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# The Northern Sea Route: A state priority in Russia's strategy of delivering Arctic hydrocarbons to global markets

## Introduction

Russia's Arctic contains tremendous reserves of hydrocarbons but the monetization of this resource has been impeded by extremely high costs of delivering oil and gas from the Russian Arctic projects to consuming markets. Gas pipelines now span for thousands of kilometres from the Yamal peninsula to bring natural gas to end-users in northwest Russia and in Europe. They were built at enormous cost and link to only few super-giant gas fields on Yamal (Bovanenkovo and Kharasavey at present) with many others remaining out of reach due to the challenging geography.

The fast warming of the Arctic in recent years, however, has given momentum to a new strategic opportunity for the Russian oil and gas producers: to send their output from the Arctic prospects (especially the ones located closer to the coastline) to consumers through the Northern Sea Route (NSR) using very large oil tankers and LNG carriers. The NSR is part of the Northeastern passage connecting the Atlantic and Pacific oceans through the Arctic seas. It is an important shortcut between Europe and Asia, providing significant distance and shipping time savings compared with the most often used shipping route from the Atlantic to Asia via the Suez Channel and Indian Ocean.

For Russian oil and gas companies, the NSR holds the promise of unlocking the reserves that have been stranded in the Arctic for many years. As a harbinger of things to come, Russia's flagship LNG project, Novatek's Yamal LNG, has been using the NSR to deliver its liquified gas to Europe and Asia. Novatek's plans of increasing LNG production on the Yamal and Gydan peninsulas four-fold in the next 15 years mean that about 70 million tonnes per annum (mtpa) of Russian LNG will be shipped via the NSR in the early 2030s and much more beyond.

For the Russian government, the NSR has emerged as both an internal and external state priority. Internally, the state views the NSR as part of a broad program for creating infrastructure that would connect Western and Eastern parts of the country. Developing infrastructure along the NSR (including ports, trans-shipping facilities, new generation ice-resistant vessels and powerful nuclear ice-breakers) holds a promise of an important commercial opportunity for cost-efficient delivery of Russian cargos between Russia's western and eastern regions, and to exports, providing Russian shippers with a competitive edge. The cargos travelling the NSR have been dominated by hydrocarbons shipped to export markets, but have also included other important items such as mineral ores, coal and food supplies, important for Russia's northern territories.

But the NSR has also become a geo-political priority with a wide range of external drivers. In particular, in a world of growing global rivalries a Russia-controlled transportation trade route to China and other Asian markets that is beyond the control of the US Navy and is secure from possible sanctions or blockade represents an important strategic asset for Russia.



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This article seeks to review Russia's strategy with regard to the NSR and to analyse how the specific goals related to the NSR may be achieved as a vital part of the country's overall Arctic strategy, and focuses on how Russia's overall NSR strategy is set to develop. It highlights the preeminent role of the current and future Arctic oil and gas projects in achieving Russian goals for the NSR traffic.

## The Northern Sea Route – The Arctic Shortcut

Almost 18 per cent of Russia's territory (over three million square kilometres) is in the Arctic. In addition to its tremendous potential for developing hydrocarbons reserves, it plays an important part in Russia's geostrategic calculations. One of the strategic priorities for the Russian government is to develop the Northern Sea Route (NSR) – the Arctic shortcut to Asia – as part of the Northern Sea Corridor, with connections via the Barents Sea and the North Sea to Europe and via the Sea of Okhotsk and East China Sea to China and the wider Asia-Pacific. The NSR route offers a significant reduction in transportation distances (and, therefore, costs) compared with the much longer route through the Suez Canal and is free from the risks of piracy often associated with travel through the Strait of Malacca (See Figure 1).

**Figure 1: Northern Sea Corridor and Northern Sea Route**


Source: https://twitter.com/TheEconomist/status/489955265761267713

The entire NSR route is within Russia's exclusive economic zone (EEZ) and in Arctic waters, introducing the necessity to follow safety and environment protection requirements amid extreme navigation challenges due to ice conditions for most of the year. The NSR water area comprises sea areas with different legal regimes, including internal waters, the 12-mile territorial sea, the 24-mile contiguous zone and the 200-mile exclusive economic zone of the Russian Federation. Beyond the 200-mile external border of the EEZ, the high seas enclave begins, where Russian regulations do not apply. These higher latitudes, however, introduce natural regulations in the form of ice conditions that make navigation there prohibitively risky.

## The NSR Boundaries

The NSR extends more than 5,000 km (the exact length depends on a specific route within the NSR water area) off the coast of the Russian Federation from its western boundary along the meridian of Cape Zhelaniya, the eastern coast of Novaya Zemlya and the straights of Kara Gate, Matochkin Shar and Yugorskiy Shar to its eastern boundary at Cape Dezhnev (the easternmost point of the Russian mainland) and the demarcation line between the territorial waters of Russia and the US in the Bering strait. It crosses four Arctic seas: Kara, Laptev, East Siberian, and Chukchi within Russia's EEZ. It is noteworthy that the Barents Sea is beyond NSR boundaries but is an important western part of the overall route between Europe and Asia.

According to Article 234 of the UN Convention on the Law of the Sea (UNCLOS) of 10 December 1982, the document governing international sea navigation, "coastal states have the right to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution from vessels in ice-covered areas within the limits of the exclusive economic zone, where particularly severe climatic conditions and the presence of ice covering such areas for most of the year create obstructions or exceptional hazards to navigation, and pollution of the marine environment could cause major harm to or irreversible disturbance of the ecological balance. Such laws and regulations shall have due regard to navigation and the protection and preservation of the marine environment based on the best available scientific evidence"[1]. Russia's current legislation governing the rules of navigation via the NSR has been developed in accordance with the UNCLOS guiding principles. Russia insists that Article 234 creates the basis for the requirements of preliminary notification of the intent to pass via the NSR by any foreign ship (including warships) and compulsory piloting and ice-breaker support services, for which Russia assesses charges. These requirements have been challenged by other countries, most importantly the United States, under a "freedom of navigation" argument. The US has insisted that the right of innocent passage should apply to the territorial waters within the NSR water area, especially for warships. The debates about the legal status of the NSR continue, and the warming in the Arctic and the receding ice-cover is likely to give them new impetus[2].

## Russia's Arctic ambition and the Northern Sea Route

### Russian latest strategic documents on Arctic and NSR

The NSR takes a prominent place in Russia's Arctic strategy. In 2020 Russia adopted important strategic documents related to its Arctic strategy, outlining the key principles of its policy and specific targets to be achieved during the next fifteen years, and streamlining and codifying its previous regulations:

- *The Foundations of Russia's Arctic State Policy to 2035* – introduced by Presidential Decree #164 of 5 March 2020[3].
- *The Strategy for Developing Russia's Arctic and Providing National Security to 2035* – introduced by Presidential Decree #645 of 26 of 26 October 2020[4].

These documents characterize the NSR development as in Russia's "national interest" and one of its key priorities in the Arctic. In order to increase the volume of shipments via the NSR and ensure year-round navigation, Russia's strategists propose to develop seaports and railroad links leading to these

[1] https://www.un.org/Depts/los/convention_agreements/texts/unclos/UNCLOS-TOC.htm
[2] See Gudev, P. *The Northern Sea Route: A National or an International Transportation Corridor?* September 2018 https://russiancouncil.ru/en/analytics-and-comments/analytics/the-northern-sea-route-a-national-or-an-international-transportation-corridor/
[3] http://static.kremlin.ru/media/events/files/ru/f8ZpjhpAaQ0WB1zjywN04OgKiI1mAvaM.pdf
[4] http://kremlin.ru/acts/bank/45972/page/1

ports from inland, build new nuclear and diesel-powered icebreakers, and designate the projects that provide cargos for the NSR.

The Strategy lists eighteen specific goals to advance the infrastructure development in the Arctic. Among the organizational goals most relevant to the NSR are these: the creation of a Marine Operations Headquarters for the NSR (promptly done in 2021); and the creation of a digital platform to facilitate the provision of logistical and transportation services in the NSR waters.

More challenging goals relate to the creation of Russia's own system of telecommunications in the Arctic based on a group of Russian space satellites and using Russian equipment and technological solutions and to laying subsea fibre optic cables along the NSR route to ensure fast internet access in all Russian Arctic seaports.

The hard-to-do "big ticket" goals include the construction of the new generation of vessels by 2035 (the Strategy specifically mentions at least five new nuclear icebreakers under the so-called project 22220 and three new nuclear icebreakers "Leader", 16 rescue tugs and support vessels of different sizes, 3 hydrographic vessels, and two pilot ships) and port infrastructure investments, including developing the existing sea ports and building new ones as well as developing the ports on Russian northern rivers (which involves extensive dredging operations).

The Strategy envisions the use of LNG as bunkering fuel in the Arctic, which can drastically reduce harmful emissions of NOx and SOx compared with using low-sulphur marine fuel oil.

## NSR's role in connecting Russia's Arctic hydrocarbon riches with markets

Russia's Arctic Strategy sets a goal for the NSR shipping turnover of 90 million tonnes per year (mtpa) in 2030 and 130 million tonnes per year by 2035 (compared with 31.5 million tonnes in 2019 and 32 million tonnes in 2020). International transit is expected to represent a small share of the total volume at only 2 million tonnes in 2030 but rising to 10 million tonnes by 2035 (compared with 0.7 million tonnes in 2019).

It is clear that the lion's share of the shipments via NSR would be represented by exports of hydrocarbons, since for many Russian oil and gas projects located in Russia's Arctic sea transportation is a viable alternative to traditional transportation by pipeline or by rail.

Geography has always played a key role in Russia's economics. According to the Arctic Strategy to 2035, Russia's Arctic zone accounts for 80 percent of natural gas and 17 percent of crude oil and condensate produced in the country. The Strategy envisions that by 2035 the share of Arctic oil in total Russian output would go up to 26 percent, and the share of dry natural gas would remain at its present levels. At the same time, the strategy predicts that the amount of LNG produced in the Russian Arctic would reach 91 mtpa by 2035 rising four-fold from its present level.

These outlooks are supported by the tremendous resource potential of Arctic hydrocarbons. The estimated mineral reserves for Russia's Arctic continental shelf include 85 trillion cubic metres (Tcm) of natural gas and 17 billion tonnes of crude oil, sufficient to cover domestic and export demand for decades to come. However, the bulk of oil and gas production and most of the reserves are located far from consuming markets at home and abroad. This makes transporting oil and gas from points of production to points of export or domestic sales one of the most significant cost items for Russia's oil and gas producers.

Hydrocarbon projects operating on Russian territory in the vicinity of the NSR are expected to drive a significant increase in shipments via this route by 2035 and beyond and will continue to pioneer Arctic marine transportation solutions, given the need to deliver their output to markets. However, the danger is that the realization of many of the existing and planned oil and gas projects may outpace the infrastructural developments, creating transportation bottlenecks. Russia's Arctic Strategy recognizes this as one of the main risks and challenges to the realization of Russia's ambitious targets.

## Russian Legislation on the NSR: The Latest Changes

In 2012 Russia adopted a law on the NSR, that introduced changes and amendments to the prior legislative acts, eliminating a good deal of the bureaucratic hassle in the NSR administration inherited from Soviet times. The 2012 law required the Russian government to introduce uniform rules for sailing via the NSR, to set up a specially designated state entity to administer the rules, to give it authority to organize, permit, and manage navigation along the route. The law also established the key variables (such as a vessel's ice class, navigation period, etc.) for calculation of tariffs for piloting and icebreaker support services in the NSR waters[5].

According to the latest version of the rules for the NSR navigation introduced by the Russian Government in 2020[6], there are 28 different zones within the NSR boundaries; for each the requirements for ships are set depending on the type of navigation difficulty, based primarily on ice conditions during passage. The possible routes via the NSR involve passage through various combinations of the zones, from the ones closer to shore and usually ice-free for longer periods but at the same time having limited water depth and therefore not suitable for the passage of the larger ships (especially in the western part of the East Siberian sea) to the ones further north with no water depth limitations but usually having more challenging ice conditions. For example, the maximum draft in the Sannikov Strait through which a lot of the NSR traffic passed in the past decade is only 12 metres, but the maximum draft along a more northerly route above the Novosibirsk Islands is 20 metres.

The rules set out standardized requirements for the types of ships allowed to travel the NSR and outline the requirements for piloting and icebreaker assistance. The ships planning to navigate via the NSR must apply in advance, at least two weeks prior to reaching the NSR boundaries. The applications are considered by Russia's Federal Agency for Maritime and River Transport in coordination with Rosatom, the Russian state nuclear corporation in charge of Atomflot, a state entity running the fleet of Russia's nuclear icebreakers. Rosatom was appointed the single infrastructure operator of the NSR in December 2018[7]. NSR's Marine Operations Headquarters (MOH) has been formed under the auspices of Rosatom to ensure navigational and environmental safety of passage via the NSR. This entity provides navigational and hydrographic support to the ships, monitors the ice situation, and coordinates the usage of icebreakers. The approval of passage via the NSR is subject to meeting the requirements for the ships travelling in Arctic waters (such as an international Polar ship certificate), ice conditions along the planned route and availability of icebreakers, if and when necessary. During their passage via NSR all ships must follow instructions and navigational orders from MOH. According to the rules, vessels of a certain ice class (e.g. Arc-7s) can navigate the entire NSR from July to November without nuclear icebreakers' support. For Arc-4 class ships the option of independent navigation is limited to certain zones within the NSR. For lower Arctic class ships, however, icebreaker assistance is usually required for the entire route, and the associated fees may be significant.

## Shipments via NSR to date: Key trends

For several centruries attempts have been made to find the sea passage from the Atlantic to the Pacific through the northern seas and then to commercialize the shipments. The Soviet Union actively developed the NSR since the 1930s because it was critical for supplying Russian Arctic cities along the coast and, with the use of Siberian rivers, – further inland. Soviet success in Arctic shipping was due to creating the fleet of nuclear icebreakers in the 1960-70s. Their use made possible established navigation in difficult ice conditions through the entire length of the NSR. Until today, Russia remains the only Arctic nation with nuclear ice-breaker capability. Transportation turnover across the NSR (mostly represented by cabotage shipments, the so-called "northern supply" (*severnyi zavoz*)) during

[5] Russian Federal Law #132 FZ of 28 July 2012. http://ivo.garant.ru/#/document/70207760/paragraph/1:0

[6] RF Government Resolution #1487 of 18 September 2020. http://publication.pravo.gov.ru/Document/View/0001202009220024 The text of the Rules in English is available at http://rosatomflot.ru/img/all/0_rules_of_navigation_nsr_2020.pdf

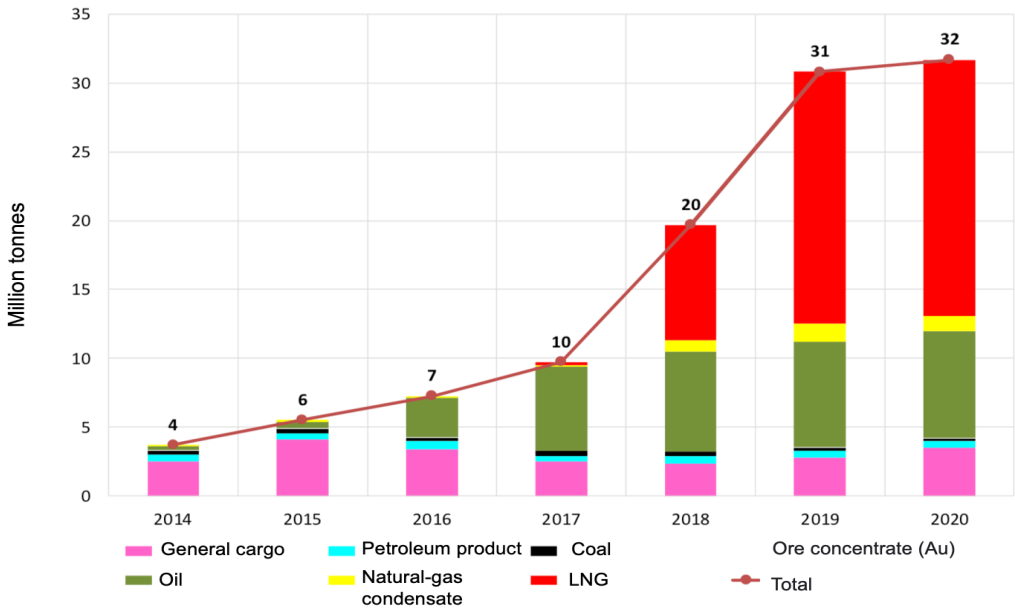
[7] https://www.rosatom.ru/en/press-centre/news/vladimir-putin-singed-a-law-on-rosatom-s-powers-in-northern-sea-route-development/?sphrase_id=1957495

Soviet times peaked in 1987 at 6.7 million tonnes, before sharply declining after the collapse of the Soviet Union and overall decline of economic activity in the 1990s. It was not until 2016, however, that transportation turnover through the NSR exceeded the Soviet record.

In the past few years a significant boost to shipping via the NSR has occured, driven primarily by hydrocarbon shipments directed to exports. The overview of the historic shipments via the NSR is based on the research by Mikhail Grigoriev, Russia's prominent expert on the Arctic developments. Grigoriev has been tracking the NSR shipments for the past decade, with key findings presented in a report prepared for Rosatom in the beginning of 2021 and in his other publications[8].

Hydrocarbons have represented the lion's share of the overall shipments via the NSR recently. Crude oil has been primarily supplied from the Novoportovskoye and Prirazlomnoye projects by Gazpromneft and LNG and condensate – from the Yamal LNG project – by Novatek. The launch of the Yamal LNG project in 2018 provided a major boost to NSR shipments which reached 32 million tonnes in 2020 (See Figure 2)

**Figure 2: Volume of shipments via NSR by type of cargo, 2014-2020**



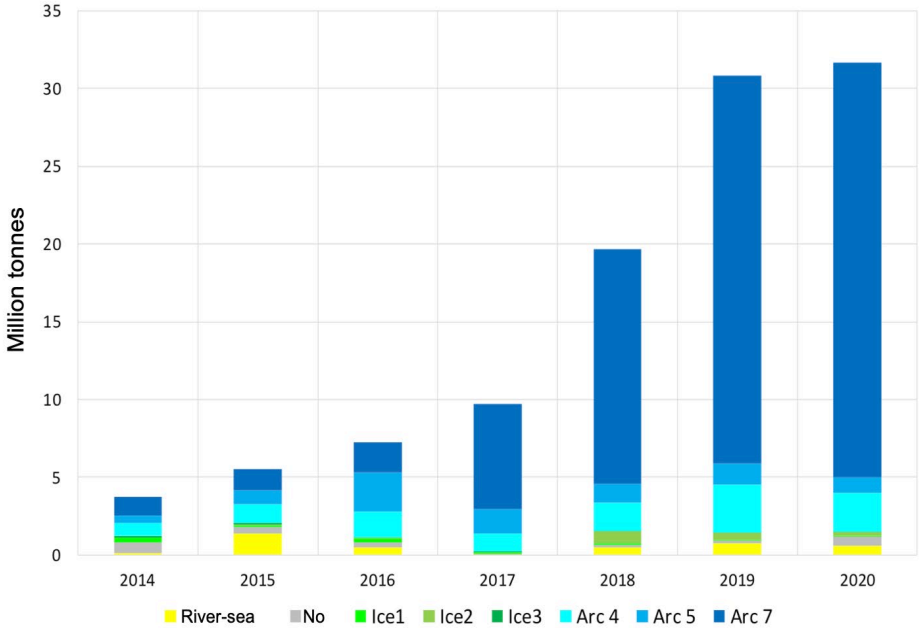

Source: Report on the NSR operations, Rosatom, 2021

In 2020, 86 percent of total shipments via the NSR were represented by hydrocarbons going to export markets, including LNG (18.9 million tonnes), oil (7.7 million tonnes), and condensate (1 million tonnes). General cargos amounted to 3.5 million tonnes or about 11 percent of total shipment volume. Refined products (0.6 million tonnes) and coal (0.3 million tonnes) accounted for a relatively minor shares of 2 and 1 percent, correspondingly.

It is noteworthy that the bulk of shipments via NSR are performed by vessels of high ice class, capable of independently sailing through relatively thick ice (See Figure 3)

[8] https://arctic.gov.ru/wp-content/uploads/2021/02/2020.pdf http://newsite.gecon.ru/publications/

**Figure 3: Shipments via NSR by Arctic class of vessels, 2014-2020**




Source: Report on the NSR operations, Rosatom, 2021

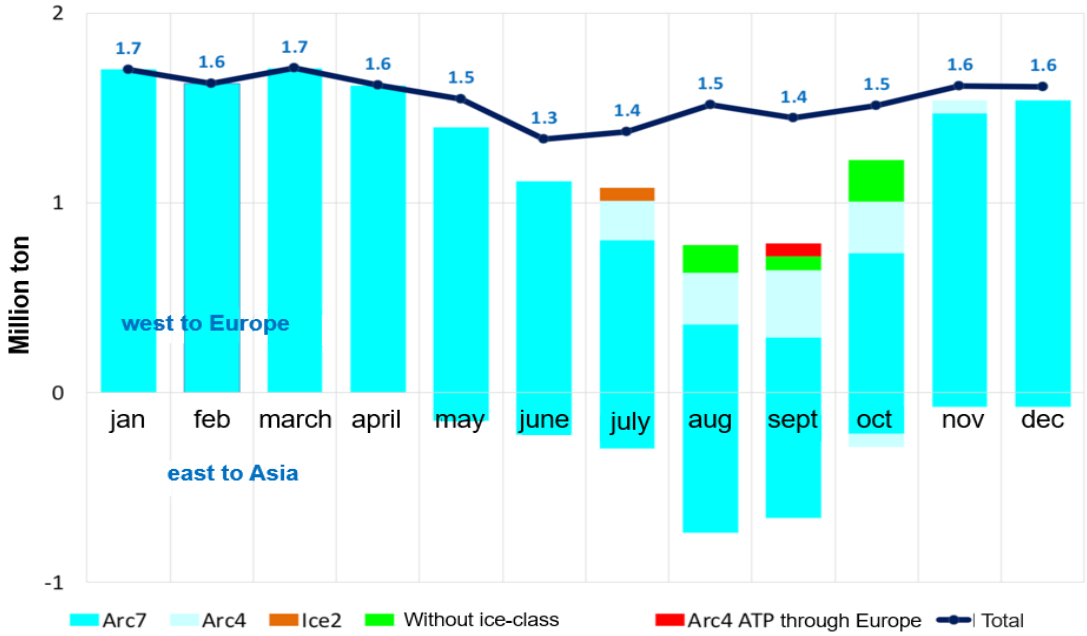
The vessels of high Arctic classes (Arc-4, Arc-5 and Arc-7) represent LNG carriers, and oil and condensate tankers that evacuate hydrocarbons from Russian Arctic projects in the vicinity of the Yamal and Gydan peninsulas.

The reported statistics on total shipments via NSR for 2020 demonstrate that the eastward shipments represent only a limited share of overall deliveries. For example in 2020, westward shipments to Europe remained the prime destination for exports of hydrocarbons from the projects in the Russian Arctic with relatively limited volumes later trans-shipped to Asia from European ports via Suez owing to relatively narrow Europe-Asia price differentials in 2020.

Eastward voyages were made possible by the retreat of Arctic Sea ice during the past decade and mostly represent trial shipments by various players who have been testing the possibility of using the NSR. The transit shipping takes place in both directions – from Europe to Asia, and from Asia to Europe. International transit via the NSR surged in 2012 and 2013 but then sharply declined, probably reflecting the worries about international sanctions against Russia. In 2020, however, it bounced back to about 1.3 million tonnes. (See Figure 4).

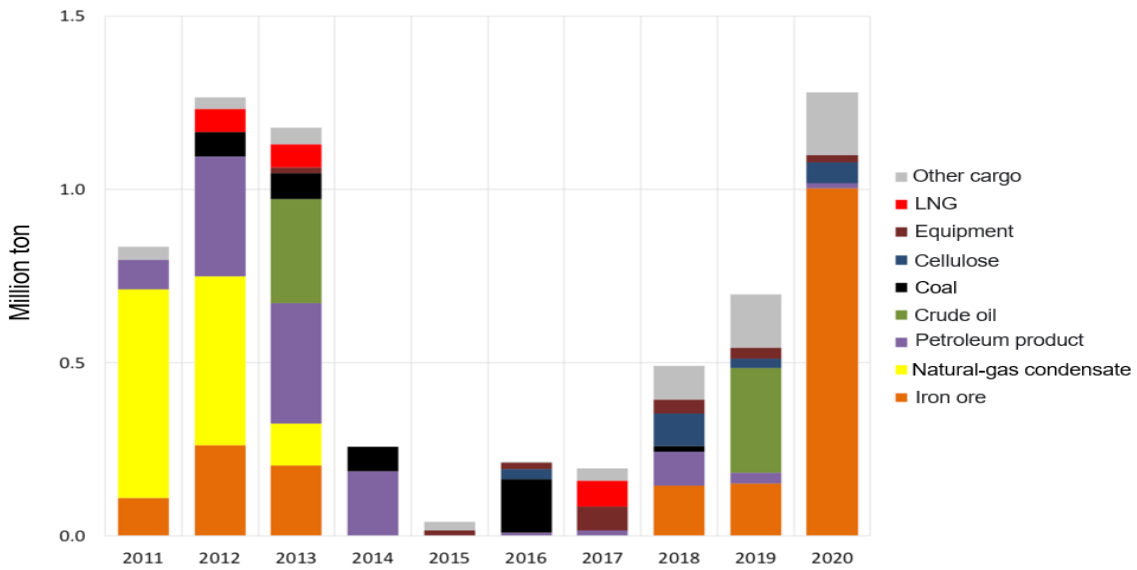
The available statistics on the composition of the NSR transit cargo indicate that a large share comprises iron ore and energy products, especially for shipments going eastward. The westward shipments contain petroleum refined products, coal, general cargo, and frozen fish products. Figure 5 shows the volumes and the cargo composition of the international transit via the NSR.

**Figure 4: The split in total shipments via NSR between Europe and Asia in 2020**




Source: Report on NSR operations, Rosatom, 2021

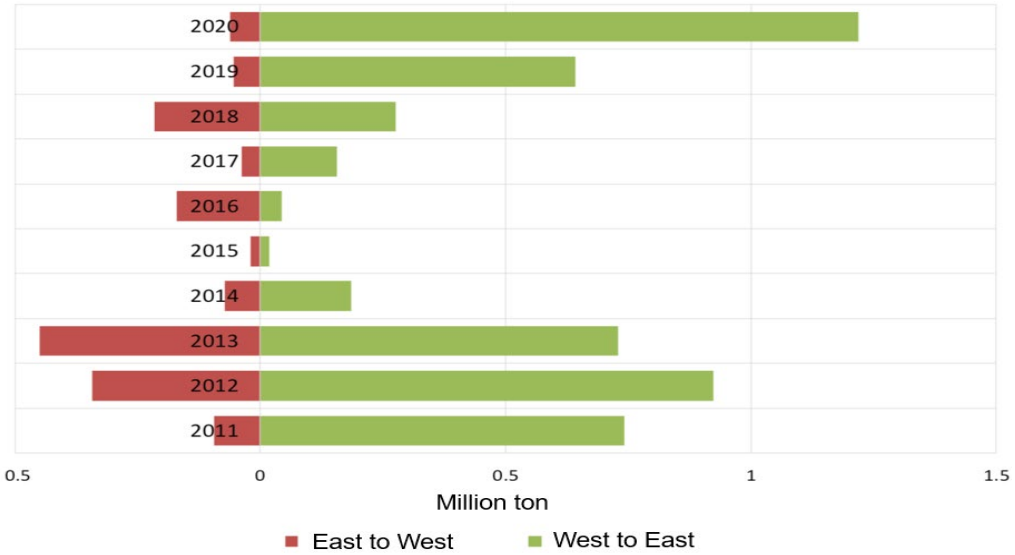
**Figure 5: International transit via NSR**




Source: Report on NSR operations, Rosatom, 2021

However, the transit from Europe to Asia via the NSR in the past decade has dwarfed the shipments from Asia to Europe (See Figure 6).

**Figure 6: International transit via NSR by direction of shipment**




Source: Report on NSR operations, Rosatom, 2021

It appears that the lion's share of transportation turnover via the NSR in the foreseeable future will comprise the Russian cargos, mostly hydrocarbons. Expanding the role of NSR as an important transit route for international shipments between Atlantic and Pacific oceans remains a longer-term goal of Russia's strategy.

## Tariffs for icebreaker support

One of the important reasons for the NSR not being able to attract significant international transit has been the uncertainty over the availability and costs of icebreaker support that remains a key requirement for safe passage through the Arctic seas.

Russia's nuclear icebreakers' fleet is a state monopoly; as a result, the tariffs for the use of the icebreakers are set by Russian regulators. The latest change in these tariffs occurred in 2014 when Russia's Federal Tariff Service (FTS) introduced a differentiated mechanism of tariff setting for icebreaking services based on seven geographical zones within the NSR waters area.

The web-site of the Northern Sea Route Administration contains a calculator that provides an opportunity to assess the costs of the ice-breakers' and piloting support when navigating the NSR[9]. The users can select the ice class of the vessel, its gross tonnage, the navigation season, and the quantity of zones within the NSR. For a 170 thousand tonne Arc-7 LNG carrier travelling the NSR over winter/spring (from December 1st to June 30th) the calculated cost for travel through 6 or 7 zones, that is through the whole length of the NSR is US$ 1.57 million, or US$ 9.2 per tonne of LNG.

This is a steep rate, and no wonder that Novatek, with its fleet of Arc-7s capable of independent travel through ice, has been trying to minimize the costly use of nuclear ice-breakers. Novatek also signed long-term contracts with Atomflot to optimize the use of the nuclear ice-breakers and thus minimize the payments.

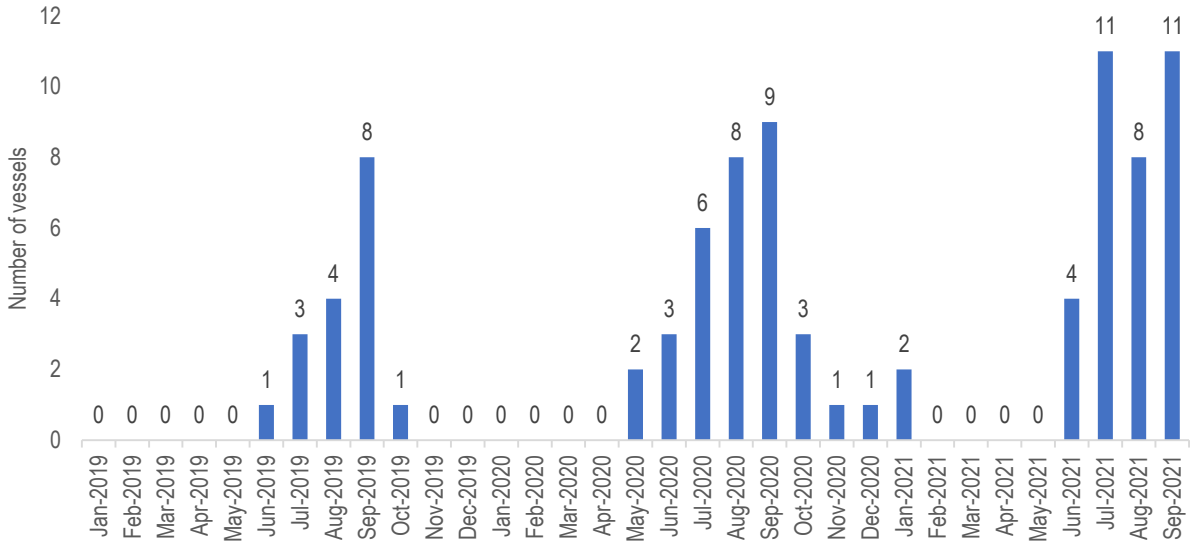
[9] http://www.nsra.ru/en/ledokolnaya_i_ledovaya_lotsmanskaya_provodka/raschet_stoimosti_ledokolnoy_provodki_v_akvatorii_smp.html

## NSR Shipments by Yamal LNG

The LNG traffic dominates the transportation turnover for the NSR at the moment. All of it has been generated by the Yamal LNG project, launched in 2018. At present, navigation for LNG carriers from Yamal via the NSR in the westward direction towards Europe is possible for most of the year due to less challenging ice-conditions in the Kara Sea. But navigation eastwards toward Asia is possible for only six to seven months of the year, depending on quantity of ice. As a result of these limitations on eastward shipments to Asia via NSR Yamal LNG's ability to send its liquefied gas westward during the winter season is an absolute must for the project to succeed. When possible, Yamal LNG would like to ship east, with the Northern Sea Route (NSR) serving as an important Arctic shortcut to reach premium Asian markets. However, for the foreseeable future the navigation window is likely to be limited to July-November with June and December as possibilities, depending on the weather). For the rest of the year, Yamal LNG has no other choice but to ship west, to European markets.

The window of opportunity on using NSR has expanded during the 2020-21 season, however, as Yamal LNG managed to not only increase the overall number of shipments via the NSR but to start navigation early in May and send its Arc-7 LNG carriers through the NSR in December 2020 and January 2021 without nuclear ice breakers support. (See Figure 7).

**Figure 7: Number of Yamal LNG carriers bound for Asia navigating NSR per month**




Source: OIES, data from Kpler

In May 2020, the Arc7 LNG tanker "Christophe de Margerie" successfully transited the eastbound ice-covered part of the NSR and reached the Bering Strait in only 12 days. The tanker passed the Ob Bay and a part of the Kara Sea without ice-breaker assistance and then met with Atomflot's nuclear icebreaker "Yamal", which escorted the tanker with ice navigation along the Eastern part of the NSR. The tanker delivered an LNG cargo produced at Yamal LNG to China. For the first time, the voyage took place before the traditional start of the summer navigation season in average ice conditions. Novatek proudly commented in its 2020 Annual Report that the eastbound transportation of LNG along the NSR is not normally performed in May as this represents one of the most difficult months for navigation[10].

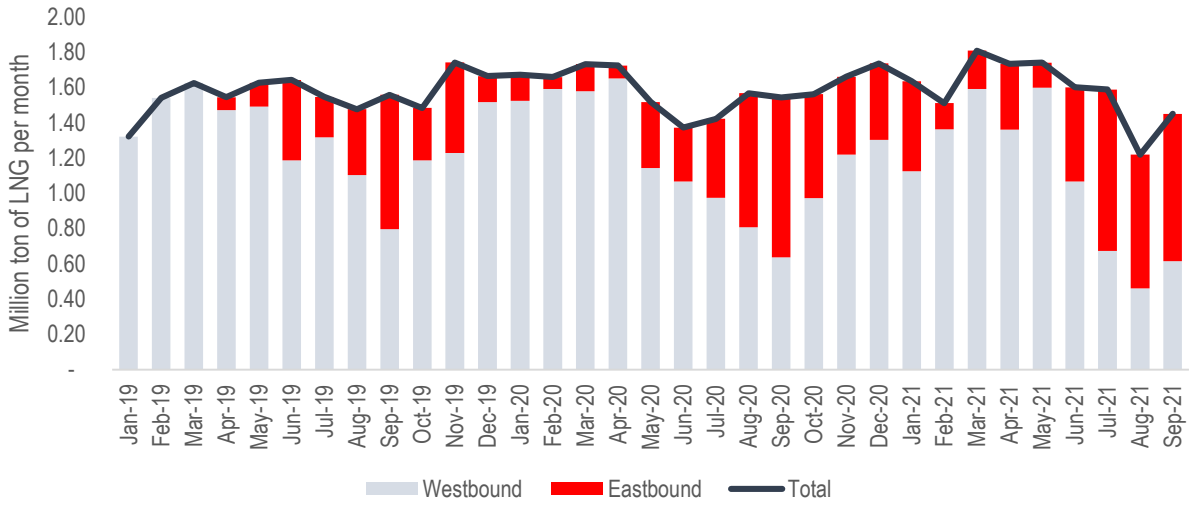
Furthermore, in January 2021, two months after the end of the traditional navigation season in the eastern part of the Arctic, the Arc7 ice-class Arctic LNG tankers "Christophe de Margerie" and "Nikolay

[10] Novatek 2020 Annual Report, p.46 https://www.novatek.ru/common/upload/doc/NOVATEK_AR2020_ENG.pdf

Yevgenov", chartered by the Yamal LNG project, successfully completed an independent passage along the eastbound part of the NSR, having reached the Bering Strait in 11 days. Both LNG tankers delivered approximately 140 thousand tonnes of LNG produced at Yamal LNG to destinations in the Asia-Pacific Region[11].

The overall split between westbound shipments and eastbound shipments from Yamal LNG has been in favour of the former but the share of the latter has been steadily increasing (See Figure 8).

**Figure 8: The split between westbound and eastbound shipments from Yamal LNG**




Source: OIES, data from Kpler

The current LNG tanker fleet for Yamal LNG comprises fifteen Arc7s and eleven conventional LNG carriers. The Arc7 LNG carriers for Yamal LNG were built in South Korea at a total cost of about US$5 billion (approximately US$333 million per ship). The custom-designed Arc7s for the Yamal LNG project, each with the capacity to hold 170,000 cubic metres of natural gas, are 299 metres long and 50 metres wide. They are powered by 45 MW engines which can be fueled by either marine fuel oil, diesel, or LNG, and can travel at a speed of 19.5 knots in open water and at a reduced speed of 5.5 knots through sea ice up to two metres thick. The Azipod propulsion system allows them to move forward and astern through ice, greatly increasing their capabilities for independent travel through ice in the Arctic seas[12].

For its next big project, Arctic LNG 2, Novatek and its project partners have placed orders for 15 Arc-7 LNG carriers to be built at Zvezda shipyard in Russia and for 6 more Arc-7 LNG carriers – at Korea's Daewoo Shipbuilding & Marine Engineering (DSME) shipyards. The upgraded Arc-7s for Arctic LNG 2 are expected to have improved capabilities for independent travel through ice due to increased icebreaking and maneuvering characteristics such as an optimized hull shape and advanced propulsion system.

The evidence from the first years of Yamal LNG operations suggests that Yamal LNG's transportation strategy has been based on creating maximum self-sufficiency through using Arc7 ice-class LNG carriers for independent passage via the NSR for most of the navigation season and limiting the costly

[11] Novatek 2020 Annual Report, p.46 https://www.novatek.ru/common/upload/doc/NOVATEK_AR2020_ENG.pdf
[12] http://yamallng.ru/en/project/tankers/

Rosatomflot nuclear icebreakers' support for the times when ice conditions are most difficult and only for the most challenging sectors of the NSR. This allows Novatek to take advantage of the shorter distance to Asia via the NSR compared with the route via Suez (Novatek reports that the actual time of travel eastward via the NSR for LNG shipments from Yamal to the Bering Strait has amounted to 11-12 days, resulting in approximately 40 percent time saving and correspondingly lower freight rates.

The new generation of Arc7 LNG carriers developed for Novatek's projects can travel through two-metre thick ice (although travel speed is significantly reduced), but even Arc7s require the support of expensive nuclear icebreakers during the winter months.

## The perspectives of year-round shipping via the NSR

The potential savings from shorter transportation distances associated with the use of the NSR are offset by the constraints imposed by difficult ice conditions. Indeed, this has been the most important limiting factor for higher utilization of the NSR. But things are starting to change due to the progressing warming in the Arctic and to the wider use of Arctic-class vessels and ice-breakers. Russia, the only Arctic nation with a fleet of nuclear icebreakers, is planning a major upgrade of its Arctic ship capabilities which could make year-round shipping via NSR a reality in the 2030s.

### Climate change in the Arctic and its impact on NSR ice-cover

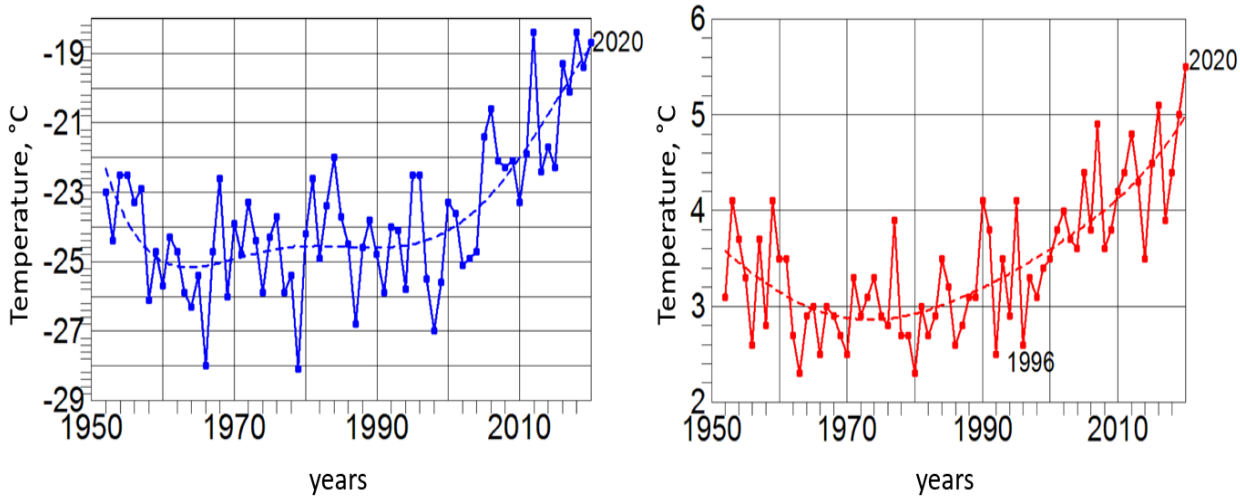
The rise of global temperatures has affected the Arctic region more than other regions of the world. The rise of temperature in the Arctic has been outpacing the growth of average global temperature more than two-fold in the past twenty years. Arctic warming may lead to reduction of ice cover in the Arctic seas, opening them for longer periods of navigation. However, it also carries significant dangers related to the melting of permafrost and methane hydrates and release of methane (which is a very potent greenhouse gas) into the atmosphere with a possibility of starting a vicious cycle of even faster warming.

The temperatures in the vicinity of the NSR have been consistently tracked by Russian agencies since the 1950s with the use of 22 meteorological stations located along the entire route. According to Rosgidromet, Russia's Federal Service for Hydrometeorology and Environmental Monitoring[13], both average winter and summer temperatures increased significantly since 2010. Winter temperatures in the past decade were hovering around minus 20 degrees Celsius compared with about minus 24 degrees Celsius on average during 1970-2000. Summer average temperatures increased from about plus 3 degrees Celsius in 1970-2000 to about 4.5 degrees in 2010-20 (See Figure 9).

Warmer temperatures have contributed to the reduction of sea ice coverage in the NSR water area. In 1979, the year when regular satellite observations of the Arctic began, the minimum ice extent in the NSR water area, which usually occurs in September, was about 1.6 million square km. In contrast, since September 2010 the ice extent in NSR waters declined to around 0.4 million square km, and in September 2012 the NSR was ice-free. A new record low for ice extent in the NSR water area was observed in 2020. The NSR was completely ice-free again in September 2020. But the extent of ice from year to year remains highly variable (See Figure 10).

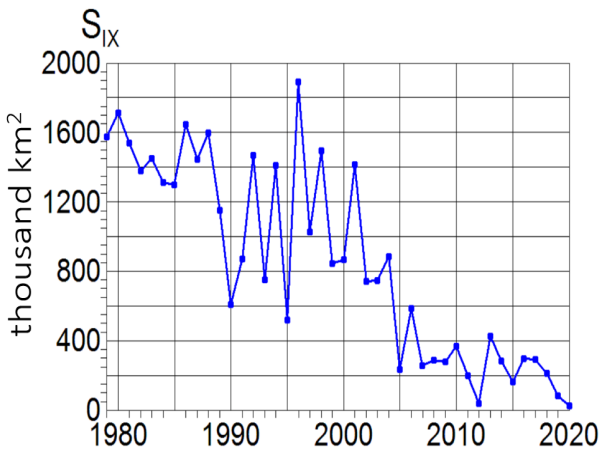
[13] https://www.meteorf.ru/upload/pdf_download/doklad_klimat2020.pdf

**Figure 9: Average winter (left graph) and summer (right graph) temperatures in the vicinity of the Northern Sea Route**




Source: Rosgidromet

**Figure 10: Extent of minimum ice coverage (recorded in September) of seas along the NSR – Kara sea, Laptev sea, East Siberian sea, Chukchi sea**



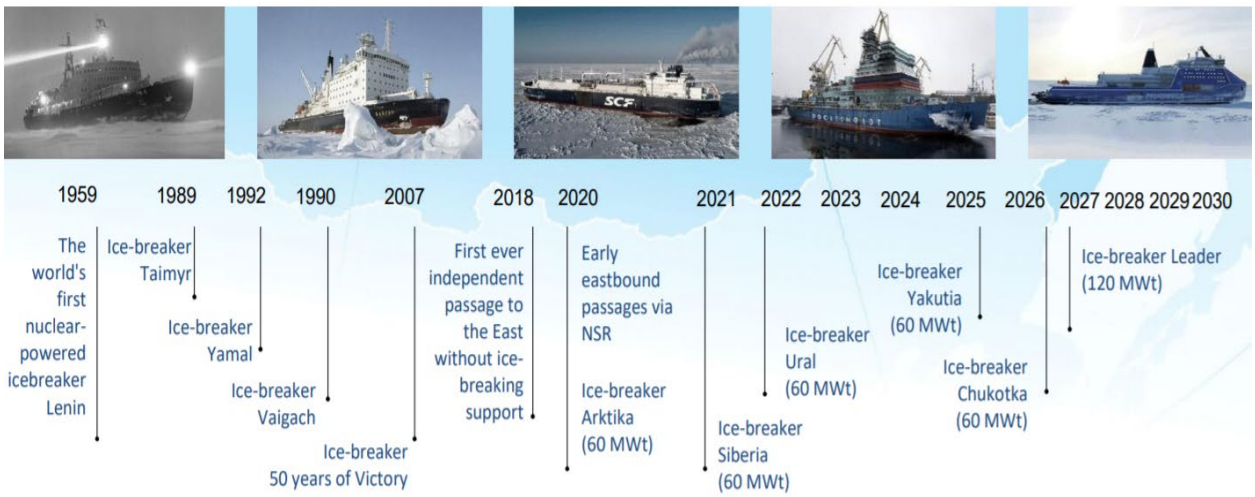

Source: Rosgidromet

Another striking development has been the reduction of multiyear ice (i.e., ice that has survived at least one summer), which tends to be harder and thicker than first-year ice, posing additional problems for vessels. The overall trend has been for shipments via the NSR to increase as ice has receded. Nevertheless, icebreaker support is an absolute necessity for successful shipping in the Arctic waters. Russia has capabilities in this area that cannot be matched by any other Arctic nation.

## Russia's plans for a new generation of nuclear icebreakers

Russia is the only country in the world with a nuclear icebreaker fleet, operated by the Rosatomflot subsidiary of Rosatom, Russia's state-owned nuclear energy operator. The history and outlook for Russia's nuclear icebreaker fleet are presented in Figure 11.

**Figure 11: Chronology of major events in the history of Soviet and Russian nuclear icebreaker fleet**




Source: Novatek

Russia's first nuclear icebreaker 'Lenin' started servicing the NSR as early as 1959. Rosatomflot currently provides ice piloting along the NSR and also for other Russian ports which freeze in winter. Russia's nuclear icebreakers are built at the Baltic Shipyard near St. Petersburg. There are five in operation, but three of them ('Taimyr', 'Vaigach', and 'Yamal') were built in 1989-1992 and are approaching the end of their service life. Rosatomflot managed to extend their operations beyond their nominal life spans to cover the period of highest risk in 2020-21 when the ramp up of construction activity in the Russian Arctic and rising hydrocarbon production from Russia's Arctic projects was not yet covered by the capabilities of the newly built icebreakers[14].

Another icebreaker, 'The 50th Anniversary of Victory', a larger and more powerful nuclear icebreaker was commissioned in 2007[15]. Finally, the fifth nuclear icebreaker on active duty currently is a new 'Arctica', the first in the so-called series 22220 that started operations in October 2020.

Two more nuclear icebreakers in the 22220 series, 'Sibir' and 'Ural' will be commissioned in 2021 and 2022 respectively with a reported price tag of about 50 billion rubles (about US$0.75 billion) each. Approximately half of this amount is financed by the Russian budget, with the rest coming from project financing. 'Sibir' was put afloat in 2017, and the construction finished in 2021. In November 2021 "Sibir" started sea trials.[16] 'Ural' was put afloat in 2019[17]. The new icebreakers are more powerful (60 MW) and have a better body design which make them able to break through three-metre thick ice. At 34 metres width they can clear the way for a 70,000-dwt tanker (two 30-metre width icebreakers are required to perform this task at present).

Another key advantage given the peculiarities of Russian Arctic operations is the dual draft construction that allows the new vessels to enter river mouths to clear the way to the ports located along the NSR. In theory, this makes the new generation of nuclear icebreakers multi-use and reduces the number of conventional icebreakers required[18]. For icebreakers under project 22220, however, this capability is

[14] For an overview of the Soviet and Russian nuclear icebreakers' fleet see https://rosatom.ru/production/fleet/
[15] https://www.ship-technology.com/projects/fiftyyearsofvictoryi/
[16] https://en.portnews.ru/news/321348/
[17] https://world-nuclear-news.org/Articles/Russia-launches-worlds-largest-nuclear-powered-ic
[18] For a detailed discussion of the current status of Russia's fleet of nuclear icebreakers see the interview of Vyacheslav Ruksha, former head of Atomflot, currently a Deputy Director of Rosatom in charge of the Northern Sea Route, Kommersant, Dec 15, 2020
https://www.kommersant.ru/doc/4614586

expected only for operations in certain Arctic ports, in particular for sailing to the port of Dudinka in the estuary of the Yenisey river (essential for the operations of Norilsky Nickel), and to the oil terminal "Arctic Gate" in the Ob river estuary (essential for Gazpromneft's Arctic oil projects). In 2026-27 Rosatomflot plans to commission two or even three more 60 MW nuclear icebreakers (of the type under project 22220).

But the ultimate goal is to build an even more powerful generation (the LK-110 series) of nuclear icebreakers that would use a 110 MW power propulsion unit to cut through ice of up to 4.3 metres which is found at higher-latitude routes. Here waters are deeper and could be accessed by larger ships than those navigating the existing NSR route. These icebreakers would have a 48-metre width, which would allow them to cut a channel 50 metres wide for 100,000 dwt tankers. Even more importantly, these icebreakers would maintain a speed of ten knots even while breaking through two-metre thick ice, providing an ultimate solution to cost-efficient year-round transportation via the NSR to Asia[19].

The cost of the 110 MW nuclear icebreaker is currently estimated at about 100 billion rubles (US$1.5 billion). The Russian state budget will fully finance the construction of the first vessel in the new series which is projected to be commissioned before 2030 at the Zvezda shipyard in Russia's Far East[20]. The financing sources for the second two are not yet determined at the time of writing.

## Main Russian projects in the Arctic and the outlook for future transportation turnover via NSR

Russia's Arctic Strategy to 2035 set a goal of increasing the volume of shipments via the NSR to 90 million tonnes per annum by 2030 and to 130 million tonnes per annum by 2035. This is a difficult-to-achieve target, but it reflects the ambition and priority that Russia's leadership assigns to the NSR. The following section reviews the main projects that are expected to generate this transportation turnover.

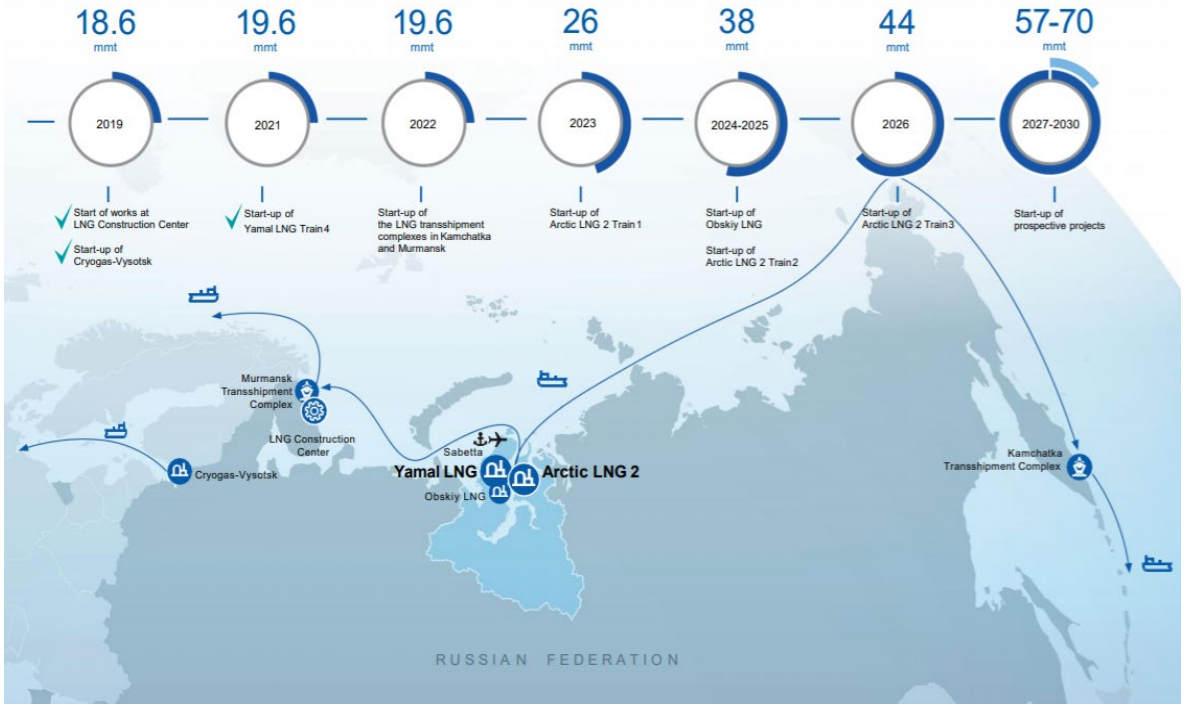
### Novatek's LNG projects on the Yamal and Gydan Peninsulas

The expansion of LNG projects on the Yamal and Gydan peninsulas will represent the main incremental sources of cargos for the NSR through the 2030s. Building on the successful launch of Yamal LNG and good progress with construction of three trains of the Arctic LNG 2 project by 2025 the total output of Novatek's LNG projects is set to reach a level of 38 mtpa, and by 2030 it may be as high as 70 mtpa, turning the company into an international LNG powerhouse (See Figure 12).

Novatek and its partners are currently planning the construction of LNG transshipment terminals at both ends of the Northern sea corridor – near Murmansk on the Barents Sea and at Kamchatka. Transshipment from Arc-7 LNG carriers to less expensive conventional LNG tankers would reduce the overall transportation costs and increase the efficiency of using the fleet of the Arc-7s by limiting their voyages to Arctic waters, where they are most fit for purpose. This will ensure additional economies by cutting the number of days of travel compared with other routes. As a result, the comparative disadvantage of Russian LNG projects in high transportation costs relative to their key competitors will be reduced, and their key advantage of extremely low production costs will make them more competitive overall (See Figure 13).

[19] https://portnews.ru/news/print/223374/
[20] https://www.kommersant.ru/doc/3771153

**Figure 12: Novatek's LNG production and evacuation plans**




Source: Novatek

**Figure 13: LNG comparative logistics and costs of shipments to Asia in 2020**

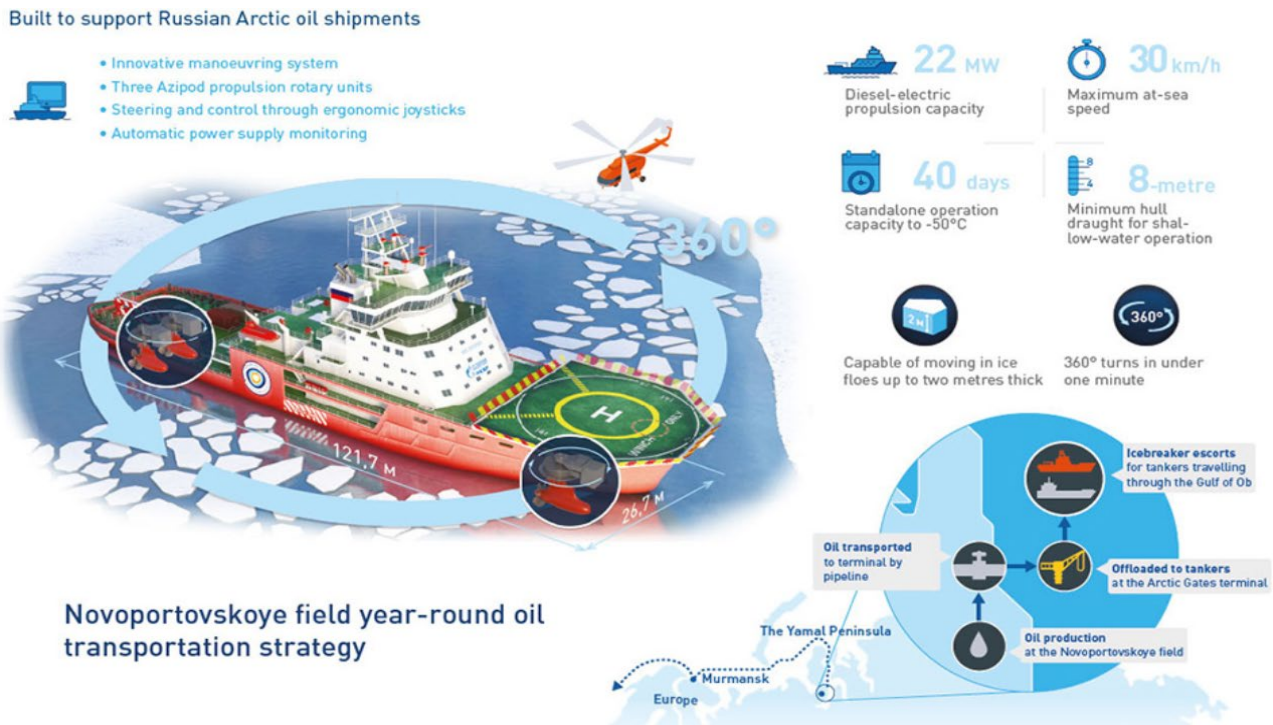

Source: Novatek

## Crude oil and condensate exports from the Russian Arctic: Vostok Oil project as potential game-changer

At present, Gazpromneft is the largest crude oil producer and exporter by sea from Russia's Arctic. The flagship oil project is the Novoportovskoye development on the Yamal peninsula, with annual peak oil production of 8 million tonnes expected in 2021[21]. Most of the natural gas produced at the field is being re-injected to increase the reservoir pressure. The field's potential has been known since the 1960s, but the full-scale development started only in the early 2010s after Gazprom transferred the operatorship to Gazpromneft-Yamal LLC, a Gazpromneft subsidiary. The Novy Port crude is light and low-sulphur, making it a good match to the requirements of the European refineries. The Novy Port crude is transported year-round from the "Arctic Gate" terminal, a single-point mooring facility located 3.5 km from the Yamal shore, where large Arctic class crude tankers can be loaded safely. The tankers travel via the Gulf of Ob and then via the westbound section of the Northern Sea Route on to Europe. The first shipment took place in the summer of 2014, soon followed by winter shipments since 2015, with the help of Atomflot's nuclear ice-breakers.

To deal with the challenge of operating in the shallow waters of the Gulf of Ob, Gazpromneft has put in place its own icebreaker fleet to service the Novy Port project, including six «Shturman» Arc7-class tankers and two diesel-electric Icebreaker-8 class vessels. The «Shturman»-type tankers, built to order specifically for Gazpromneft, have a cargo-bearing capacity of 42,000 tonnes, and a maximum draught of 9.5 metres, enabling them to operate in shallow waters. The vessels can independently navigate through 1.4 to 1.8 metres thick ice[22]. (See Figure 14).

**Figure 14: Transportation scheme for Novoportovskoye**




Source: Gazpromneft

[21] https://www.gazprom-neft.ru/company/major-projects/new-port/
[22] https://www.gazprom-neft.ru/company/major-projects/new-port/

Two 22 MW diesel-electric ice breakers, “Alexander Sannikov” and “Andrey Vilkitsky” were built to order for Gazpromneft at the Vyborg Shipyard in Saint Petersburg. These have speeds up to 16 knots in open water and the ice-breaking capacity of up to two metres, making them the fit-for-purpose alternatives to nuclear ice-breakers in the Gulf of Ob.

Another unique project in the Russian Arctic developed by Gazpromneft is the Prirazlomnoye field in the Pechora sea with output in 2020 of 3.3 million tonnes from an offshore ice-resistant platform. Production started in 2015 and is expected to reach 5 million tonnes per annum in the early 2020s[23]. In this area, ice cover is present for seven months, with ice ridges reaching two metres high. The Prirazlomnaya platform, designed specifically for this project, is equipped to cover all technological operations, including well drilling, production, processing, storage, the offloading of oil to tankers, and heat and power generation. Due to the depth of the sea (19.2 metres), the facility — at 126 square metres, the size of two football fields and weighing 500,000 tons — has been installed directly onto the seabed and reinforced with a protective 45,000 cubic-metre-plus stone berm (weighing 120,000 tonnes) ensuring the well cluster has no direct contact with the water.

Oil is offloaded from the platform’s storage facilities onto tankers that undertake non-contact docking with the use of a dynamic positioning system that ensures the vessels are held in place regardless of wind or waves. Two reinforced, 70,000-tonne maximum-deadweight double-hulled ice-class oil tankers, “Mikhail Ulyanov” and “Kirill Lavrov” have been working on evacuating crude oil from Prirazlomnoye.

In the future, Gazpromneft’s projects in the Arctic could be dwarfed by an ambitious Rosneft Vostok Oil program. This project, if realized to plan, might become a real game-changer for Russia’s overall hydrocarbon development in the Arctic and for the expansion of shipments via the NSR in particular.

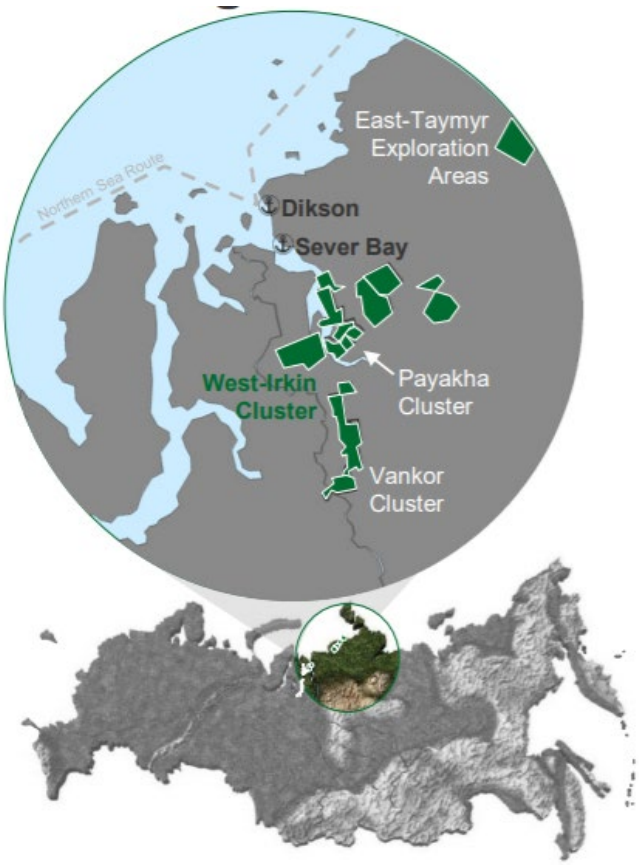
The Vostok Oil project is based on the production potential of 13 oil and gas fields on the Taimyr peninsula and in the northern part of Krasnoyarsk Kray, some of them already producing, such as the fields in the Vankor cluster, and some being new developments in the Payakha cluster (See Figure 15).

The Vostok Oil project represents a massive undertaking that is going to lead to significant job creation (the total number of people involved in the work on the project is estimated at 400,000, including 130,000 Rosneft personnel and contractors) and a significant increase in Russia’s GDP as a result of both direct and indirect economic effects. This is a flagship project for Rosneft with confirmed oil reserves of 6 billion tonnes and expected combined hydrocarbons production from the project at 50 million tonnes per annum by the mid-2020s during phase one based on the Vankor and Payakha clusters and at up to 100 million tonnes per annum during phase two, based on the East-Taymyr fields development which is planned by the early 2030s[24].

Crude from the Vostok Oil fields has a uniquely low sulfur content of 0.01-0.04%, making it more valuable and more environmentally friendly due to lower SOx emissions[25]. To protect this unique crude quality that would command a price premium at the market[26], Rosneft intends to build a dedicated 770-km pipeline from Vankor to a new seaport in Bay Sever (North) near the existing port of Dixon. Rosneft has pledged to deliver up to 30 million tonnes of oil per annum to the Northern Sea Route by 2024, and much more in the longer term[27]. The Vostok Oil project indeed may become a game-changer for the NSR, ensuring extremely high levels of shipments in the 2030s and beyond.

[23] https://shelf.gazprom-neft.com/upload/iblock/109/spravka_o_proekte_prirazlomnoe.pdf
[24] https://www.rosneft.ru/upload/site1/document_publication/Rosneft_Gazeta2020_RUS.pdf
[25] https://www.rosneft.com/press/today/item/206597/
[26] https://www.rosneft.com/upload/site2/attach/0/14/02/SPIEF_slides_2021_EN.pdf
[27] Minutes of the meeting of Russia’s President Vladimir Putin with Rosneft’s CEO Igor Sechin on 25 November 2020 http://kremlin.ru/events/president/news/64493

**Figure 15: Vostok Oil Project**




Source: Rosneft

The project also involves construction of new ships on a grand scale. In total, 50 vessels of different types, including oil tankers, LNG carriers as well as various support ships are expected to work on the project. The orders for 10 Arc-7 ice-class tankers have been placed at the Zvezda shipyard.

## Conclusion

Over the past decade the Russian government has placed considerable efforts into transforming the NSR into a major trade route between Europe and Asia and has clearly articulated its priorities and strategic goals to 2035. These goals suggest that Russia sees the NSR (at least initially) as an energy bridge connecting Russia's Arctic resources to global markets. LNG exports from Yamal and Gydan have emerged as a key element in the expected increase in NSR transportation turnover to 2035.

At the same time, the Russian government seems to recognize that the prospects for a major ramp-up in international transit volumes via the NSR in the next decade are limited. As a result, the emergence of the NSR as a major Arctic marine shortcut between Europe and Asia that might compete with the Suez route for a significant share of the overall international shipping volumes remains, at best, a distant possibility. Evidently the technological and logistical efficiencies of the well-established international marine trading routes present global shipping companies with sound alternatives, while Russia still has some way to go as it aims to create the logistical infrastructure for the NSR almost from scratch.

Nevertheless, it is already clear that Russia has set out on an ambitious course for NSR development supported by domestic industrial development, and although it will have to overcome many practical difficulties in achieving its ambition, it has already taken significant steps forward and appears likely to continue its efforts on putting NSR traffic on a growth trajectory over the next decade.

The NSR has emerged as an important element of Russia's Arctic strategy, that now incorporates active development of the hydrocarbon riches in the Russian Arctic, development of the Arctic ports and other infrastructure and relies on expanding domestic capabilities in shipbuilding that involve economic multipliers and are seen as important engines of economic growth and job creation in Russia. From a geo-political standpoint, NSR also provides a new avenue for developing international relations with new and existing customers for Russian hydrocarbons, while also allowing Russia to compete with key rivals in a rapidly globalizing market.