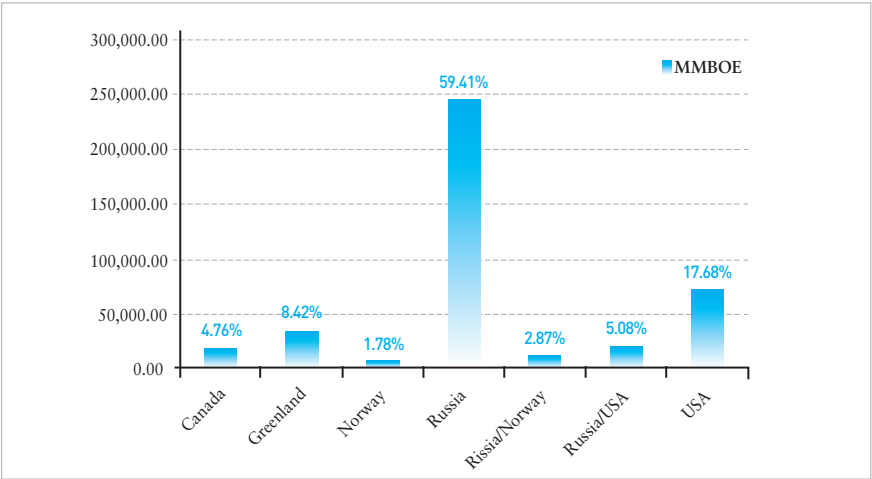


Figure I-2. Arctic resources by geography

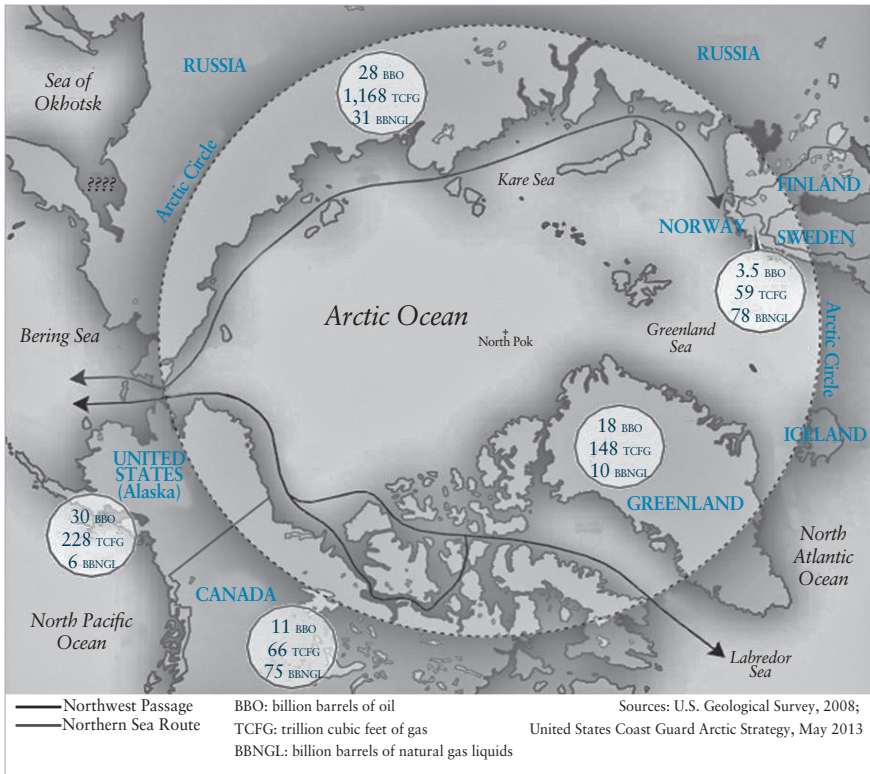


Figure I-3. Estimated undiscovered Arctic oil and gas and potential trade routes

frequent icy storms and low temperatures, the drilling window term is very short (summer time from June to October), and the drilling equipment may be polluted. The third is regulatory risk. Since the Macondo accident in the U.S. Gulf of Mexico in 2010, governments around the world have strengthened safety and environmental regulations. This has brought about increased costs of complying with the regulations, along with the inflation of insurance costs, which is a big burden for smaller resource development corporations. The fourth risk is environmental sensitivities. In order to develop resources in the Arctic, operators must adapt to ever-changing conditions of the Arctic. The fifth risk is infrastructure challenges. It is difficult in the first place to build and operate infrastructure safely in the Arctic, but transporting the resources produced in the Arctic safely to the market is another problem. And out of these risks, whether a transportation infrastructure exists or not greatly affects the investment cost for resource

development.

Although it is difficult to treat it as a risk indigenous to the Arctic, political risk exists as well. Due to the current situation in Ukraine, sanctions on the Russian energy sector have been imposed by the United States and the European Union. The banning of all exports of Arctic offshore drilling rigs for oil has been applied against Russia. Yamal LNG (Novatek 60%, Total 20%, CNPC 20%) is unlikely to be impacted by the technology sanction, and Yamal LNG is not a sanctioned entity, but its financing options will be restricted, increasing its cost of capital. In addition, Rosneft and ExxonMobil have recently expanded their strategic collaborative relationship for Arctic resource development. But western sanctions have frozen this arrangement as well.

The majority of gas development in the Arctic will take the form of LNG investment projects. The reason for this comes from the long transportation distance between the Asia-Pacific region, which is thought to possess most of the world's gas demand increase,² and the Arctic. Also, because the form of LNG is favorable for long-distance shipping, gas developed in the Arctic area will most likely be processed into LNG instead of PNG. The picture below explains this situation clearly.

As the picture shows, as distance increases, (1) the benefits of LNG transportation surpass those of gas pipelines, (2) LNG ships are more flexible when it comes to shipping out to its destination, unlike PNG with designated destinations, and (3) long-distance shipping requires passing

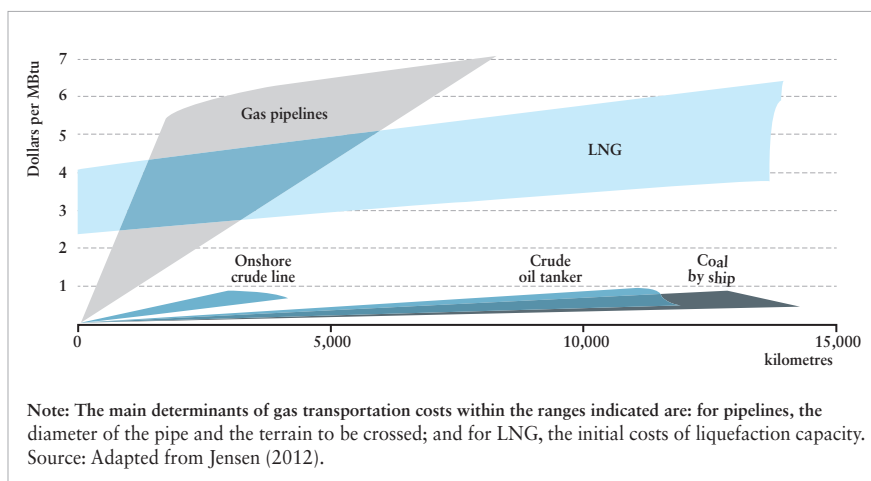


Figure I-4. Cost comparison among transportation modes

through multiple national boundaries, and LNG tankers are better suited for avoiding this trouble.

Economics of Russian Arctic LNG Projects

Arctic resource development projects have a high cost business structure. Because of the hard development conditions (weather, frozen ground, ice flows and lack of infrastructure), the development cost is greater than that of LNG projects involving North America's shale gas resources or those in East Africa. And the additional costs (charges for using icebreakers or specialized transport vessels, establishment of transportation facilities in frozen ground areas) regarding resource transportation are also likely to be high, no less than the development costs.

In December 2013, Novatek and Total announced a final investment decision on a three-train, 16.5 mmtpa, Yamal LNG project in the Arctic Circle. The first LNG shipment is scheduled for 2017. Novatek, Russia's largest independent gas producer, has a 60% equity, while Total and more recently CNPC have each acquired 20% in the project. Yamal LNG will be the first LNG project in Russia since the Sakhalin-2 investment decision in 2003. The project has received heavy government backing in the form of significant tax breaks, support in gas sales negotiations, liberalizing of LNG exports and funding for the construction and dredging of Sabetta Port. So

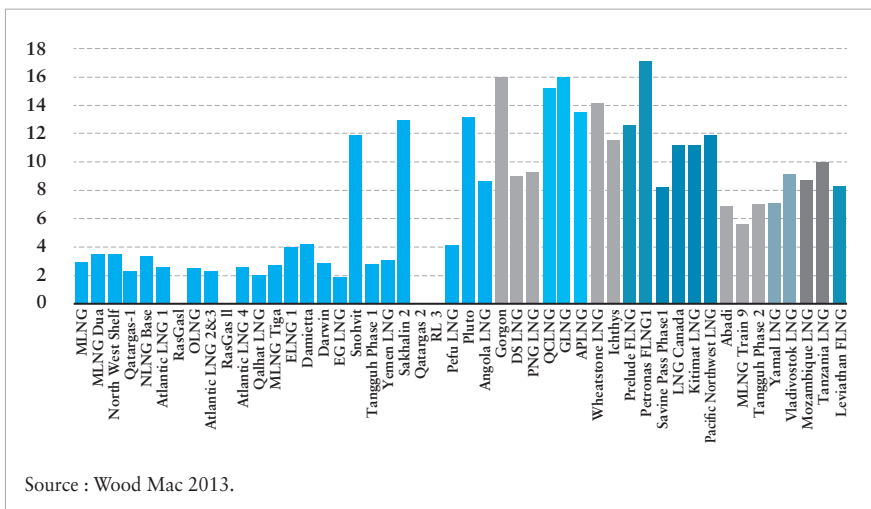


Figure I-5. FOB break-even cost at 12% IRR (\$MMBtu)

far, it has announced two agreements: a 3-mmtpa contract with CNPC, and a 2.5 mmtpa with Spain's Gas Natural Fenosa (GNF). The remaining 11 mmtpa should look for other takers.

Novatek has estimated the total cost for CAPEX for Yamal LNG development to be 20 billion, and it is argued that the project possesses price competitiveness against U.S. shale gas LNG. But according to Wood Mackenzie (2013),³ taking the challenging development conditions into consideration, the facility development cost is estimated to be 37 billion USD (gas field development 6.8 billion USD, drilling 14 million USD per well, liquefaction plant installation and maintenance costs 30.8 billion USD). Also, an additional 27 billion USD (2013 base) is estimated for operations and management (upstream operation 1.80/boe, liquefaction plant maintenance 0.60/MMbtu, icebreaker 10/ton). Taking a few additional assumptions into consideration, the final FOB cost for Yamal LNG development is estimated by Wood Mackenzie (2013) to be 9.41 USD/MMBtu. The regasification cost and transportation cost (nuclear icebreaker, ARC7 LNG transportation, storage cost) are not included in the final FOB LNG export costs.

With the advancement of multiple LNG projects around the world, development costs have increased rapidly, up to 1,200 USD/tonne, due to soaring raw material costs, lack of human resources and delayed construction. And most LNG projects have 20-60% in additional costs after they begin, while also being delayed for four to 17 months. Taking this situation into consideration, it is expected that the U.S. Henry Hub price level, crude oil price and Arctic area development costs will become the key to the competitiveness between all LNG projects, including those in the Arctic.

Progress of the U.S. Alaska LNG Project

Alaska's State Assembly agreed to the state government's participation in the Alaska LNG project on April 21, 2014. The state government is planning to conclude a contract with ExxonMobil, BP, Conoco Philips and TransCanada for the export of North Slope natural gas.

The Alaska LNG project includes connecting 800 miles (about 1,287 km) of export pipelines from the North Slope gas production sites (Prudhoe Bay, Point Thompson, etc.) to gas export terminals in the southern shore of Nikiski, along with the construction of liquefaction plants, storage facilities and export terminals. The total cost is estimated to be 45-65 billion USD.⁴



Figure I-6. The Alaska LNG project

With the approval of the state assembly, the related companies have entered the FEED phase with the state government and are expected to export natural gases from the North Slope into Asia and Europe starting from the mid-2020s.⁵

The Alaska LNG project holds promise for Asian countries, as it is a lot closer for them than Russia's Arctic, Western Canada, or the U.S. Gulf of Mexico. However, as of today, whether the long-term contract options can meet the demand of Asian consumers, as well as how large the possible amount of gas supply stock will be, is hard to know. But considering its location, it seems to be the closest Arctic LNG project for Northeast Asian consumers.

IMPLICATIONS FOR ASIAN BUYERS

Opening of Arctic Sea Route and South Korea's Gas Consumption Pattern

South Korea will likely participate in the Yamal LNG project if the nation

is willing to join any Arctic project.⁶ However, Russia is employing a strategy of simply allowing shareholding or securing offtakers from South Korean and other Asian companies.

According to South Korea's long-term supply outlook for natural gas, the supply and demand situation is not as tight either. Especially with the introduction of American Sabine Pass gas in 2017, new options are opening up. Therefore, as a gas consumer, South Korea is not experiencing urgency in securing Russia's gas exports. Also, given the recent progress regarding China-Russia gas contracts, it is noted that a South-North-Russia gas pipeline project is at a wait-and-see level.

An important fact about South Korea's gas consumption pattern is that it shows a typical high-winter and low-summer consumption rate. This sort of pattern does not fit well with the conditions of the Arctic Northern Sea Route, which opens up for about four months during the summer. Therefore, if South Korea wishes to become an offtaker of Yamal LNG, it is important to consider the contractual flexibility of swapping unnecessary gas at will along with the price conditions. South Korea, along with Japan and other consumers around Asia, is trying hard to come out of an oil-indexed scheme. And the Yamal LNG Project is focused on securing additional offtakers. Whether or not KOGAS participates in the project will depend upon the conditions of negotiation.

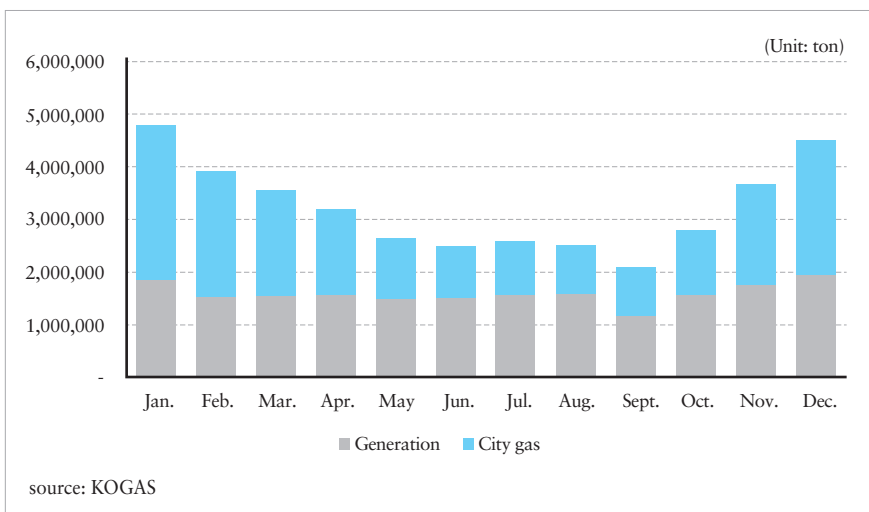


Figure I-7. Korea's gas consumption by month (2013)

Cost of LNG Based on East Asian Destinations (LNG Delivered Ex-Ship Cost)

The picture below compares the destination costs of LNG from several locations with South Korea's Port of Incheon set as the common destination. With Incheon as the standard, it is not hard to estimate the cost for China's and Japan's key LNG ports as well.

The competitive levels between LNG projects around each region of the world are based on a long-term LNG price formula. As of now, regarding the recent crude oil price and Henry Hub standard, the Henry Hub-indexed price formula is likely to ensure better price competitiveness than an oil-indexed price formula.

The key points for competitiveness for North American projects depend upon the gas market price level, while the new projects in the Arctic and East Africa will be based on development costs. Asian nations will continue to make efforts to come out of an oil-indexed scheme and lower the contract price. But considering the new LNG supply costs, the portion of contracts with oil-indexation will remain high for long time.

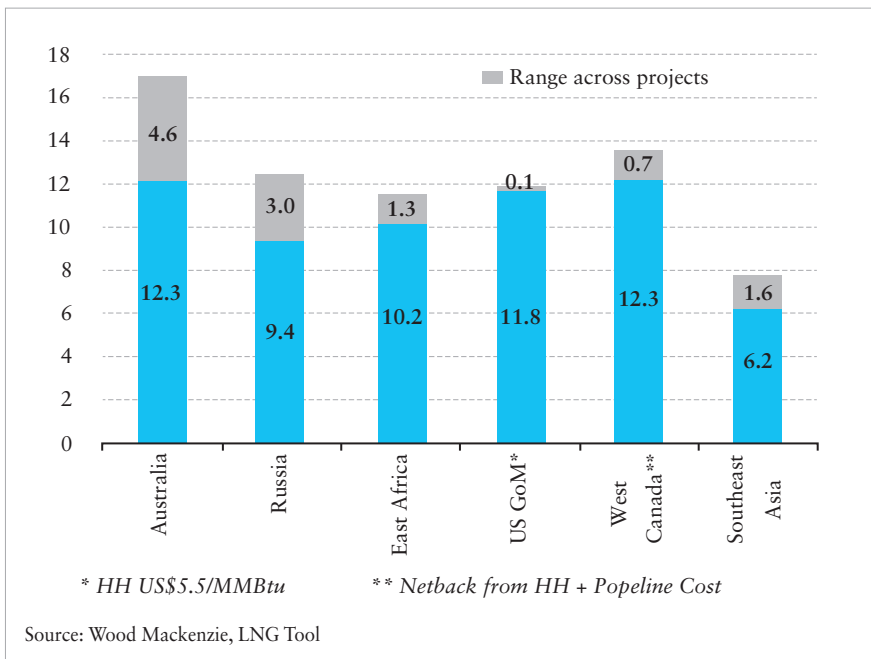


Figure I-8. LNG DES cost stacks to Incheon (\$MMBtu)

South Korea, Japan, Taiwan, and other key Asian LNG importers are working side by side to reduce the Asia gas premium, reform the destination clause and secure flexibility within contract options. LNG suppliers who are desperately willing to accept these conditions will be a key factor moving toward ensuring offtakers for the new projects.

Notes

1. USGS 2008 Data.
2. As of 2014, 70-80% of the world's LNG consumption is in the Asia-Pacific region, and this trend is likely to continue.
3. Wood Mac, LNG Supply Analysis, Russia, April 2013.
4. The Alaska LNG project transports 3-3.5 Bcm/d of natural gas to a liquefaction plant through a 42-inch pipeline, and the liquefaction plant produces 15-18 million tons (2~2.4Bcf/d) of LNG every year.
5. Alaska began exporting LNG in the 1960s, and its main gas source is located south of Anchorage at Cook Inlet.
6. South Korea's KOGAS took some stakes in Northern Canada's Umiak gas field in the Arctic in 2011.

Commentary

Heather A. Conley

When we read about the Arctic in the print media, we are greeted by sensational and typically inaccurate headlines such as “A New Cold War!,” “A Race for Arctic Riches!,” and “Arctic Bonanza!” Rare is the factual headline, much less detailed information, about the overall political, economic, and security trend lines in the Arctic region. Arctic analysts and experts must perpetually employ “myth-busting” analysis to temper wild assumptions about Arctic developments.

Thankfully, three thoughtful authors provide rich and detailed descriptions of two important Arctic investment patterns: “Arctic Offshore Petroleum and Shipping” from Arild Moe and Svein Vigeland Rottem of the Fridtjof Nansen Institute in Norway, and from Valeriy A. Kryukov, “Patterns of Investment in the Russian Onshore Arctic—An Area of Stable Growth? The level of detail related to both the scope and scale of significant Arctic development projects provides a concrete understanding of what is at stake for both the sovereign and commercial actors involved.

To understand the region with the greatest level of economic ambition and potential dynamism, one must begin in the Russian Arctic. Kryukov notes that for Russia, the Arctic is “the most important component of socioeconomic development as a whole,” a fact that the international community wholly underappreciates, as well as the “historical significance of Russian northern development.” This concept bears repeating: the international community profoundly underestimates the forces influencing Russia’s and ultimately President Putin’s future for a region that encompasses nearly the entire northern coast of Eurasia. The Arctic is home to Russia’s strategic nuclear fleet, 14% of Russia’s GDP, 25% of its exports, 50% of the total Arctic coastline, and two million Russian citizens, thus making the Arctic a key driver of Russian policy in the 21st century. Dmitry Medvedev noted in 2008 that “Our first and main task is to turn the Arctic into a resource base for Russia in the 21st century ... Using these resources will guarantee energy security for Russia as a whole.”¹ As former Murmansk Oblast Governor Dmitri Dmitriyenko further underscored, “For Murmansk Oblast, the election of Vladimir Putin as President of the Russian Federation is a very important event, which means the continuity

of the current course ... a course of huge breakthrough projects, which gradually will transform the social and economic situation in the region. Probably, Putin is the only of our politicians who knows and understands the Russian Arctic, and who underlines that it is in the Arctic that Russia has its future.” With such an emphasis on the importance of the Arctic for Russia’s future, the economic and political stakes for Russia are enormously high.

Kryukov provides an important analytical framework to examine the plethora of new Russian development projects, ranging from the excavation of mineral resources, such as phosphate, nickel, platinum, diamonds, and gold, to the extraction of energy resources such as coal, oil, and natural gas. The analytical framework consists of: (1) the need for extensive capital investment; (2) the introduction of new technology; (3) the technological difficulty of reaching these resources; and (4) the resources exceed Russian domestic demand and are produced for export. Helpfully, he geographically breaks the Russian Arctic into three strategic and quite different regions of development: European Russia, Siberia, and the Russian Far East. Kryukov contends that all Russian onshore activities—regardless of location—require two things: (1) significant technology, as well as technical skills enhancements, and (2) modernization.

After the annexation of Crimea and the destabilization of Eastern Ukraine, technology transfer from the West to Russia will be interrupted by enhanced Western sanctions. Modernization, defined by adaptation to the mechanisms of the global economy, would require domestic political and economic reforms that fuel entrepreneurship and foreign investment and legal reforms that create an independent judiciary and ensure transparency. Modernization would also require a less-centralized Russia (it is more centralized than ever) and a better investment climate, bolstered by improvements to the rule of law, management, and social and environmental concerns. These elements do not exist in Russia today, posing significant obstacles to successful Russian modernization.

Kryukov offers two contradictory Russian Arctic investment trends: general stagnation in the Russian mining sector and growth potential in the oil and gas sector, with specific attention being given to the Yamal Peninsula liquefied natural gas (LNG) terminal and the Port of Sabetta. In the mining sector, stagnation has translated into a decline in industrial production and decreases in the mining sector workforce. From a socioeconomic standpoint, this stagnation has significant implications for the northern

“monotowns” that are completely dependent on one industry. Norilsk Nickel, the world’s largest producer of refined nickel, is both an important example of static Russian investment and a shift in business practices. As a monopoly, whose “private” investor ownership consists of major Russian financial and industrial groups, and that has been slow to modernize and adapt to global economic forces, Norilsk Nickel accounts for 1.9% of Russia’s GDP and has its own Arctic fleet (seven ice-class cargo ships and one ice-class tanker). Norilsk Nickel is also one of Russia’s largest polluters, accounting for a quarter of Russia’s sulfur dioxide emissions. Norilsk Nickel, seeing the greatest growth potential in its polar division, recently reduced its mining operations in southern regions and eliminated Russian jobs. Now, contrast this with a newly formed Russian company, Russian Platinum LLC, which views environmental stewardship as a high priority and plans to construct its own infrastructure, not relying on use of the Northern Sea Route (NSR), but rather the Yenisei River to transport resources from the Norilsk-I field (Krasnyorsk Oblast).

While international attention tends to focus on the European and Siberian portions of the Russian Arctic, one must not forget the great mineral resources of the Russian Far East. Significant deposits of iron ore, rare earths, and impact diamonds in the Russian Far East’s (Yakutia) Tomtor field constitute one of the largest ore deposits in the world. As these resources are developed, the eastern portion of the NSR will likely be utilized to transport these riches to Asian and international markets, which could significantly increase shipping traffic in the Bering Strait over time.

While mineral extraction is stagnating in Russia, oil and gas projects are on the rise and are considered national “prestige projects.” Kryukov notes that these prestige projects are granted “state guarantees [to ensure that] even constant unprofitable businesses will survive.” Russian state guarantees have been ubiquitous following the 2008 definition of “subsoil plots of federal significance,” which narrowly defines a federally significant project as more than 70 million tons of discovered oil and 50 billion cubic meters of natural gas. Simply put, nearly every commercially viable mineral and natural resource discovery in Russia is deemed significant to the Kremlin. This new definition, however, has dramatically reduced new licenses. Clearly, increased Russian central control over mineral and energy resources, coupled with the requirement that Moscow must approve any sale of 10% or more to foreign entities and that foreign ownership of an investment project cannot exceed 51%, has substantially restricted the

forces of foreign investment and advanced technologies entering Russia today.

Why has the Kremlin enacted a stranglehold over new Arctic investment projects when decentralization and incentivizing international technology transfers are necessary for success? The answer is budget dependency. In 1995, oil and gas revenues accounted for 9% of the Russian budget. In 2012, oil revenues made up 52% of the Russian federal budget. Although global oil and commodity prices remain quite high (at the time of this writing, Brent oil was 104 USD per barrel), these prices are unable to sustain Russia's ailing economy.² Today, Russia finds itself in a completely new operational environment where its most important energy customer, Europe, has a rapidly decreasing appetite for Russian energy due to anemic economic growth, deteriorating demographics, the decreased price of natural gas (which has spurred contract renegotiation), anti-monopolistic rules, and increased use of renewable energy and energy efficiency. Moreover, Europe is currently racing to diversify itself away from Russian energy resources. In addition to Europe's decreased demand, Russia is also facing increased global competition from other energy suppliers such as Australia, North America, and Africa.

The Russian gas market faces the dual challenge of rising costs (a 10% increase in 2013) and declining demand. This environment has forced Russian companies—Gazprom, Rosneft, and Novatek—to compete with each other while simultaneously competing for foreign direct investment (FDI) and Kremlin approval of their projects as they attempt to increase natural gas revenues. The Yamal LNG project appears to be the most competitive Russian Arctic gas project. In 2002, the Gazprom Board of Directors named the Yamal Peninsula a region of strategic interest. Rosneft's CEO Igor Sechin, a close confidant of President Putin, has for now successfully concentrated Rosneft's power and influence in the Russian gas market and Arctic energy development, thus ensuring its geopolitical relevance.

For the Russian oil market as well, regulating controls will be as important as reform of the Russian tax system. While it may be true that the Russian government will continuously sustain unprofitable businesses, international companies will not. The long-term development of new Russian oil fields is not economically competitive under the current Russian tax regime, although tax exemptions have been granted for Arctic development. Due to the over-reliance of the Russian budget on rent income from the oil and gas sector, Russian authorities are extremely

reluctant to reform the tax code, as it would entail great political risk to Russian authorities.

After taking a deep dive into Russian Arctic development, Arild Moe and Svein Rottem take us on an Arctic offshore circumpolar journey which can best be described as “the unevenness of Arctic development.” While Arctic offshore activities are at present limited to two fields in Norway and Russia, Canada is exploring limited, private-led opportunities in the Beaufort Sea. The United States is slowly exploring its offshore potential in the Chukchi and Beaufort Seas, and Greenland, while initially exploring opportunities, has found mostly gas (and not necessarily commercially viable amounts) but seeks oil deposits. Having recently identified potential rare earth minerals in Greenland, there may be greater economic benefits from mining than from energy discoveries.

Norway and Russia demonstrate some similarities in offshore Arctic development. State companies are the principal conduit for development, and both countries rely on energy exports to support their national economies. For Norway, Arctic development has taken on some urgency as declining productivity in the North and Norwegian Seas has required exploration further north, with a particular focus on the 12 billion USD Snøhvit field. Like Russia’s federal significance determination, the Norwegian government conducts “opening processes” in which it formally assesses the risks and prospects of exploration in a particular area. Moreover, the Norwegian government is also responsible for issuing exploration licenses to oil and gas companies. Several areas of the offshore Norwegian shelf, including all of the northern Barents Sea, the eastern part of the southern Barents Sea, and the northeastern Norwegian Sea, have not been approved for petroleum activities due to limited knowledge of seismic activity in the region. However, the Norwegian government will offer 34 licensing blocks in the Barents Sea before the end of 2014, increasingly moving into areas further north and east. The Norwegian government is also grappling with its Arctic infrastructure. Should it export its Arctic energy via pipeline or LNG tanker? The choice of infrastructure is based largely on the choice of market. Does Norway seek to export its Arctic offshore resources to Asia (a 2013 LNG condensate tanker departed Hammerfest, Norway for Tokyo, Japan) or could Norwegian gas one day displace Russian gas exports to Europe? In 2012, Norwegian gas exports to Europe exceeded Russian exports, but in 2013 Russia once again became the leading exporter of gas to Europe.

Russia, enjoying the largest continental shelf in the Arctic, has only explored about 10% of its offshore potential, principally in the Barents and Kara Seas. Thus far, approximately 80% of the energy discoveries have been natural gas rather than oil. Russia's most significant offshore project is the 5.7 billion USD Prirazlomnoye field 60 kilometers offshore in the Pechora Sea. In April 2014, the Prirazlomnoye field became the first to produce and deliver to market Arctic offshore oil. The field was discovered in 1989, and the Prirazlomnaya Arctic offshore platform, operated by Gazprom Neft, was the first of its kind to work in shallow water, although it has frequently been afflicted by drifting ice.

Moe and Rottem also examine the state of Arctic infrastructure, where it can be argued that there is an abundance of ambition but a scarcity of investment. Once again, Russia has taken the most ambitious and aspirational approach to the NSR, consisting of port infrastructure (such as the Port of Sabetta on the Yamal Peninsula), 10 search and rescue centers to be completed by 2015, and roughly 35 governmental and privately owned ice breakers with three new nuclear-powered icebreakers to be completed by 2020. Because Russian infrastructure development is tied to project development, some of these "prestige projects" may fall victim to sanctions or lack of commercial viability for international companies due to shifting global energy patterns (such as the postponement of the Shtokman field). Norway has the most developed infrastructure along its western coast, including the Port of Narvik, which has the advantage of being ice free and can accommodate ships up to Cape size. The Canadian government also has an aspirational vision to export its Arctic resources, such as the Northern Marine Transportation Corridor Initiative and the Pacific Gateway Initiative. Yet these plans have developed slowly over time based on private sector demand, global economic trends, and environmental and indigenous community impacts. One issue that is not frequently addressed, however, is the impact of climate change on existing, as well as future infrastructure in the Arctic. The impact on Russian infrastructure in particular from permafrost thawing, coastal erosion, and ocean acidification will be considerable.

At the time of this commentary, the United States and the European Union had agreed to substantial economic sanctions against Russia, specifically targeting the energy and financial sectors. These sanctions will have a direct impact on Russia's future ability to attain offshore technology and financing from the West for its large-scale projects. However, this does

not prevent China from attempting to replace some of this lost Western investment, and the sanctions could potentially enhance China's overall economic investment strategy and presence in the Arctic. The imposition of Western sanctions can also alter global trade patterns as well as accelerate global energy and commodity patterns through technological innovation (such as the U.S. unconventional gas revolution).

Finally, experts tend to view the Arctic as if it is a hermetically sealed and increasingly ice-free region. However, it is neither. The Arctic is a rapidly changing region where the decisions and activities implemented by one Arctic state can have a lasting impact on all Arctic nations. Nor is the Arctic immune to global economic trends and turbulent geopolitical periods – whether they are stagnating oil prices, low natural gas prices in the United States, or the increased costs of oil and gas exploration and production. While Russia is more immune, or at least more willing to bear the costs of economically infeasible “prestige projects” in the Arctic, it is not immune to these forces if Western partners do not transfer Arctic technologies and offer long-term investment options.

In conclusion, there is an unevenness of development and state approach in the circumpolar Arctic; however, Russia will remain the epicenter of Arctic development. Its development will be state-directed and state-led, as Arctic progression is a “federally significant” part of Russia's historic narrative as a great power and is of greatest socioeconomic importance to Russia. Yet, Russian Arctic development faces serious headwinds due to its domestic policy choices as well as global economic trends, and these challenges will become greater with the imposition of sanctions. Murmansk, for instance, may be the perfect example of Russia's Arctic conundrum and the effect of domestic headwinds. Murmansk will be the hub of Russian economic development along the NSR, yet despite great aspirations, its development plan is continually altered or postponed. According to reports, Murmansk currently has a 20% budget deficit in the first half of 2014, yet it has increased spending by 18%.³ It is likely that Murmansk's budget deficit will increase due to the imposition of Western sanctions.

While the other Arctic coastal states have varying degrees of state ownership and involvement, their development models stand in stark contrast to that of Russia. Norway and Greenland will continue to develop their Arctic resource potential with the aim of future economic well-being for Norway and eventual political independence from Denmark

for Greenland. The North American Arctic, however, will develop more slowly, with the United States the furthest behind in its Arctic development. Canada's Arctic development is more instinctively inclined toward economic development, while offering tenuous footsteps toward greater northern development.

This unevenness potentially poses a considerable challenge to Arctic cooperation. When the stakes are so great for the largest Arctic state; when that state is under increasing external (and eventual internal) political and economic pressure; and when non-Arctic actors like China are introduced to the region, it is difficult to predict how Russia and the other Arctic states will respond both to future economic opportunities and to grave environmental and geopolitical challenges.

Notes

1. "Medvedev: Arctic Resources are key to Russia's Future," *The Seattle Times*, September 18, 2008, http://seattletimes.nwsources.com/html/nationworld/2008187217_russia18.html
2. Since this was written, world market prices for oil have declined sharply.
3. Atle Staalesen, "In Murmansk, a growing budget deficit", *Barents Observer*, July 29, 2014, <http://barentsobserver.com/en/business/2014/07/murmansk-growing-budget-deficit-29-07>

Commentary

Lawson W. Brigham

The papers in this part focus on strategies and investments in offshore hydrocarbon development around the circumpolar Arctic (Arild Moe and Svein Vigeland Rottem) and in the Russian Arctic onshore (Valeriy A. Kryukov). Both are comprehensive reviews focusing on Arctic natural resource developments that are also the primary drivers for the emergence of increased Arctic marine shipping and operations. This was a key conclusion of the Arctic Council's Arctic Marine Shipping Assessment (AMSA) released in April 2009, and it remains consistent with what is observed regarding ship traffic in the Arctic today. Most trans-Arctic voyages along the Northern Sea Route (NSR) involve tankers, bulk carriers and LNG carriers transporting natural resources from northern Norway and the Russian Arctic to Asian ports in the Pacific. Offshore hydrocarbon exploration in Greenland, Norway, Russia and Alaska all involve small armadas of support ships attending to the needs of the drilling rigs and vessels. Arctic sea ice retreat is certainly a key driver in that this profound environmental change enables greater marine access and potentially longer seasons of navigation and drilling. However, it is Arctic natural resource development that is driving the requirements for expanded marine operations. In both papers, Arctic waterways (coastal and riverine) represent the critical links of the Arctic's vast resources to global markets. Protection of these waterways and the Arctic people who live in these marine areas requires large investments in navigation and safety systems that have yet to be realized.

It is important to note, as the paper by Moe and Rottem does, that one of fundamental challenges to the future of Arctic natural resource development is the volatility of prices of global commodities. These economic forces have influenced the uneven nature of offshore hydrocarbon development around the circumpolar world. The Arctic is a challenging frontier production location, both onshore and offshore, and higher levels of capital investment are likely required at the outset of major projects. Increasing environmental concerns and greater regulatory oversight may also play key roles in the uncertainty of regional Arctic development and the need for higher levels of investment in operating environments that

are considered “higher risk.” It is clear that fluctuating global commodity prices will remain a strong factor even for long-term, strategic investments in the Arctic. The global natural gas market particularly is experiencing dramatic change, and there is uncertainty as to the future role of Arctic gas in a global context (except perhaps for West Siberian gas to Europe and future Russian Arctic gas to China). Current investment in Arctic oil exploration seems to be moving ahead, as evidenced by the summer 2014 exploration in the Kara Sea by the ExxonMobil-Rosneft joint partnership. However, uncertainty now surrounds the return date of Shell to summer exploratory drilling in the Chukchi Sea off the northwest coast of Alaska. Other influential factors involve the facts that large Arctic development projects will likely require international investment and technology transfer, and involve Arctic states, non-Arctic states, and multiple companies. Such stakeholder complexity requires enhanced cooperation and partnerships and can make any investment climate challenging.

For the Arctic states, one of the greatest concerns and fundamental challenges is the lack of significant marine infrastructure in most sectors of the maritime Arctic, with the exception of the Norwegian coast, coastal northwest Russia, and Iceland. This major gap in marine infrastructure remains a key limitation in pursuing strategies of sustainable development for much of the Arctic’s coastline and marine areas. The Arctic Council’s AMSA identified key missing infrastructure including adequate hydrographic data and marine charts; complete and adequate coverage of modern communications; environmental monitoring of weather, sea ice and icebergs; search and rescue (SAR) capacity; marine environmental response capacity; aids to navigation; salvage and towing services; ice navigation training; ship monitoring and tracking; port reception facilities; icebreaker capacity; deepwater ports; places of refuge; and more. The Moe/Rottem and Kryukov papers appropriately mention the importance of ports: the roles of Murmansk, the new LNG port at Sabetta on the Yamal Peninsula, and the lack of major ports in the Canadian and U.S. Arctic sectors of the Arctic. Ports are integral to trade, links to offshore development, support to SAR and environmental response, support to law enforcement and sovereign security, access to marine services, and as gateways to future Arctic development. The lack of major, functioning ports in vast stretches of the Arctic region is a fundamental missing element in providing an adequate safety net to Arctic marine operations. The Arctic Ocean’s sparse hydrographic database and the lack of an adequate observing network of

environmental observations key to safe navigation are additional, critical limitations requiring long-term investment. This huge deficit in the range of infrastructure components as defined by AMSA also makes it difficult to evaluate the risks of current and future Arctic marine operations. The marine insurers and ship classification societies are challenged to create risk-based models when marine infrastructure is minimal or nonexistent in many Arctic regions where large development projects will be sited.

There are many challenges to the increasing marine uses of the Arctic Ocean that confront the Arctic states. But the most difficult is likely reducing this infrastructure deficit. Large investments are required, but there are many questions regarding the funding mechanisms for such infrastructure. The Arctic state governments are not likely to have the capacity to fund this frontier infrastructure in its entirety. New public-private funding mechanisms and partnerships will be required. New schemes may also be necessary for the cost recovery of select infrastructure, for example the observation and distribution of environmental data; the deployment of special aids to navigation; the conduct of unique hydrographic surveys in remote areas; the use of response services; and the use public-private icebreaker escort services. To complement expanded marine safety and environmental protection strategies and measures, public and private assets will have to be combined where remote, regional projects are under development. The Arctic state governments and the maritime industry must work more closely together to prioritize where these large infrastructure investments should be directed, and where private rather than fully public investments are needed. Examples include: co-developing integrated systems for monitoring and tracking of Arctic ships; matching advancing traffic to where new hydrographic surveys should be conducted; addressing icebreaker fleet renewal, both government and commercial icebreakers and associated services; and defining satellite requirements for expanded environmental observations and Arctic communications. Adequately addressing the critical marine infrastructure needs can only be achieved through greatly expanded government-industry cooperation and joint funding.

The World Economic Forum's Global Agenda Council on the Arctic recently outlined several key issues regarding Arctic infrastructure investment:

- Certain types of infrastructure are important preconditions for

sustainable Arctic development (e.g. icebreaking ships, oil spill response ships, ports, energy supplies and telecommunications).

- High-level cooperation is required between the Arctic state governments and stakeholders in the development of plans for new infrastructure linking population centers and states.
- Arctic infrastructure inevitably requires greater levels of monitoring, management and maintenance compared with infrastructure at lower latitudes. A greater level of investment in these critical areas is a necessity to attain higher levels of safety and environmental protection.
- The Arctic Council is an effective intergovernmental forum focusing on environmental protection and sustainable development issues and promoting common interests among its constituents.
- Arctic projects require from regulatory authorities a clear articulation of the procedures, requirements and timeliness for project approval. This environment relates directly to investment strategies and addressing infrastructure needs.
- The Arctic needs an infusion of skilled people to realize large and complex industrial projects. Expanded investments in education and infrastructure, making the region more livable, are necessary requirements.
- A new Arctic investment vehicle for sustainable development may be necessary to assist in the funding of cross-border infrastructure.

These key issues suggest that more dialogue and cooperation is necessary among the Arctic states, industry, and private investors, particularly in the newly emerging maritime Arctic.

Commentary

Hua Xu

Under the grand trend of global warming and Arctic summer sea-ice retreat, Arctic resources have become more accessible. The major explored Arctic resources include natural gas in the Barents Sea and Yamalo-Nenets Okrug, oil in north Alaska and Canada's Mackenzie valley, nonferrous metals on the Taymyr Peninsula and in Alaska, and iron ore on Baffin Island and the Kola Peninsula and in northern Scandinavia. There are also some promising but unexplored petroleum deposits in the Arctic, including oil and gas in the Siberian Shelf and waters near Greenland and the Canadian Arctic Archipelago. One of the most attractive Arctic resources is the natural gas from the Russian Arctic, due to the scale of the reserves that are nearly one-sixth of the world's total natural gas reserves.

The majority of the explored Russian Arctic gas is located in the Barents Sea and Yamalo-Nenets Autonomous Okrug. In the southern part of this okrug, some giant gas fields (e.g., Urengoykoye) have been in production for several decades as major gas sources for Europe. Because they are declining, Russia decided to develop the gas resources on the Yamal Peninsula (in the northern part of Yamalo-Nenets Okrug) and the Arctic seabed. Due to a shortage of experience in Arctic offshore drilling, Russia sought foreign companies to cooperate with domestic industries in Arctic offshore petroleum exploitation.

Gazprom, a Russian state-controlled energy company that nearly monopolizes Russia's gas production and exports, identified the Yamal Peninsula as a region of its strategic interest in 2002, and then brought forward the "Yamal Project," in which a series of gas fields and a pipeline system on the Yamal Peninsula will be developed. The total recoverable gas reserves of Yamal Project are estimated to be up to 16 tcm, and the annual output of its largest field, Bovanenkovskoye field, is expected to be 75-115 bcm. Gazprom also invested in several Arctic offshore projects with foreign partners: the Shtockman gas field with Total and Statoil and exploration and development of petroleum in the Arctic shelf with Shell. Gazprom now runs Russia's first Arctic offshore petroleum project, Prirazlomnoye field, in the Pechora Sea. The Dolginskoye offshore field nearby also belongs to Gazprom.

Rosneft, Russia's largest oil producer, has many international offshore projects in the Barents Sea and the Kara Sea with partners from different countries. Two of them are located near the maritime boundary between Norway and Russia: the Perseevsky oil field with Statoil and the Fedynsky oil field with ENI. One project is near the west coast of Novaya Zemlya: the Zapadno-Prinovozemelsky oil field with CNPC. Two are located in the Pechora Sea: the Yuzhno-Russky and Medynsko-Varandeysky oil fields, both with CNPC. Finally, there is the "East-Prinovozemel Project" covering the exploration and development of oil and gas in three regions of the Kara Sea with ExxonMobil.

Novatek, Russia's largest independent gas producer, operates in the gas fields on the Yamal Peninsula; it cooperates with Total and CNPC on the "Yamal LNG Project." This project is based on the Yuzhno-Tambeyskoye gas field, which is one of Novatek's two largest gas fields (the other is the Yurkharovskoye field), and is expected to produce for export 16.5 million tons of LNG (or 22 bcm of gas equivalent) and 1 million tons of gas condensate annually, mainly to Europe and East Asia (3 million tons of LNG are committed to China). For this project, the port of Sabetta, a new LNG loading terminal for the gas field, will be built. This project is deeply involved with East Asian countries, and is considered an important influence on shipping via the Northern Sea Route (NSR). On the one hand, traffic on the NSR will increase rapidly when the Yamal LNG Project is in full production in 2018; on the other hand, the construction of the Sabetta LNG port will bring maritime delivery of materials, components, machines and supplies. NSR shipping will be stimulated by this project.

Due to its importance, the Yamal LNG Project has become one of the hottest topics in Arctic shipping and energy development. There are many studies dealing with the financial, regulatory, and technological aspects of the project, but one problem is rarely considered: can other gas fields compete with the natural gas from Yamal? There has been a long negotiation between China and Russia on gas pipelines in South Siberia, and Russia plans to build LNG terminals in Vladivostok and on southern Sakhalin Island, which are far closer to East Asian markets than Sabetta is. From this perspective, the focus of this commentary is not Yamal LNG itself, but gas projects from Russia to East Asia, especially China. Although these projects are situated outside the Arctic, they may influence Yamal LNG in the long run, so we cannot neglect them in an evaluation of Arctic energy shipping.

THE REASONS FOR EAST ASIA'S ATTENTION TO RUSSIAN GAS

According to BP's data, at the end of 2013, the annual natural gas consumption of China, Japan, and Korea was 161.6, 116.9, and 52.5 bcm, respectively. Consider that among the three countries, only China produces gas. China's net imports are 44.5 bcm, whereas the gas consumed by Japan and Korea is totally imported. So China, Japan, and Korea rank as the fifth, second, and third most gas deficient economies in the world, respectively (the first and fourth are the European Union and the United States). More seriously, the gas consumption of the three East Asian countries is still growing rapidly, whereas U.S. gas consumption is growing slowly and that of the EU is falling. From 2003 to 2013, gas consumption has increased 377%, 46%, and 117% in China, Japan, and Korea, respectively, whereas the growth rates in the United States and the EU are 17% and -8%.¹

Why is the demand for gas in East Asia growing faster? The reason is that the share of gas in the total prime energy consumption of East Asian countries is lower than the level of the United States or the EU. As a clean energy, natural gas emits less CO₂ and other pollutants than oil or coal does. Japan and Korea turned to gas from oil to reduce their CO₂ emission, so their gas consumption increased faster than consumption in the EU and the United States, which have a higher and more stable gas consumption share. For China, to carry out the promise made by President Hu Jintao in 2009 of a reduction in CO₂ emission intensity, the extraordinary high coal consumption share must be lowered, and gas is a better option than oil to substitute for coal. Moreover, China's total energy consumption is increasing quickly because of its fast-growing economy. So, East Asian countries are and will still be big importers of natural gas in the future.

But why Russia? The first reason is that Russia has huge gas reserves, which rank as the second largest in the world (after Iran). The second but more important reason is that Russia is much closer than other gas exporters to East Asia. For Japan, Korea, and most part of China, Russia is closer than Southeast Asia, another important gas producing area. Additionally, Russia and China are land neighbors, and Russia is separated from Japan by narrow straits. The maritime distance between the Russian Far East and Korea is also short. This is why Russian gas is so attractive for East Asia. But we should keep in mind that Russia is a vast country, and most of its gas fields are located far from its border. To deliver gas to East Asia, Russia has to build

long pipelines or develop expensive LNG supply chains. So, it is natural for East Asian countries to participate in the Russian gas sector.

THE YAMAL LNG PROJECT

Yamal LNG is a multinational project in the Russian Arctic focused on exporting natural gas, mainly from the Yuzhno-Tambeyskoye field, in the form of LNG. Its design capacity is 16.5 million tons of LNG annually when its three trains of LNG plant are fully completed in November 2018. Its first train is expected to be finished and to produce the first LNG in November 2016. The port of Sabetta, its loading terminal, is being built on barren land and is expected to be completed in 2016.

Yamal LNG was acquired by Novatek from Volga Resources, which controlled the Yuzhno-Tambeyskoye field, in May 2009. Novatek sought cooperation with Gazprom and foreign partners, and in October 2011 Novatek and Total signed an agreement to hold 80% and 20% shares of the project, respectively. In June 2013, the Chinese state-owned petroleum company, CNPC, bought a 20% share from Novatek. Now the owners of the project are Novatek (60%), Total and CNPC (20% each). We should note that this is not the first Chinese investment in the Russian Arctic. Before this, China had already invested in three oil fields with Rosneft in the Barents Sea.²

In the beginning, the overall of the Yamal LNG project was estimated to be 18-20 billion USD. By now, however, the estimated expenditure has risen as high as 27 billion USD due to unpredicted costs. The LNG will be shipped by 16 ARC7 ice-class carriers, which have been contracted to Daewoo Shipbuilding and Marine Engineering (DSME) Company. The cost of these ships is about 2.2-2.3 billion USD each. These ships can sail independently in waters covered by 1.7 m-thick level ice in summer and autumn. So, the strategy of Yamal LNG to access the Asian market is bi-directional: in the summer and autumn the ships go eastward via the NSR, while in winter and spring they go westward via the Suez Canal or still via the NSR with icebreaker escorts.

The construction of the port of Sabetta is financed primarily by the Russian state. In June 2014, the cost of the port was estimated to be 69.7 billion RUB (or 1.9 billion USD), 40% above the original project budget, and the construction has encountered a money shortage. Now, the Russian Ministry of Transport is proposing to move 4.9 billion RUB (or 135 million USD) from the project of

the Murmansk Transport Hub to Yamal LNG, because the delay of delivery will require a huge compensation to LNG buyers.³

The port construction was contracted to Murmansk Shipping Company (MSCO), and MSCO will deliver 1.5 million tons of goods to Sabetta in three years. The LNG will be shipped by Sovcomflot, Teekay, and a joint venture between MOL and China Shipping, which ordered ARC7 LNG carriers from DSME. All LNG buyers have signed long-term contracts (20 or 30 years) with Yamal LNG. They are Total (4 million tons/year), Gas Natural (2.5 million tons/year), CNPC (3 million tons/year), Novatek Gas & Power (2.86 million tons/year), and Gazprom (3 million tons/year).

It is interesting that Gazprom has purchased gas from Yamal LNG, since that company is the largest gas producer in Russia and monopolized gas exports for a long time. In 2013, Russia liberalized gas exports and permitted Novatek and Rosneft to export gas in the form of LNG, but Gazprom still kept a monopoly on Russian pipeline gas exports. Thus, Novatek can export LNG from Yamal without seeking cooperation with Gazprom. In fact, in 2012, Gazprom and Novatek had a long round of negotiations over a partnership on Yamal gas production, but the plans soon crashed.⁴ Now here is a question: will Gazprom buy gas from the Yamal fields owned by Novatek and transport it through its vast pipeline network to Asia in the future? This option may compete with Gazprom's future plans of continuing to contract to Yamal LNG, and in turn compete with the Yamal LNG Project itself, considering that Gazprom is planning a pipeline across the Ob Bay from the Yamal Peninsula to its other field in the Yamalo-Nenets area, and eventually to China.

Moreover, there are several other LNG projects conceived or under development in the Yamalo-Nenets area. Novatek is planning a second LNG project there, which is located on the Gydan Peninsula on the east coast of the Ob Bay; Rosneft is interested in establishing an LNG project on the Yamal Peninsula after it drills out gas with ExxonMobil in the Kara Sea;⁵ and Gazprom also has its own LNG project on this peninsula south of Sabetta. All these projects may compete with the Yamal LNG Project in the long run.

We should note that the monopolistic right held by Gazprom in pipeline gas exports is being challenged. Recently, Rosneft wanted to negotiate with Gazprom to use its "Power of Siberia," a pipeline system under construction in Eastern Siberia, to export gas from its gas fields in Evenkia and Irkutsk to China. But this proposal was refused by Gazprom, which is afraid of losing its monopoly in pipeline gas exports. However, Rosneft

keeps struggling and lobbying to obtain the pipeline gas export right.⁶ If Rosneft wins, it is reasonable to suppose that it will also connect its Vankor field near the border of Krasnoyarsk Krai and Yamalo-Nenets Okrug to Gazprom's gas pipeline systems in the Western Siberian Lowland to export to China or other markets. For the same reason, Novatek will struggle for the export rights as well. If its Yamal gas fields obtain a pipeline outlet, the importance of Yamal LNG may be weakened. So, the gas pipelines south from the Russian Arctic will influence the future of Yamal LNG, due to their overlapping main market – East Asia.

COMPETING GAS PROJECTS IN EASTERN SIBERIA AND THE RUSSIAN FAR EAST

Long before the investment in Yamal LNG and the offshore oil fields in the Barents Sea, China began to cooperate with Russia in developing cross-border pipeline systems to import oil and gas from the Russian Arctic.

The Russia-China oil pipeline (now called the Eastern Siberia – Pacific Ocean oil pipeline, or ESPO) was proposed in 2001 by the Russian oil company Yukos to go from Angarsk to Daqing via a route south of Lake Baikal to export its oil from Khanty-Mansi Autonomous Okrug to Northeast China. At the same time, Transneft, the Russian oil pipeline monopoly, proposed an alternative route from Tayshet to the Far East port Kozmino near Nakhodka via a route north of Lake Baikal, which could serve other Far East markets. In May 2003, the Russian government decided to combine these projects and said that Transneft would be in charge of the pipeline, while Yukos would supply the oil, and signed an agreement with CNPC for a 25-year oil contract. In December 2004, however, Yukos was acquired by Rosneft, and Transneft's route was adapted to bypass China. The construction of ESPO began in 2006, and the first stage, from Tayshet to Skovorodino in Amur Oblast, was completed in May 2009. In June 2009, Russia and China signed a deal to build a branch pipeline from Skovorodino to Daqing to export 15 million tons of oil to China each year for 20 years. This branch line covering 64 km in Russia and 992 km in China was completed in September 2010. On January 1, 2011, Russia began to export oil to China by the ESPO pipeline. The second stage of the pipeline, from Skovorodino to Kozmino, was inaugurated in 2012 and will be completed in 2014 or 2015. The total distance of the ESPO pipeline is

4857 km, and the initial transport capacity is 30 million tons per annum (it will be upgraded to 80 million tons per annum by 2025). The capacity of the branch to China is 30 million tons per annum.

At the same time, other Russia-China cross-border gas pipelines have been planned and built. These lines relate not only to Russian Arctic gas, but also to gas deposits in Eastern Siberia. As early as 1987 and 1989, two large gas fields, Kovyktinskoye (in Irkutsk Oblast) and Chayandinskoye (in the Sakha Republic), were discovered. Their recoverable gas reserves are estimated to be 1.5 tcm and 1.2 tcm, respectively. Due to their remoteness from European Russia, their main market is oriented to East Asia.

In 1994, CNPC began to negotiate a cooperative agreement with SIDANCO, the then owner of the Kovyktinskoye field, but the negotiations were delayed. In 1999, CNPC and RUSSIA Petroleum, which held the license for the field at the time, signed a cooperation agreement. In 2000, Korea's Kogas joined this project. It included a 4887 km gas pipeline from the field to Northeast China and Korea (including a subsea pipeline across the Yellow Sea); the estimated expenditure was 17 billion USD. The predicted gas exports to China and Korea were 20 and 10 bcm per annum, respectively. The project was expected to begin in 2005 and be completed in 2008, but was postponed to later. In 2003, the holding companies of TNK International, SIDANCO, RUSSIA Petroleum and some other Russian companies established a joint venture with BP known as TNK-BP. The ownership of Kovyktinskoye field was then shifted into the hands of TNP-BP. However, in June 2010, RUSSIA Petroleum went into bankruptcy, and Gazprom bought its assets and obtained the field in March 2011. So the field became a part of Gazprom's "East Gas Program." TNP-BP was acquired by Rosneft in March 2013.

The cooperation between Gazprom and CNPC plays a critical role in Siberian gas projects. They signed a strategic cooperation agreement in October 2004. In March 2006, during Putin's visit to China, the two companies signed a protocol on gas supplies from Russia to China, including a gas supply schedule, volumes, routes and pricing principles. They agreed on two routes: the western route or Altai pipeline from Urengoyenskoye field to the Xinjiang Uyghur Autonomous Region in northwest China with a connection to China's West-East Gas Pipeline (completed in 2004) via the Altai Mountains, and the eastern route from Chayandinskoye field in the Sakha Republic to northeast China. The supply volumes of the western and eastern routes are 30 bcm and 38 bcm per annum for 30 years, respectively.

The partners gave the Altai pipeline priority for construction. It runs 2800 km and was estimated to cost 4.5-5 billion USD. However, the partners could not agree on the price, and the negotiations lasted a long time. The project was shelved in 2008. In December 2010, negotiations resumed, but the estimated cost was updated to 14 billion USD and the first gas shipment could not be delivered in 2011 as anticipated in the initial plan. The estimated completion date was put off to 2015-2018. More seriously, the pressure from protests in the Altai Republic, which the pipeline would transit, made the project less appealing. To protect the Ukok Plateau, a sacred land in native culture and a part of the “Golden Mountains of Altai,” a UNESCO World Heritage Site, and to protect local endangered species such as the snow leopard and Altai argali, Altaian activists and the general public opposed the pipeline. As a compromise, Gazprom announced in May 2013 that it would temporarily stop funding of the project during 2014 and 2015. But it didn’t cancel the project.

Meanwhile, the eastern route was given more attention. In October 2012, Putin instructed Gazprom to start construction of the Yakutia-Khabarovsk-Vladivostok gas pipeline, also known as Power of Siberia, at the time of the final investment decision on the pre-development of the Chayandinskoye field. This project included a plan to link the Kovyktinskoye and Chayandinskoye fields later, so the total distance of the pipeline is about 4000 km: 3200 km from Chayandinskoye field to Vladivostok in the first stage, and 800 km from Kovyktinskoye field to Chayandinskoye field in the second stage. The annual transport capacity is designed to be 61 bcm. In May 2014, Gazprom and CNPC signed a 400 billion USD contract to supply 38 bcm of gas per annum to China for 30 years via Power of Siberia. The estimated date to initiate exports of gas from the Chayandinskoye field is 2019, and its annual production will be 25 bcm. The investment in the field’s development is about 13.7 billion USD, and in the pipeline about 24.5 billion USD, as estimated in 2012. The construction of the first stage of Power of Siberia will start in 2015. Its eastern section, between Skovorodino and Khabarovsk, will share an integrated corridor with the ESPO oil pipeline. From Blagoveshchensk, there will be a branch pipeline heading to China. At Khabarovsk, Power of Siberia will join the Sakhalin-Khabarovsk-Vladivostok gas pipeline, which is 1188 km long, linking the gas projects in the northern Sakhalin Island (opened in 2011) to Vladivostok. Its capacity will be 30 bcm per annum in 2020, of which 8 bcm will be from Sakhalin. At the end of this pipeline in

Vladivostok, an LNG terminal will be built as a joint venture of Gazprom and the Japan Far East Gas Company (a consortium led by Itochu and involving CIECO, INPEX, JAPEX, and Marubeni) that will be opened in 2018 with a total capacity of 15 million tons of LNG (or 20 bcm of gas equivalent) when three production trains are completed. The main market of the Vladivostok LNG Project is expected to be Japan and Korea. There is another LNG port in the southern Sakhalin Island, also designed to serve the Japanese and Korean market.

Japan has paid attention to the oil and gas resources on Sakhalin Island for a long time. Now there are six existing or planned offshore petroleum projects along the Sakhalin coast, from Sakhalin-I to VI, operated cooperatively by Russian and foreign companies. Among them, Sakhalin-I is operated by Exxon Neftegas Ltd., a consortium including ExxonMobil (30%), SODECO (30%, jointly funded by JAPEX, Japan National Oil, Itochu, and Marubeni), ONGC Videsh Ltd. (20%, an Indian company), and Rosneft's two subsidiaries (11.5% and 8.5% each); Sakhalin-II is operated by Sakhalin Energy, a consortium including Gazprom (51%), Shell (26.5%), Mitsui (12.5%) and Mitsubishi (10%). The former project holds 310 million tons of oil and 0.48 tcm of gas, began production in 2005 and mainly yielded oil; the latter project holds 160 million tons of oil and 0.5 tcm of gas, began to produce in 1999, and also includes the Trans-Sakhalin oil and gas pipelines and an oil terminal and an LNG plant, plus a terminal near Korsakov in the southern Sakhalin Island. In 2005, the total investment of Sakhalin-II was estimated to be \$20 billion USD. The output of the project is 19.7 million tons of oil and 19.3 bcm of gas per annum. The LNG terminal was opened in 2009, and it exports 9.6 million tons of LNG (or 13 bcm of gas equivalent) each year. The buyers of Sakhalin LNG include seven Japanese companies (three of which are electric power companies), one Korean company, and one Dutch-British company. Sakhalin-III holds 800 million tons of oil and 0.9 tcm of gas, and one of its fields, Kirinskoye gas field, is owned by Gazprom, with the first gas being extracted in October 2013. Gazprom has created two outlets for the gas produced from these Sakhalin projects: one is the Sakhalin LNG terminal near Korsakov, the other is the Sakhalin-Khabarovsk-Vladivostok gas pipeline, which connects the eastern route of Power of Siberia for exports to China.

We should note as well that Power of Siberia will connect the Chayandinskoye and Kovyktinskoye fields, and Gazprom has a plan to build a pipeline from Kovyktinskoye to Irkutsk in order to gasify this

industrial center in Eastern Siberia. In the long run, Gazprom plans to build a connection between its pipeline networks in Western and Eastern Siberia. With this connection, the gas from the Yamalo-Nenets area can be piped to Northeast China, or the gas from Eastern Siberian fields can be piped to Xinjiang once the Altai Project is completed. Given this potential scenario, the Yamal LNG Project may be challenged in the long run after the first gas deal expires, since the pipeline network developed by Gazprom in South Siberia will provide a major alternative to this Arctic project. Of course, there is no need to worry about Yamal LNG in the next 30 years.

CONCLUSION

This commentary is relevant to the future of Yamal LNG, which plays a key role in the development of NSR shipping, though it does not focus directly on Yamal LNG or other Arctic projects. It examines the petroleum projects, especially natural gas projects, in South Siberia and the Russian Far East that involve cooperation between Russia and East Asian countries, since these projects may affect Yamal LNG in the long run. The key observations are:

- (1) East Asia is close to Russia, so that pipeline and short-sea LNG shipping are competitive;
- (2) Although Gazprom still enjoys a monopolistic position in pipeline gas exports, Rosneft is struggling to obtain export rights. If Rosneft wins, it is reasonable to imagine that Novatek will follow, and its gas from the Yamal Peninsula to China can go through pipelines southward;
- (3) Gazprom has major projects, existing or planned, to export gas to the East Asian market; and
- (4) Last but not least, the capacity of gas pipelines and LNG shipment in South Siberia and Russia's Far East are much bigger than Yamal LNG, though Yamal LNG is important for traffic via the NSR. Consider that each year Power of Siberia will provide China with 38 bcm of gas, and the Altai pipeline will provide 30 bcm, whereas Yamal LNG will only provide 4 bcm.

As dramatic changes are not unusual in Russian projects, however, there are many uncertainties in the future, so these challenges to Yamal



Figure I-9. The eastern part of Gazprom's gas pipeline networks (solid for existing, dashed for planned)

LNG are potential rather than certain. At least in the next 30 years, these challenges are not likely to derail the Yamal LNG project.

Notes

1. BP Statistical Review of World Energy, June 2014.
2. Barents Observer. "China to drill in Barents Sea" - <http://barentsobserver.com/en/energy/2013/03/china-drill-barents-sea-25-03>
3. Barents Observer. "Budget crash at Sabetta puts Murmansk in squeeze" - <http://barentsobserver.com/en/energy/2014/06/budget-crash-sabetta-puts-murmansk-squeeze-10-06>
4. Barents Observer. "Gas giants with Yamal deal" - <http://barentsobserver.com/en/energy/2014/05/gas-giants-yamal-deal-27-05>
5. Barents Observer. "Sechin eyes LNG plant in Yamal" - <http://barentsobserver.com/en/energy/2014/02/sechin-eyes-lng-plant-yamal-11-02>
6. Reuters. "Russia's Rosneft says will take Gazprom to court over pipeline refusal" - <http://uk.reuters.com/article/2014/07/01/oil-russia-rosneft-courts-idUKL6N0PC37I20140701?feedType=RSS&feedName=rbssEnergyNews>

Commentary

Ryuichi Shibasaki

ESTABLISHMENT OF PUBLIC-PRIVATE PARTNERSHIP COUNCIL IN JAPAN FOR THE NORTHERN SEA ROUTE

In May 2014, the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT) established a “public-private partnership council for the Northern Sea Route (NSR),” in order to share information on the NSR with maritime shipping companies, cargo owners and administrations in Japan and encourage use of the NSR.¹ The Council members are not only the Maritime Bureau, Port and Harbors Bureau, Meteorological Bureau, Japan Coast Guard and Policy Bureau of MLIT, but also other governmental administrations, including the Cabinet Secretariat, the Ministry of Foreign Affairs (MOFA) and Ministry of Education, Culture, Sports, Science and Technology (MEXT), as well as major shipping companies (NYK, MOL, K-Line), major shippers, including electric power companies, gas companies, trading firms, and several related associations and foundations such as ship owner associations, marine safety associations, the OPRE, and JOGMEC.

On May 30, 2014, the first meeting of the Council was held, and related information such as the current situation and economic analysis of the NSR, international cooperation and collaboration on Arctic Seas (including the introduction of NPAC), and movement of investigation and research on the Arctic Seas were delivered from several ministries and agencies.

SHIP BUILDING CONTRACTS OF ICE-CLASS CARRIERS BY MOL FOR YAMAL LNG PROJECT

On July 9, 2014, Mitsui O.S.K. Lines, Ltd. (MOL) announced that a joint venture between MOL and China Shipping (Group) Company was concluded and shipbuilding contracts signed with Korea’s Daewoo Shipbuilding & Marine Engineering Co., Ltd. (DSME) to build three ice-class LNG carriers for the Yamal LNG project.

According to the press release issued by MOL,² the ice-class LNG

carriers for the project will have independent ice-breaking capabilities that enable them to sail in icy seas with a maximum 2.1 m ice thickness (“ARC7” type). A profile and image of the vessel are shown in Table I-2 and Figure I-10. The vessels will be capable of transporting LNG from the Yamal LNG liquefaction plant at Sabetta Port on the Yamal Peninsula to the main LNG markets in the world. During the summer period, the carriers will also be able to sail independently on NSR to transport LNG to East Asia.

Table I-2. Profile of ice class LNG carrier ordered (source: MOL)

Dimensions	Length: 299m, Breadth: 50m
Ship type	172,000 m ³ membrane type
Ice class/ Specifications	RMRS ARC7/ Special specifications for Arctic environment
Ice-break sailing capabilities	Icebreaker bow structure; aft structure: three-axis POD propeller Max. ice breaking capacity: ice thickness 2.1m (when going astern)
Shipyard	Daewoo Shipbuilding & Marine Engineering Co., Ltd.

The Japan Maritime Daily reported³ that the headquarters of the joint venture company will be in Hong Kong. MOL and China Shipping Development Co., Ltd. each have a 50% share. The price of each vessel is 310 million USD. By sharing the financial burden with partner companies and obtaining loans for financing (i.e., project financing), the total amount of self-financing per company can be limited to 100 to 140 million USD for building three vessels. The operation of these carriers will be conducted by



Figure I-10. Illustration of LNG carrier for Yamal project

MOL. The first vessel is expected to be completed in March 2018.

DSME gave notice of acknowledgement of orders to build nine ARC7 ice-class LNG carriers this time. These vessels will be delivered by the end of February 2020. The six LNG carriers other than those ordered by the joint venture company of MOL and China Shipping are supposed to be ordered by Teekay LNG Partners LP (USA). In addition, one ARC7 ice-class LNG carrier was already ordered by Sovcomflot (a Russian state-owned company) in March 2014 and will be delivered by the end of June 2016. Since it is expected that 15-16 specialized LNG carriers (around five carriers per LNG train) are needed for all-year constant shipping of LNG from Sabetta Port, around two-thirds of them have been ordered from DSME.

All ARC7 LNG carriers now built or contracted for building will serve under a time-charter contract with Yamal LNG, of which the shareholders are Novatek (Russia, 60%), Total (France, 20%) and CNPC (China, 20%). The contract period of the time-charter is 25 years. Under the time-charter contract, the ARC7 ice-class LNG carriers operated by MOL will transport LNG to any destination that the customer (i.e., Yamal LNG Project) instructs. From Sabetta Port, operation to Europe will be conducted all year long, with operation to East Asia, including China, Japan and Korea via the NSR being possible only during the summer season (for example, from May to November) as shown in Figure I-11.

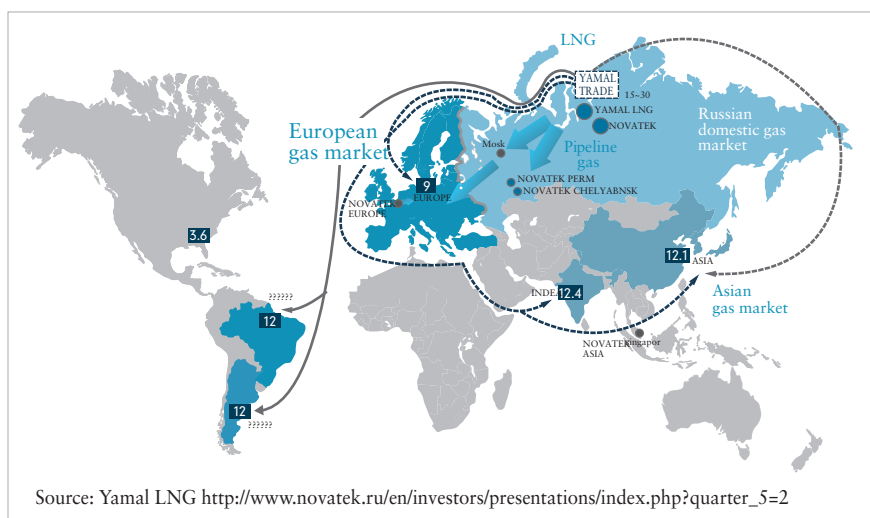


Figure I-11. Expected importers of Yamal LNG and shipping routes

TRANSSHIPMENT HUB OF LNG

According to a press release⁴ issued on May 20, 2014 by Yamal LNG, a binding contract with CNPC to provide for the supply of three million tons of LNG per annum at delivered ex-ship (DES) terms, including delivery cost by maritime shipping for a period of 20 years, has been concluded. In addition, in order to provide year-round supply to East Asia, Yamal LNG has signed an agreement outlining the parameters of cooperation on the transshipment of LNG with Fluxys, which is a Belgium-based, fully independent gas infrastructure group, according to a press release issued on April 4, 2014. The Zeebrugge LNG terminal, which is owned by Fluxys LNG, a 100% affiliate of Fluxys, will be the transshipment platform enabling LNG supply from Yamal to the Asian-Pacific countries when winter navigation is closed on the Arctic Ocean's NSR (see Figure I-12). Fluxys will carry out all technical, permitting and regulatory processes with a view to provide LNG transshipment services.

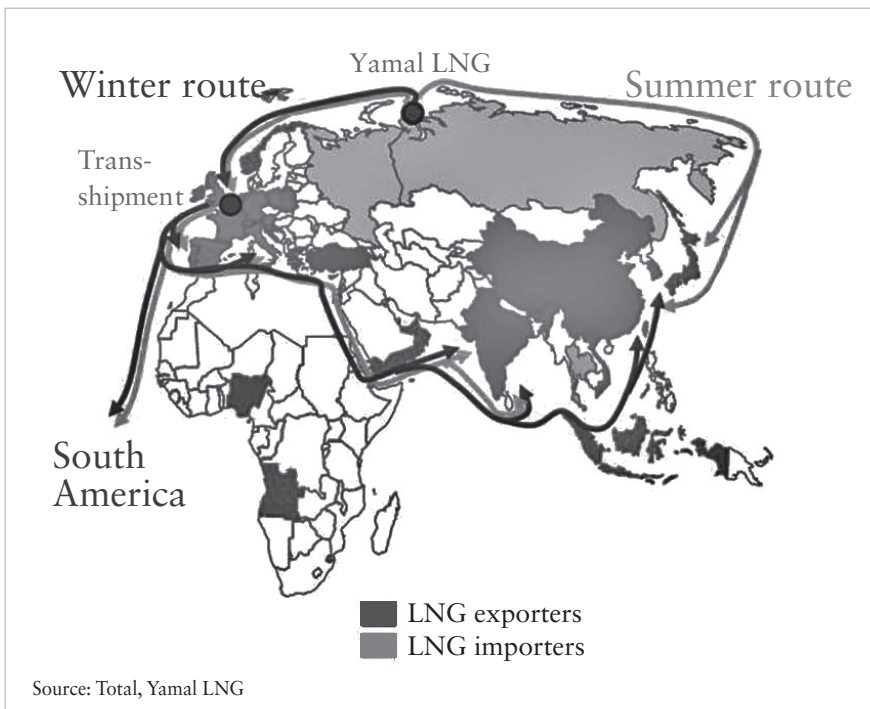


Figure I-12. Yamal LNG shipping options with transshipment in Europe to East Asia during the winter season

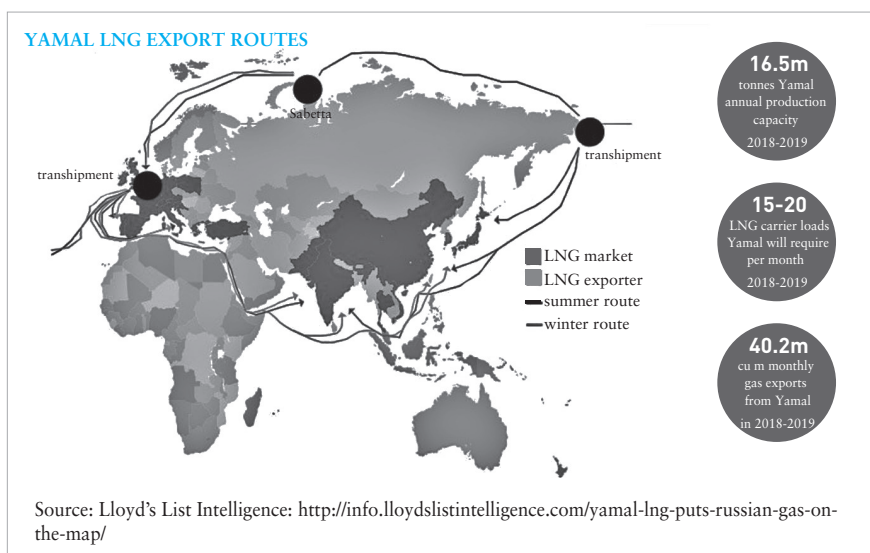


Figure I-13. Is the transshipment hub needed for East side?

The transshipment hub of LNG in Europe to be provided by Fluxys Belgium targets the shipping demand of LNG to East Asia during the winter season when the NSR is not available. Some figures available through Internet (one example is shown in Figure I-13) show a possibility of the hub in East Siberia or East Asia as well. Also, some seaports including Petropavlovsk-Kamchatsky, Vladivostok, Busan and some Japanese ports are said to aim at being a hub of the NSR, although they do not target only the LNG transport. Is it possible to be a hub in the east side? In order to realize that, it must be proven that the shipping system with transshipment is economically advantageous (i.e. the shipping cost with transshipment is cheaper), compared with the direct shipping to the destination.

One possibility of the transshipment hub in the east side is to emulate the original business model of Fluxys Belgium to provide the LNG to neighbor countries as secondary transport. Some transshipment hub located in an ice-free port can sell the LNG in the winter season which the price of LNG become higher, by stocking them at full capacity from Sabetta Port via the NSR during the summer season.

RISKS IN BUILDING ICE- CLASS CARRIERS

According to our interview survey to MOL, the company considers that the risk on the demand side will be undertaken by Yamal LNG because they entered a long-term, time-charter contract; therefore, MOL can keep its mind on the operational issues of vessels. MOL considers that the know-how and resources needed for ship operation on the NSR will further enhance and expand its ocean transport services, not only in LNG carriers.

Another risk for shipping companies such as MOL is whether the LNG terminal for exports will be completed as scheduled. There may be a large risk if no cargo is found to be shipped after the vessels are completed.

RESPONSE OF THE SUEZ CANAL AUTHORITY (SCA)

Finally, let me comment on some responses from the Suez Canal Authority in Egypt, since the OCDI is involved in a Japan International Cooperation Agency (JICA) project to enhance the strategy of the Suez Canal with the SCA staff. The staff of SCA is interested in the current situation and future direction of the NSR, which they consider to be a potential competitor with the Suez Canal. They would also like to attend the NPAC from next year in order to gather information as well as to develop a friendship with relevant people in Arctic shipping.

Notes

1. http://www.mlit.go.jp/sogoseisaku/ocean_policy/sosei_ocean_tk_000021.html (in Japanese)
2. <http://www.mol.co.jp/en/pr/2014/14036.html>
3. Japan Maritime Daily, July 10, 2014.
4. <http://www.novatek.ru/en/business/yamal/southtambey>

Commentary

Sung Woo Lee

HIGH INTEREST IN ARCTIC ONSHORE AND OFFSHORE RESOURCES

The Arctic is well known for its rich repositories of energy and mineral resources. Energy importing countries around the world pay considerable attention to Arctic offshore and onshore oil and gas resources. In particular, East Asian countries, including China, Japan, and South Korea, have a great interest in the Arctic offshore and onshore, mainly due to the supply potential for meeting their needs for energy and the mineral resources

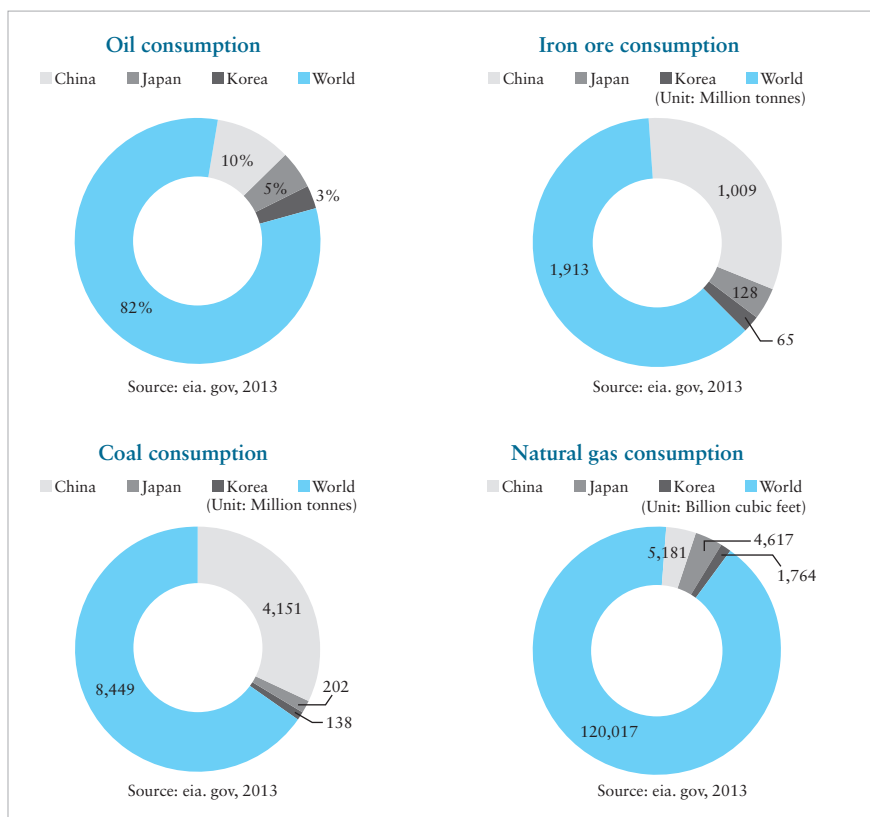


Figure I-14. Consumption of energy and mineral resources in East Asia

essential for supporting their economies. As shown in Figure I-14, the three countries in East Asia account for 18% of the world's oil consumption.

In order to comprehend South Korea's perspective on Arctic energy and resources development, we need to understand the nation's position relating to energy and mineral resources. South Korea is energy and mineral poor. Moreover, it is located a long way from available natural sources and has been heavily dependent on the high-cost Middle Eastern and Southeast Asian markets for supply.

To maintain its economic growth, South Korea has been increasing its demand for energy and mineral resources abroad. The country has been suffering from natural resource-related difficulties, such as a lack of natural resources, long-distance transportation, and vulnerability to the fluctuations of international commodity prices. In this respect, the prospect of easier access to Arctic natural resources—mainly due to the emergence of the Northern Sea Route (NSR) in the world energy market—should be increasingly valuable in South Korea's strategic considerations for energy and natural resource supply.

WHAT IS SOUTH KOREA'S INVESTMENT TARGET FOR ONSHORE AND OFFSHORE RESOURCES IN THE ARCTIC?

Despite the growing need for the Arctic's natural resources, in particular in the Russian Arctic, numerous barriers in the region discourage South Korea from entering the energy resource market. The deficiency of transportation infrastructure is the most salient. Improvement of the transportation infrastructure in the Arctic region requires an increase of seaport facilities, logistic centers and supporting cities. These projects are expensive. During the next decade, according to a recent Lloyd's report,¹ as much as 100 billion USD in investment will take place in the Arctic, mostly in offshore oil and gas. In short, the improvement of the transportation infrastructure in the Arctic offshore alone could increase the cost of using the NSR by tens to hundreds of billions dollars in the decades to come.

A similar situation exists regarding onshore petroleum and mining activities in the Russian Arctic. The development of onshore natural resources needs to connect to regional logistic networks, including railroads, river ports and roads, which support onshore activities, and

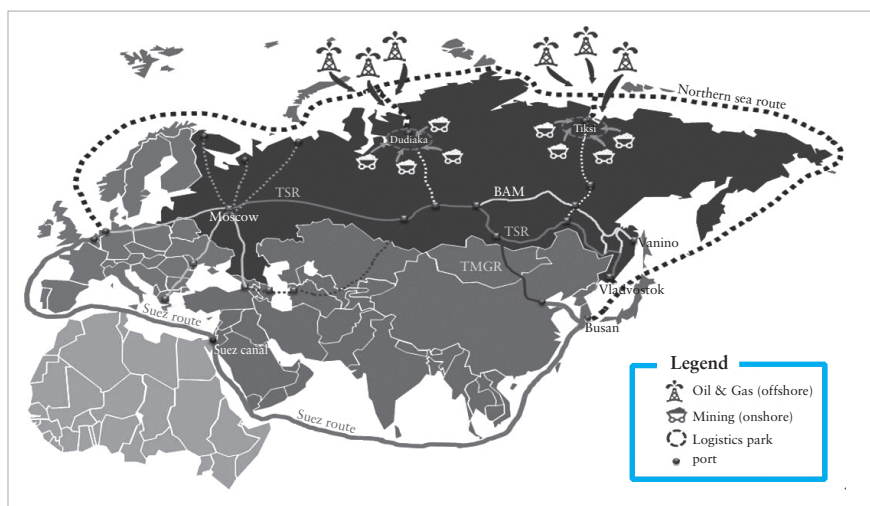


Figure I-15. Concept of accessible logistics network on and offshore in Russian Arctic

provide East Asia and Europe with useful transport routes via the Trans-Siberian Railway (TSR) as well as the NSR, as shown in Figure I-15.

Apart from physical infrastructure, commercial Arctic shipping needs to address other requirements shown in the Arctic Marine Transportation System (AMTS) by the Norwegian expert Bjørn Gunnarsson. This system consists of four sectors, as follows:

a) Physical infrastructure such as adequate ports and terminals with deep draft access, cargo handling and passenger/crew facilities and the provision of refuge for ships, b) information infrastructure such as navigational charts with updated hydrographic and shoreline mapping data, aids to navigation and real-time navigation information, marine weather and sea ice forecasts, proper communication systems and vessel traffic monitoring and reporting systems, c) response services such as services of icebreakers for vessel escorts, search and rescue and emergency response, oil spill prevention and preparedness and available response technologies to clean up oil and other hazardous wastes spilled at sea, and d) Arctic vessels, including a fleet of ice-strengthened cargo ships and specialized vessels operating in the harsh Arctic environment, possibly on a year-round basis.

This list will apply to South Korea's case if it gives serious consideration

to entering into the NSR energy resource logistics market.

WHO ARE THE INVESTORS IN ARCTIC ONSHORE AND OFFSHORE RESOURCE DEVELOPMENT?

The development of Arctic resources will require huge investments in related infrastructure development. The question is: who will invest? In general, development of infrastructure abroad is conducted by government funding, private investments, and private-public partnerships (PPP).

In some cases, especially those involving infrastructure development for less developed countries by developed countries, official development assistance (ODA) may be available. Coastal nations in the Arctic region, however, do not meet the requirements for ODA investments. As a result, the next-best option for investment will be a combination of government and private investment efforts.

But the problem is, as Valeriy Kryukov mentions, that the lack of transparency in foreign direct investment regulations and complex ownership problems in Russia make it difficult to find appropriate ways to safeguard investments. An alternative may be investments by international development banks. But the problem still remains because international development banks such as World Bank and Asian Development Bank need their monetary sources to assist LDCs. Even in the case of a monetary source being secured, they would face limitations arising from the institutions' basic roles. So for infrastructure development in the Arctic region, the Asian Infrastructure Investment Bank (AIIB), recently initiated by China, seems to have potential for funding.² Additionally, the tentatively named Arctic Development Bank, which will be able to establish joint efforts of Arctic coastal nations and Arctic user countries, can play a significant role in raising funds for Arctic infrastructure development. However, in both cases, the prospect of conflicting interests in stakeholder countries demands more consideration in order to make such an institution work well.

ARE ECONOMIC BENEFITS FROM ARCTIC RESOURCE DEVELOPMENT POSSIBLE?

Eventually, the value of Arctic natural resources depends on the question

of whether the development and extraction of such resources would be profitable. Energy resource development in the region must address a number of factors such as environmental risks, the social safety of Arctic aboriginal communities, costs entailed by infrastructure development and building and maintaining icebreakers, and price fluctuations braising from world energy markets. Such cost factors will be reflected in transit charges imposed by the Russian government. Moreover, the ups and downs of resource prices can lead to irregularity in the NSR's commercial use. In addition, a lack of preparedness in terms of institutions and administration and unclear private ownership problems may interrupt the smooth entry of foreign capital into Arctic energy development. Thus, it seems doubtful if energy resources in the Arctic—again especially in the Russian Arctic—will emerge in the world energy resource market.

HOW CAN THE PROBLEM OF COMMERCIALIZING THE ARCTIC'S NATURAL RESOURCES BE SOLVED?

In order to solve the cost problems involved in the development of natural resources in the Russian Arctic, technological progress regarding the prevention of oil spills, ship building, resource extraction, and related infrastructure development will be needed to reduce costs. Furthermore, effective ways to maintain the price of commodities produced in the Russian Arctic will be needed. One of the prime tasks in this respect will be setting up a stable price structure that is immune to seasonal fluctuations.

In this regard, the option of constructing a transshipment hub like the Zeebrugge LNG terminal in the Yamal LNG project deserves attention. The advantage of such an approach is that companies can use such a transshipment hub to store products in order to sell them at a favorable time, minimizing the limitations of using the NSR in the winter season with their inventories. Moreover, this sort of facility can support value-added activities such as the dehydration of mineral products and desulfurization and refinement of petroleum (see Figure I-16).

In this respect, the South Korean government is examining the future role of Ulsan Port, one of the largest ports in South Korea in terms of liquid cargo, as an international hub for the transshipment hub of energy resource cargos in East Asia.³ Ports in the Russian Far East and on Japan's West Coast would likely join in competition with Ulsan Port to play a leading

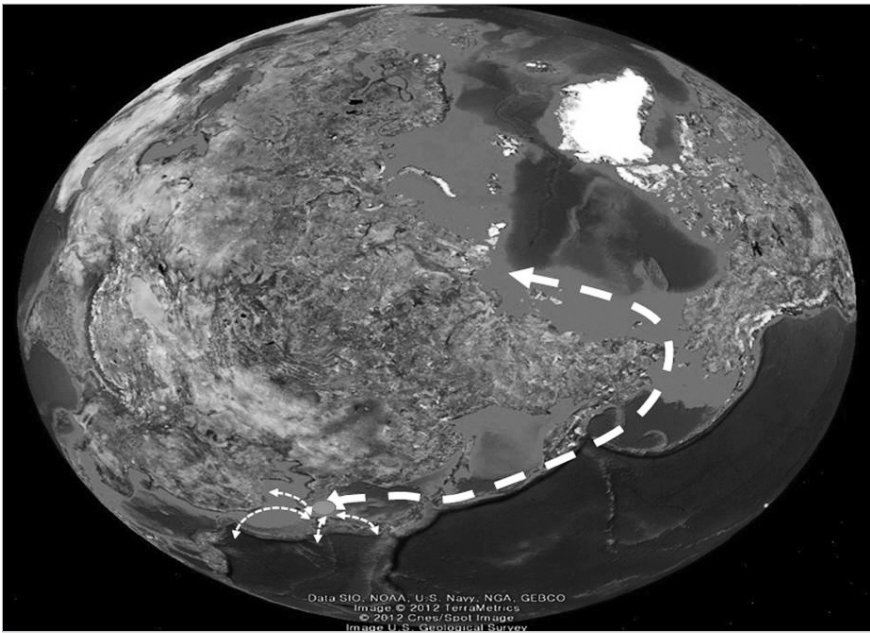


Figure I-16. Transshipment hub in East Asia

role in this realm.

To facilitate the business activities surrounding Arctic natural resource development and related commercial maritime shipping via the NSR, a concerted effort will be needed. For Russia, it is essential to improve legal systems so they are more favorable for attracting foreign direct investment, especially for private investments, and to introduce eco-friendly and aboriginal-friendly natural resource development rules. Along with the Russian efforts, cooperative international efforts will be needed for the joint development of a logistics infrastructure in the Arctic region, development of transshipment ports to improve demand and supply flows and create added value, construction of storage facilities, R&D efforts related to shipbuilding technology, and energy resource and mineral resource development. At the same time, and simultaneously, the consolidation of international governance for the sustainable development and use of resources will be essential for the commercialization of Arctic natural resources and vitalization of the NSR.

Notes

1. Lloyd's Report, "Arctic Opening: Opportunity and Risk in the High North." (2012). Available at: www.lloyds.com.
2. The AIIB is an international financial institution proposed by China in 2013. In June 2014, China showed a revised proposal, doubling the registered capital of the bank from 50 billion USD to 100 billion USD and invited India to join the bank. The South Korean government has asked China to move the headquarters of the AIIB to Seoul or Songdo (Incheon City). See "Korea asks China for the AIIB headquarters," *Joongang Daily*, July 15, 2014.
3. According to UPA statistics, liquid cargo handling, including oil and oil products, accounted for 70.5 % (134,600 ths. tons) in the total cargo handling volume in Ulsan Port in 2013. Ulsan Port consists of four ports: Main, Onsan, Mipo, and New ports. For more detailed information, see "Statistics of Ulsan Port" (in English) on the UPA's official website (www.upa.or.kr).