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The consequences of the war in Ukraine in the Arctic

Frédéric Lasserre and Hervé Baudu

Introduction

To everyone's surprise, on February 24, 2022, Russia invaded Ukraine. The sanctions of Western countries, in particular at the initiative of the European Union and the United States, are immediate and ambitious. Certainly, the condemnation of Russia is not unanimous in the vote in the general assembly of the UN, in particular India and China, major economic partner countries of Moscow, abstain, too anxious not to upset their political ally. While the sanctions directly and almost immediately target the exchange of financial flows, only oil, refined products and coal will be subject to a complete embargo. Japan and the European Union, too dependent on Russian gas to align themselves with the firm American policy, only undertake to reduce their imports pending the development of substitute solutions. The European Union then turned to the United States and Norway to partly offset this deficit, while China and India took advantage of this to increase their imports of hydrocarbons on advantageous terms. On the political level, from the beginning of March, the Arctic Council, of which Russia had held the presidency since May 2021, decided to suspend the activities of the institution, then to resume work without Russia from June 2022. In response to Russia's continued belligerence in Ukraine, Finland and Sweden seek NATO membership, militarily isolating Moscow in the Arctic space. Faced with this Western rebellion and the impact of sanctions on major industrial gas projects in Siberia, the Kremlin is not changing its position, vehemently condemning Western sanctions, is continuing its policy of expansion in the Arctic, affirming that nothing in this space cannot be done without the presence of Russia, which occupies almost half of its surface.

So, is the Arctic becoming a space of tension? This area, which until then had benefited from regional exceptionalism thanks in particular to its particular mode of governance, made the Arctic a zone of cooperation in the making. Russia, President of the Arctic Council for 2 years since May 2021, had the ambition to make the Arctic an area of open economic development. Vladimir Putin's reactions to this wave of Western economic sanctions, to the reaffirmation of NATO with the decision of Finland and Sweden to join [1], will they result in a halt to the projects of economic development in the Russian Arctic?

The Arctic can be called a controlled space for three reasons. The first is geographical, with accessibility to sea routes restricted by sea ice, particularly in winter when the Arctic Ocean is totally frozen, but also due to the presence of a Russian military bastion in the Barents Sea, which is heavily defended because in the heart of Russia's nuclear deterrence doctrine. The second reason is geopolitical with the powerful states bordering this ocean, half of whose coastline is Russian. The suspension of Russia from the work of the Arctic Council has weakened the governance of this space since the creation of this forum in 1996. Finally, the third reason is economic where, on the side of the North American continent, accessibility to waters Arctic is constrained both by its difficult geography of the Canadian archipelago and the greater prevalence of ice than on the Russian side, but also by Ottawa's proactive policy of not promoting the development of transit traffic through its waters interior. This is not the case with Russia which, on the contrary, is actively seeking to develop and promote the North-East Passage along its coasts, over which it exercises strict control, at the limit of the legality of international maritime law, in

[1] Even if Sweden's accession process is hampered by the conditions formulated by Turkey regarding Sweden's posture towards Kurdish associations. In February 2023, negotiations between Stockholm and Ankara had still not been successful.

order to promote destination traffic from its hydrocarbon and mineral extraction sites. 15% of the GDP of the Russian Federation (Zysk, 2017) comes from the industrial and extractive sites of Siberia which are in full expansion, but which risk suffering from the withdrawal of Western investments and technologies. We will seek to define and develop the reasons for the instability of this space and the underlying tensions exacerbated by the Ukraine war crisis.

1. The consequences of the invasion of Ukraine on the Siberian economy

1.1. Industrial hydrocarbon production projects

The economic sanctions immediately triggered against Russia are unprecedented. With the notable exception of China, India and the Persian Gulf countries, all the countries having interests with Moscow have unanimously denounced the military attacks against Ukraine. Very quickly, the "majors" of the oil and gas industry announced the withdrawal of their investments in Russian projects, existing or to come. The British company BP (BP, 2022) was the first to announce the sale of its 19.75% stake in the capital of the Russian public oil giant Rosneft – Russia's second largest oil producer after Gazprom. The general manager of BP also resigned from the board of directors of Rosneft "with immediate effect". A radical and costly decision for BP – its stake was valued at 14 billion dollars (bn$) at the end of 2021. The Anglo-Dutch group Shell followed suit by withdrawing from the LNG liquefied natural gas project Sakhalin-II, a complex in the Russian Far East, in the Sea of Okhotsk in the northeast Pacific where the major has a 27.5% stake in this structure, which is 50% owned and operated by the Russian gas giant Gazprom (Shell, 2022). Shell also pledged to end its 10% stake in the stillborn Nord Stream 2 gas pipeline project with an estimated total cost of €9.5bn (Alifirrova, 2022). The Norwegian company Equinor (formerly Statoil) has announced that it is suspending its partnership with Rosneft. Equinor has $1.2bn in assets in Russia (Solsvik, 2022).

The American multinational Exxon Mobil (Valle, 2022) has declared that it will withdraw from Russian oil and gas operations which it has valued at more than $4bn and that it will stop all new investment. Exxon has a significant stake in running major oil and gas production facilities on Sakhalin Island, putting the fate of a multi-billion-dollar LNG facility project at risk. Swiss commodities trader Trafigura has said it will make no new investments and will sell its 10% ($8.5bn) stake in the Vostok oil project Rosneft 's Oil, valued at $85bn, a project that was to go into production in 2024 (Wallace, 2022). Ditto for the Indian state oil company Oil India Ltd (OIL) (Bhaskar, 2022) which had expressed its interest in investing in this same oil project through a consortium as well as in Novatek 's Arctic LNG 2 project in the Gydan Peninsula. Although India is a privileged partner of Russia, it now declares that it has no immediate intention to invest in Russia. In contrast, Japanese Prime Minister Fumio Kishida said that the war in Ukraine should not affect the implementation of the Sakhalin-2 project in which Japan is a shareholder (Sakhalin Energy). Statement along the same lines for the French giant TotalEnergies, a 19.4% shareholder in the Russian private company Novatek, which did not wish to withdraw from the Arctic LNG2 project, of which it is a 10% shareholder alongside the Chinese (29, 9% of Yamal LNG and 20% of Arctic LNG 2), Japanese and its main shareholder Novatek (Stemler, 2022).

If companies like BP or Shell have already made their investments profitable, their withdrawal from projects will be penalizing, but their shares have been bought back at market conditions,

which may limit their losses. In the summer of 2022, TotalEnergies finally gave in to European pressure and announced that it was completely disengaging from Russian hydrocarbon production investments with an estimated loss of €4.1bn[2] (Corric, 2022). The Franco-American company Technip FMC (French subsidiary Technip Energy for the Arctic LNG2 project) with its Italian coun-terpart Saipam won the engineering contract in July 2019 for the design, construction and commissioning of the Arctic project. LNG2 for an amount of $7.6bn, the total project being estimated at $25,5bn, almost as much as that of Yamal LNG (GNL Prime, 2022). They will eventually leave Russia and abandon the project in the summer of 2022. The withdrawal of Western investors and industrialists will certainly affect all Russian gas production projects under development in Siberia and in the Russian Far East whose technologies put in place depend on the know-how of these industrialized countries. These are the 4 most important projects of tens of billions of dollars of investment, Vostok Oil, Arctic LNG2, Sakhalin 2, Ob LNG which risk falling behind and not reaching the desired production capacities (Schreiber, 2022).

Figure 1: gas production sites

It is the latter who were to contribute to ensuring a large part of the hydrocarbon exports from which Russia derives a large part of the 15% of its GDP. It is that of Arctic LNG2 from Novatek,

[2] TotalEnergies was forced to sell its shares but would have retained the benefit of its long-term LNG supply contracts linked to Yamal LNG. TotalEnergies had invested €2bn in Arctic LNG2 associated with long-term contracts of 25 years and had a 10% stake in the LNG transshipment hubs (Novatek) at the ends of the Northern Sea Route.

Russia's largest private gas company, which risks being penalized the most. The gigantic Belokamenka site near Murmansk is in the process of completing the construction of the 1st train of the 3 liquefaction trains of the plant located on the Gydan peninsula, opposite that of Yamal LNG in Sabetta. Each train must be able to produce 6.6MT of LNG. The first train built on a huge barge, concrete gravity structure (GBS) with a length of 330 m, a width of 152 m and a height of 30 m, should have been towed in the summer of 2022 on the east coast of the Gydan peninsula where a port, Sever, is under construction. The first train was to go into production in the summer of 2023, the second in 2024 and the last in 2025. The suspension of supply of Western cryogenic technologies halted the nominal progress of work on the Arctic LNG2 project, in particular with the supply of American Baker Hughes turbines, Linde heat exchangers and German Siemens compressors. Only 4 turbines out of the 7 required for the operation of the 1st train are installed – 4 for gas compression, 3 for electricity production. 20 LM 9000GT turbines with a nominal power of 73.5 MW[3] had been ordered from the American manufacturer Baker Hughes, only the 4 of the 1st train were delivered (Humpert, 2022a). Suspended in May 2022, construction of the modules in China (14 per train) of the last two trains resumed in November 2022 (Staalesen, 2022). The boss of Novatek also declared that alternative solutions would be found to compensate for the withdrawal of Western technologies, in particular by replacing the production of current by turbine by a floating power plant purchased from the Turkish company Karpowership, 400 MW being necessary by train (Komersant, 2022d). However, industry experts remain very skeptical about Russia's ability to produce turbines equivalent to American ones and to provide alternative floating electricity production with conventional barges moored in an ice-covered port in winter[4].

Novatek has however developed its own so-called "cascade" technology for the 4th train at the Yamal LNG plant, but the yield is 3 times less than the Western one and still requires development times. According to Novatek, the 1st train could however be put into production at the end of 2023 with half of its initial output of 6.6MT of LNG production. Only 4 turbines out of the 7 needed, 2 for compression and the other 2 for electricity production, will be able to produce LNG. The same question remains for the spare parts and maintenance of these turbines which are subject to very rigorous monitoring and whose level of regular intervention requires a return to the factory to be tested on specific benches. This particularly concerns the components of the cryogenic production chain (compressors, pumps, etc.) integrated by the German Linde with the American Baker Hughes turbines. In July 2022, it was also a controversial subject for the restart of the North Stream 1 gas pipeline between the German operator and Gazprom, the Siemens turbine being under maintenance in Canada (La Tribune, 2022). The problems are the same on the Sakhalin-2 project with the American Baker Hughes Frame 7EA turbines with a power of 90 MW (Kommersant, 2022). The sanctions applied to these high-tech materials are an effective means of pressure on the performance of these factories. Novatek 's 3rd project, Ob LNG near Yamal LNG, for which investment decisions should be made, will not achieve the performance envisaged because all the technology of the liquefaction trains was based on the same technological choices of the two other plants, notably the American turbines of which Novatek held a license for 12 trains (Kommersant, 2020a).

[3] Turbine derived from that of the Boeing 777.

[4] The only viable alternative would be the construction of a floating nuclear power plant like the one moored at the port of Pevek in Chukotka, *the Akademik Lomonosov,* with a capacity of 64MW. Even though there is a draft construction program of about ten units, nothing has been planned for the Gydan Peninsula.

It is unlikely that this time the sale of this equipment will fly under the radar of economic sanctions as was the case for the American turbines sold through a Chinese sector for the similar Yamal LNG project which entered service in 2017, while that the project was under Western sanctions following Russia's annexation of Crimea in 2014. Due to the disengagement of Western investors, the Arctic LNG2 project was taken over by two new contractors, Nova Energies controlled by the Russian Nipigaz and a newly registered entity in the United Arab Emirates, Green Energy Solutions (Kommersant, 2022b). Chinese industries (CNOOC, CNPC and Sinopec) are considering buying Shell's stake in the Gazprom-led Sakhalin-2 project. With regard to the two other major projects in progress, Vostok oil Oil from the Russian giant Rosneft and coal company AEON, both in the Taymyr Peninsula, they are little impacted by Western sanctions because the level of engineering is much lower than the gas projects.

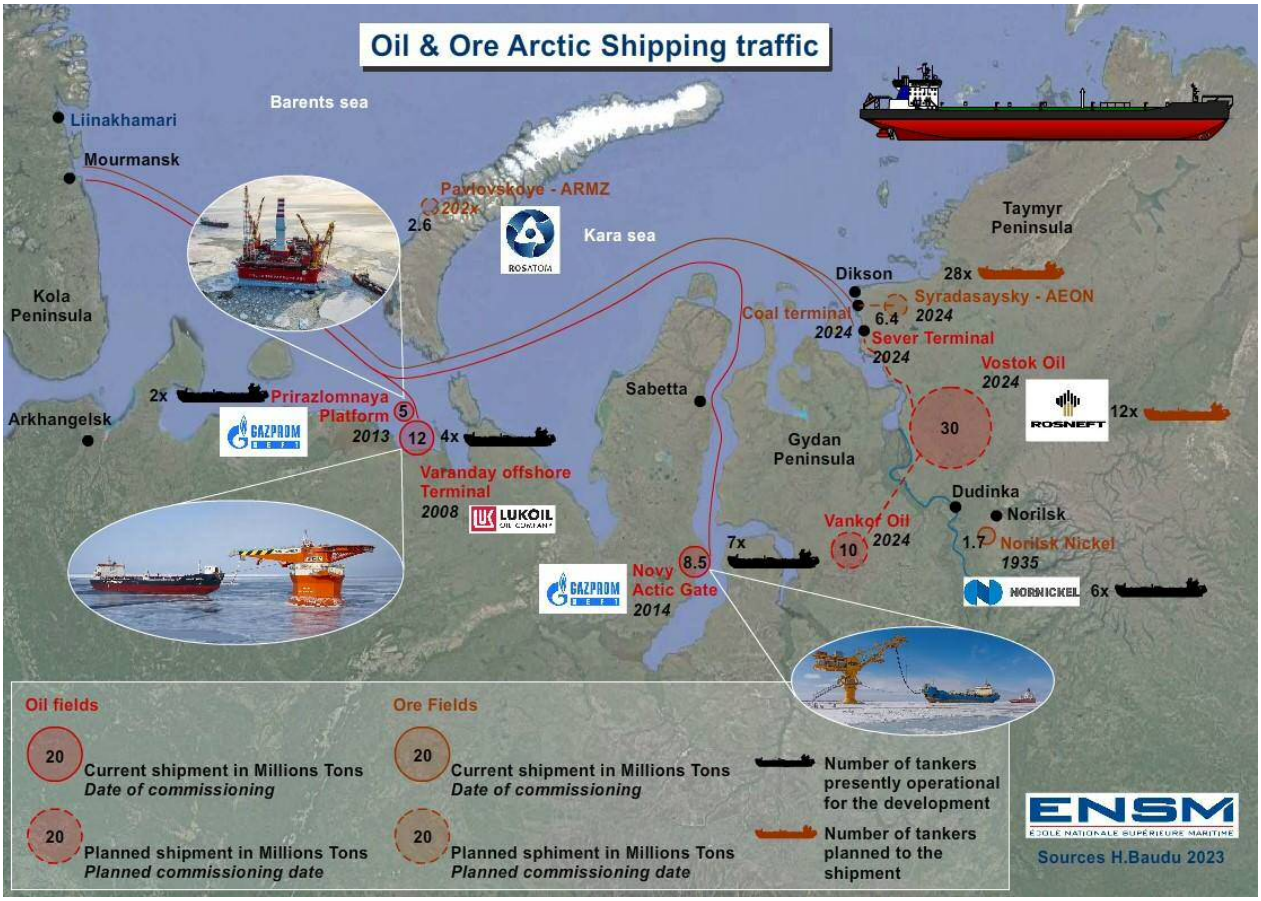

Figure 2: Oil and mineral production facilities in Western Siberia.

All these multiple sanctions measures applied to entities owned or controlled by the Russian government, Gazprom, Gazprom Neft, Sovcomflot etc. or private companies close to power – Novatek – aimed to influence the bellicose policy of the strongman of the Kremlin. In view of the stalemate of the conflict in Ukraine, one can doubt their effectiveness, at least on the intentions of the Kremlin to continue the conflict. The hypothetical prospects for the medium and long term development of hydrocarbon production projects in Siberia, burdening considerable future income, should have been a sufficient argument to temper the policy of the master of the Kremlin. Vladimir Putin has repeatedly repeated in his speeches at forums devoted to the Arctic, that

companies must show ingenuity to find technological solutions that can free themselves from Western industrial dependence. Special funds have been released for Research and Development in key sectors such as gas turbines. Russia has even approached Iran, which has know-how in these technologies, in exchange for support in the development of their civilian nuclear program (PressTV, 2022).

1.2. The impacts of the war on Russian hydrocarbon exports

Contrary to popular belief, the European Union has not sought to hinder the present exports of Russian gas. Too dependent on this source of energy in the short term, Europeans in particular and Westerners in general have instead sought to reduce Russia's ability to pursue the development of Arctic deposits, through industrial sanctions affecting the possibility for companies to pursue the supply of equipment and technology necessary for the development of new deposits and the liquefaction of natural gas into LNG. If the Europeans sought to reduce their imports of Russian gas through the pipelines, it was not so much through sanctions and to affect Russia, as to protect themselves against the economic risk represented by their heavy dependence on this source of gas energy. The reduction in this dependence and in European imports had begun before the war in Ukraine and was noticeable from February 2021. On that date, European imports from Russia (gas pipeline and LNG) represented 48% of gas deliveries. In February 2022, when the war broke out, they had already increased to 35.7%, reaching 12.9% in November (European Council, 2023).

This strong dependence of European countries on Russian gas[5] has resulted in the rapid increase in LNG imports, from the United States, Norway, Qatar and Nigeria, but also massively from Russia (Carter, 2023). If gas imports through the pipelines have collapsed, it is clearly because of Moscow: it is Russia which, to a large extent, has decided to cut off most of the deliveries to Western Europe, accrediting by the very fact of the political risk represented by the dependence developed over the years by the Europeans. What strongly resembles the sabotage of the Nord Stream gas pipelines on September 26, 2022, thus leaves the actor behind the gesture in suspense: the West, to avoid any temptation to resume gas imports, or Russia, to put more pressure on particularly dependent European countries such as Germany, which imported 55% of its gas from Russia in 2021? In fact, deliveries of Russian gas outside the Commonwealth of Independent States (CIS) by gas pipeline, operated by Gazprom, increased from 185 billion m^3 in 2021 to 101 billion in 2022 (Enerdata, 2023). In 2021, EU imports amounted to 155 billion m^3, compared to 66.6 billion (gas pipeline) in 2022 and 20.4 billion LNG (Elijah, 2023), a decrease of 68 billion m^3.

Not all Russian companies were affected, with Novatek benefiting greatly from expanding LNG purchases in Europe, but overall Russia sold less gas in 2022, despite efforts to redirect sales to Asia and in particular China (La Tribune, 2023). Gazprom's deliveries fell from 185.1 billion m^3 in 2021 to 100.9 billion in 2022, a drop not offset by the 10% increase in LNG deliveries, to 32.8MT or 46 billion m^3 (Robinson, 2023; Tass, 2023). Gas production is affected and decreased by 16%

[5] In 2021, one third of the gas consumed in the European Union came from Russia. The second largest supplier to the EU is Norway. Russia accounted for 20% of imports from the 27 Member States. Europe was the destination of almost half of Russian crude oil exports, just over a quarter of EU oil imports in 2020. The EU depended on Russia for around 45% of its coal imports.

in the 4th quarter of 2022, hitting the activities of Gazprom, while the production of Novatek, Rosneft and Gazprom Neft increased (Energy Intelligence, 2023). In December 2022, European countries managed to agree on a cap on the price of Russian gas, at 180 euros/MWh maintained for three days in a row (Sanchez Molina, 2022).

It is towards other Russian energy products that the EU has decided to decree restrictive measures. An embargo was thus decreed on coal (August 10, 2022), oil (December 5, 2022)[6] and refined products (February 5, 2023), while a ceiling price on Russian exports was set at $60 per barrel of crude oil on December 3, 2022 by the EU, the G7 and Australia, and $45 per barrel of refined product from February 5, 2023.

These measures must curb Russian export possibilities, not by controlling sales transactions of Russian products, which is impossible, but by sanctioning any Western company that provides a service in the event of delivery above the price ceiling: carrier or insurer mainly. Prior to the measure, companies in G7 countries provided insurance benefits for 90% of global shipments (Malingre, 2022). This measure does not seek to stem Russian oil deliveries – other transport and insurance companies have emerged, notably from the United Arab Emirates (Sampson, 2022) and India (Mathonnière and al, 2022), and the European Union does not want to turn the oil market into chaos. If Russia lost all economic interest in producing and withdrew its production, this would have caused world prices to soar (Malingre, 2022; Cooper, 2022). The aim here is to force down the price of Russian crude sold on world markets in order to reduce the amount of its sales – with, it seems, a real impact, the price of Russian crude having been evolving for several months at around $20 less than the price of Brent, and nearly $40 less since December 2022 – and to mark a certain political solidarity of the 27 members of the EU, in coordination with the G7 partners and Australia (Malingre, 2022). In January 2023, the price of Russian oil (Urals) was around $45/barrel against $87 for Brent, with a significant drop since February 2022, accentuated since December 2022 and the implementation of the cap (BBC, 2023). While China has absorbed some of the oil abandoned by Europeans, it is above all India that has increased purchases, going from almost nothing in January 2002 to nearly 1 million barrels per day in November 2022 (Menon, 2022).

From a logistical point of view, a fleet of so-called "grey" tankers, often old and poorly insured, has developed to circumvent the embargo. It joins the tankers already operating on behalf of Iran and Venezuela under American embargo. According to an estimate by shipping broker BRS Group (Bockmann, 2022), this would now represent around 10% of the international tanker fleet. By falsifying their identity, changing their flag regularly and sailing discreetly by switching off their AIS transponder[7], these tankers come moored alongside, "Ship to Ship" method, transshipping their cargo to other tankers at anchor in international waters. We are therefore witnessing a major reorientation of oil exports from Russia: deliveries by pipeline to Europe have considerably decreased, the embargo is blocking all deliveries by sea, and it is to customers Asian markets, China and especially India that Russian producers are now turning to (Mathonnière and al, 2022), especially in the Arctic where flows are now directed towards Asian markets (Humpert, 2023a). It is still too early to say what the impact of Western sanctions on Russian oil sales could be, but it seems that at the end of 2022 there was a moderate drop in deliveries, estimated at around 5 to 7% (CREA, 2023; Kennedy, 2023; Reuters, 2023).

[6] With derogations for Slovakia and Hungary.
[7] AIS: compulsory on-board transponder which transmits the position of the vessel and its voyage information.

Multiple sanctions have been taken by the West since the start of the conflict, or measures aimed at reducing European dependence on Russian gas. These measures and sanctions target the Russian extractive sector and therefore in particular the energy sector in the Arctic. It is still too early to gauge the impact of these decisions. It is not certain that they strongly affect the sector but they do seem to have a certain weight on production, income, the implementation of new projects and on the general directions of the flow of deliveries.

However, even if the economic sanctions are unprecedented against a single country, it is clear that Russia is still resisting these measures well. Thanks to its manna of fossil resources, Moscow has succeeded in restructuring and consolidating its debt like no other industrialized country, giving it the necessary time to adapt to these constraints and to finance a war in Ukraine at the same time. If one makes the comparison with the economic sanctions already imposed on North Korea, Iran[8], Venezuela and even Russia following its annexation of Crimea in 2014, it questions the effectiveness of these short-term measures. Vladimir Putin declares that he does not suffer from the Western embargo on Russian hydrocarbons. Gazprom has cut off its gas supplies to the EU. He signed a number of decrees to take over the shares of Western companies in LNG projects to transfer them to Russian industrial and financial interests or those of allied countries. Very resilient, the strong man of Russia pledges that the growth of Asian countries will be enough to absorb a very large part of its hydrocarbon production, including that now neglected by Westerners.

1.3. Shipbuilding

The series of 8 packages of European sanctions (European Council, 2022) hit the main Russian financial institutions, in particular the two largest Russian banks – Sberbank and VTB Bank – and their subsidiaries in the world, the very ones which finance in large majority of Novatek and Vostok projects Oil. The impossibility of carrying out financial transactions had an immediate effect on the progress of the Arctic LNG2 project but also on the launch of the 21 Ice-class vessels which were to be in phase with the commissioning of the 3 LNG production trains between 2023 and 2025[9]. This is how the South Korean shipyards (Shen, 2022) had to cancel their contracts with the Russians for non-payment of the ships they were building for the Novatek Arctic LNG2 project. Samsung Heavy Industries SHI, alongside its Russian partner at the Zvezda shipyard in Vladivostok, was to build blocks for the first 5 of the 15 Arc7 icebreaker LNG carriers on behalf of Smart LNG, a joint venture between Sovcomflot and Novatek. It was also to build 4 Arc4 LNG carriers jointly ordered by Sovcomflot and the Japanese Nippon Yusen Kabushiki Kaisha (NYK Line) in October 2021. Same disappointment for the DSWE Daewoo Shipbuilding & Marine Engineering yard, which had committed in 2020 to build 6 Arc7 LNG carriers - 3 for Mitsui OSK Lines (Jiang, 2022) and 3 for Sovcomflot (Rowles, 2022) – deliverables in 2023 worth $872 million (Kommersant, 2022c). The entire order book between 2022 and 2025, comprised of both wholly owned and joint-venture vessels, leveraged nearly $2bn in investment from Novatek and $3bn in commitments under long-term charter contracts. The major Finnish engine manufacturers

[8] In terms of technological and financial constraints, Russia has almost reached the level of Iran. This country has the second largest gas reserves in the world, the vast majority of which is concentrated on the Persian Gulf coast. Before the imposition of sanctions due to the nuclear program, Iran planned to build 3 LNG plants with a total capacity of 37 Mt per year. After the imposition of the sanctions, the projects are still frozen (Kommersant, 2022e).

[9] That is 5 to 6 vessels in operation per liquefaction train for the Arctic LNG2 project.

Wärtsilä and German Man Energy have declared that they no longer supply the propulsion engines and generators for Ice tankers (Saul, 2022). Many of these tankers under construction at Zvezda will have to find local solutions, in particular for the supply of propulsion by Azipod[10] from the Swedish - Swiss equipment manufacturer ABB and the Finnish Wärtsilä, which is endemic to Ice tankers (ABB, 2023). In January 2023, the French company Gaztransport & Technigaz (GTT), the exclusive supplier of membrane containment systems for LNG storage tanks, ended its work with the Russian shipyard Zvezda. The company states that it will complete the installation on the first two Arc7 tankers, on the 1st train of the Arctic LNG2 project and on Novatek 's LNG hubs (Humpert, 2023b). These measures could benefit China for the construction of future Arc7 LNG carriers or Japan with another MOSS-type spherical tank containment system, less common. Western sanctions should not affect too much the output rate of the nuclear-powered icebreakers of the 22220 projects, the first 3 of which are already in service, although some Russian media report difficulties in finding for the last two icebreakers, the *Yakoutia* and *Chukotka*, essential substitute equipment such as propellers or certain types of auxiliary engines (Korabel, 2022a). Another consequence is the suspension by the Finnish shipyard Helsinki Shipyard Oy of the construction of an LNG-powered icebreaker for the Russian mining giant Norilsk Nickel (Korabel, 2022b). On the other hand, the two FSU (Floating Storage Unit) barges of the LNG unloading hubs built by DSWE, one for the Kola peninsula and a second for Kamchatka's anchorage should indeed be delivered during 2023[11] (Humpert, 2023c). These hubs replace, for the eastern part, the anchorage in the safe place off the island of Kildin near Murmansk, where the Arc7 tankers from Yamal LNG came to transship their LNG cargo to traditional LNG carriers. We can also ask ourselves the question about the viability of the future hub of Ura Guba at the Russian-Norwegian border due to the very significant drop in the volume of LNG to Europe from 2023.

The consequences on the insurance market of the Russian merchant fleet have also been the subject of severe sanctions. Lloyd's Register, one of the world's leading ship classification societies declared in March 2022 that it would divest from providing all services to Russian owned, controlled or operated assets or companies (Humpert, 2022b). In reaction to these measures and in order to circumvent these sanctions, the main part of the fleet of Sovcomflot SCF, the first Russian shipping company, registered in the Russian shipping register of navigation (RMRS) switched to the Indian register IRClass (Indian Register of Shipping) (Adjin, 2022). According to the IRClass, more than 90 ships managed by the subsidiary SCF Management Services which became Sun Ship Management based in Dubai have already been certified (Korabel, 2022c). The purpose of this artifice is to maintain its integration within the IACS (International Association of Classification Societies) which brings together the seven most important class societies in the world [12]. According to the Equasis database (Equasis, 2023), 81 Sovcomflot ships under the Russian flag have to date made this transfer to the IRS since their decommissioning to maintain the confidence

[10] An Azipod nacelle drives a propeller that can turn 360°, serving both as propulsion and as a rudder. This type of propulsion, *dual fuel engine* Wärtsilä and ABB Azipod, is a standard adopted for the vast majority of High Ice class ships (Baudu, 2018).

[11] Two gravity-fed offshore LNG transshipment complexes of 360,000m^3 and an annual capacity of 21.7Mt per year are under construction at the South Korean shipyard DMSE. The first will be moored in Ura Bay Guba in the Kola Peninsula and the second in Bechevinskaya Bay on the Pacific coast of the Kamchatka Peninsula. These barges will be able to receive 2 tankers at the same time.

[12] Oil tankers traditionally have two types of insurance: Hull & Machinery (H&M) insurance and Protection & Indemnity (P&I) insurance. The former covers physical damage to the vessel, while the latter offers protection against a wide range of civil liabilities, including loss of cargo, collision and pollution.

of insurers but also to avoid being the target of excessive and systematic checks at the ports of call. In addition, Russian maritime operators, including Sovcomflot, which operate a number of Ice-class vessels have been hit hard by financial sanctions and have been forced to sell parts of their fleet to obtain cash from Russian banks (The Maritime Executive, 2022). More than 10% of Sovcomflot 's fleet of oil tankers and gas carriers was thus sold, the armament representing only 111 ships. The 15 LNG Arc7 icebreaker tankers which deliver LNG from the Yamal LNG plant are however not affected and therefore not subject to sanctions because they are under foreign flag (owned by Greek shipowners Dynagas, American-Canadian Teekay - Seapeak and Japanese MOL), including the first of the series, SCF *Christophe de Margerie* , owned by Sovcomflot but operated by its subsidiary in Dubai.

2. The development of Arctic maritime routes

Three maritime routes are taking shape to cross the Arctic Ocean. The most direct, the so-called orthodromic route which passes through the North Pole, remains for the moment only practicable by high-class icebreakers. Although IPCC projections (IPCC, 2022) suggest an ice-free Arctic Ocean from 2050 intermittently during the summer period, it does not represent long-term commercial interest due to the risks of drifting ice, large inter-annual variations, perennial seasonality (there will always be ice in winter). The second route is the one that runs along the Canadian and American coasts, known as the Northwest Passage. Most of the passable route passes through the northern Canadian archipelago. It is, for the moment, open only about a month and a half in the year from the end of August to mid-October due to the presence of pack ice from the center of the Arctic Ocean. The most direct passage through the McClure Channel is therefore not really practicable by commercial maritime traffic. Ottawa considers archipelagic waters to be internal waters over which it exercises full sovereignty. For reasons of environmental preservation and the specific means necessary to put in place to secure this area, the State does not wish to promote the development of this maritime route which, commercially, is of no interest to the moment in the eyes of most shipping companies. Only a few cruise ships use it to reach Greenland and Alaska. Finally, the third route, the one that runs along the 23,000 km of Russian coastline, is the one that offers the most potential. The "*Sevmorput*" or Northern Sea Route (NSR), was commercially opened in 1935 by the Russians to serve the landlocked ports of Siberia. It is this Northeast Passage linking the North Pacific Ocean to the North Atlantic Ocean that attracts the most attention. Its frozen part in winter between the Bering Strait and the Novaya Zemlya archipelago is named the Northern Sea Route.

However, the number of ships in transit that use it each year remains very low. Its volume remains anecdotal compared to that which transits between China and Europe via the Suez Canal. If on paper, the gain in distance reaches 30 to 40%, it is not attractive enough to compete with the flow by the Indian Ocean. It could at most represent an alternative route to Suez for bulk transport or niche markets for manufactured products, in the summer period, in a few decades, for many operational and economic reasons. No climate model predicts the disappearance of the ice in winter, the polar night lasting from October to April, the route in the winter period is therefore reserved only for icebreakers capable of progressing in an ice pack whose average thickness is 1.20m. Even if global warming leads to a later reconstitution of the pack ice at the end of the summer period, the maximum extension of the frozen sea varies little at the end of winter. The

dislocation of the pack ice into more or less large ice sheets (*Floes)* takes place more quickly, making the risk of collision greater. Large sheet of multi-year pack ice drift into open water in summer and replenish at the start of winter in the Laptev Sea and the Chukchi Sea, making pack ice difficult to cross in winter. In terms of nautical safety, the communication and navigation infrastructures are still insufficient, the same goes for the means of maritime or air assistance which are not sufficiently well distributed to ensure an effective intervention along the 23,000 km of Russian coastline. Economically, this shortcut is only relevant between northern Chinese ports and northern European ports (Lasserre, 2015, 2019). However, the vast majority of container shipping lines that provide a regular transit trip called "just in time" call at many Asian ports and in the Mediterranean.

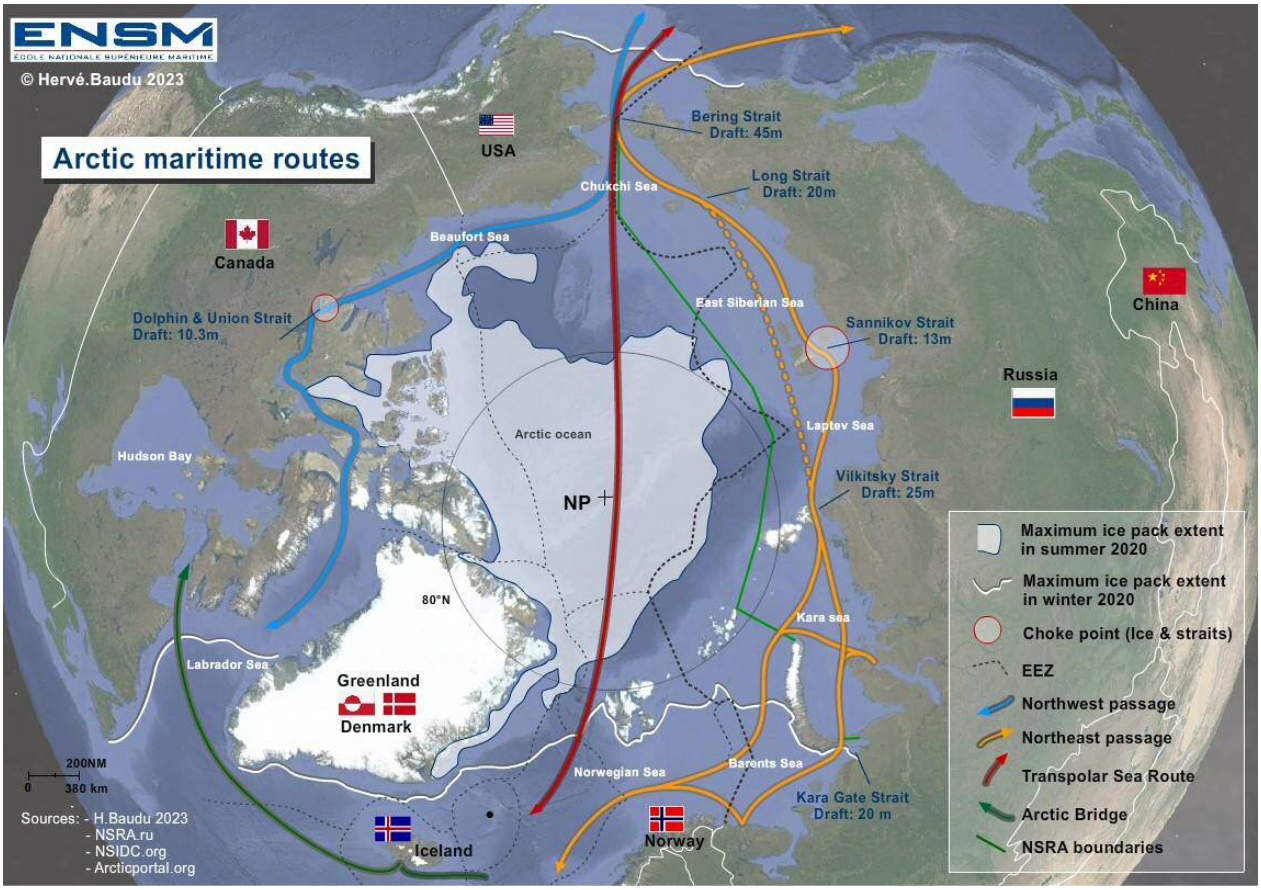

Figure 3: Polar Sea routes

The risks generated by navigation in the polar zone are subject to high insurance premiums, the compliance of the ship with the binding regulations of the Polar Code (additional safety equipment on board, specific training for deck officers, etc.). All these factors combined do not play in favor of a regular trade route which could compete with that which passes through Suez. As proof, all the major shipping companies for containerized transport between China and Europe show no desire to create a regular line via the Arctic Ocean which would replace, for a very small part of the year, an already very optimized.

Table 1. Transit traffic along the Northern Sea Route, 2011-2021
Unit: number of trips, volume transported in million tons

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Icebreaker	2	3	2	2	1	2	0	1	0	1	0
government ship	1	0	1	1	3	1	0	0	0	0	0
Cruise	1	0	1	3	1	1	0	0	0	1	1
Tugboat, logistic vessel,	4	5	1	1	2	4	1	2	0	6	0
Merchant ship	31	38	64	24	11	11	24	23	32	51	84
Research	2	0	2	0	0	0	0	0	2	0	0
Fishing	0	0	0	0	0	0	2	1	3	5	0
Total, official transit	41	46	71	31	18	19	27	27	37	64	85
Volume in transit (Mt)	0.8	1.3	1.2	0.3	0.1	0.2	0.2	0.5	0.7	1.2	2
Total volume transported (Mt)	3.3	3.8	3.9	4.0	5.4	7.3	10.7	20.2	31.5	33.0	34.9

Note: The volume transported corresponds to all goods in circulation, including destination traffic to Murmansk.
For 2022: the available data seem unreliable and report, according to contradictory sources, 5 transits, 4 of which were provided by foreign companies over the first 5 months of the year. Total traffic on the RMN would have amounted to 34 Mt for 2022.
Source: CHNL, data compiled by F. Lasserre.

In its ambitious project for the economic development of the Arctic zone for 2035 (Government.ru, 2019), Russia is trying to promote this route, which it aims to make an alternative transit route, competing with Suez by developing a gateway service -ice-breaking shuttle containers between transshipment hubs located at the ends of the North-East Passage, one in Murmansk and the other in the Kamchatka Peninsula, at the same location as the LNG hubs scheduled to enter service in 2023. To the new fleet of nuclear-powered icebreakers which should be fully operational in 2027, Russia claims to want to offer this service all year round from 2030. If the volume of transit traffic is low, on the other hand, the volume so-called destination traffic is growing rapidly because it is directly linked to the transport of hydrocarbons and minerals exported from the deposits of Western Siberia (Gunnarsson, 2021). Of the 35 Mt of annual volume recorded in 2021, more than 19 Mt comes from the Yamal LNG liquefied gas production plant in the eponymous

peninsula [13]. Completed in 2018, these three trains alone provided until then ¾ of the volume to northern European and Asian ports.

Table 2. Vessel movements in the waters of the Northern Sea Route
Unit: number of trips, volume transported in million tons

	2016	2017	2018	2019	2020	2021	2022*
Tanker	477	653	686	799	750	705	
LNG carrier	0	13	225	507	510	528	
Bulk	109	49	10	18	49	94	716
General goods	519	515	422	546	710	800	
Container ship	169	156	150	171	171	177	
Icebreaker	58	101	232	231	220	354	252
jumbo ships	62	46	6	0	5	26	
Refueling, service	0	57	104	169	154	156	
Research	91	87	85	93	114	138	
Tug	63	105	49	62	108	141	
Fishing	37	38	7	15	27	25	
Passengers	15	17	10	11	1	1	
Pleasure	0	7	0	3	3	0	
Drilling, exploration	55	12	8	22	41	60	
Others	50	52	28	47	42	22	
Voyages in the waters of the NMR	**1,705**	**1,908**	**2,022**	**2,694**	**2,905**	**3,227**	**968**
Volume transported (Mt)	**7.3**	**10.7**	**20.2**	**31.5**	**33.0**	**34.9**	**34 (2022)**

Note *: figures for the first 5 months.
Source: Center for High North Logistics, CHNL.

Following the sanctions, we can also expect traffic to Asia to increase due to the significant drop in travel to Europe, particularly in winter. The rest of the traffic is national feeder traffic, partly oil

[13] In 2021, Yamal LNG made 266 shipments (19.5 Mt), of which 199 (75%) were under long-term contracts, the remaining 25% were sold under spot contracts.

from the Novy terminals of the Ob delta and those of the Pechora Sea to Murmansk, for another part of transport of ores from Norilsk and large ship voyages carriers for the construction of new coal, oil or gas industrial complexes in Western Siberia. Even if there is a lot of publicity around the exponential development of destination transit linked for the most part to the volume of LNG transported, the number of ships that provide a destination or transit voyage on the Northern Sea Route remains intrinsically low. For comparison, the annual volume of traffic on the NSR is equivalent to the volume of a single day in the Suez Canal. China, itself very interested in the potential of the NSR and which until 2021 sent a dozen ships in transit in the summer to justify its Polar Silk Road project, seems to be more wait-and-see. It is readily credited with great ambitions in this space, as much political, economic as maritime with, for example, a nuclear-powered icebreaker project (Eiterjord, 2019) to ensure its own ship escorts, but it is clear that its actions are currently focused on securing hydrocarbon supplies from Siberia.

However, one should not underestimate the fierce desire for the development of the Northern Sea Route wanted by Vladimir Putin. The projects to secure this area are numerous and for some very advanced. Atomflot, the state entity that manages the NSR, will have its own polar satellite coverage for telecommunications and ice coverage. The Russians orbited the 1st of a series of four Arktika satellites in February 2021. There are plans to launch 4 more by the end of the decade (Korabel, 2022d). The Russian group Sitronics will launch 12 satellites to ensure the operation of an automatic ship monitoring system in the spring of 2023 (Korabel, 2022e). A total of 70 are planned to be launched. The satellite will carry a load of the AIS automatic identification system, a mandatory navigation system that can identify vessels, their characteristics, course and other voyage data[14] and follow their path. Previously, Russian users received the necessary data from American satellites. They are currently blocked. The 5 nuclear-powered 60 MW icebreakers of the 22220 series, 3 of which are already in service (the *Arktika,* the *Sibir* and the *Ural*), have complied with the scheduled commissioning schedule, a performance that must be underlined the two previous ones (the *Yamal* and the *50 Let Pobedy*) were many years late before being operational (Korabel, 2022f). The last two (the *Yakutia* and the *Chukotka)* are on hold for commissioning in 2025 *and* 2027 respectively. The 4th nuclear-powered icebreaker *Yakutia* will be dedicated exclusively to escorting the tanker traffic of the Vostok Oil project from 2024. Vladimir Putin even announced to budget 2 additional icebreakers of this same class to satisfy the increase in destination traffic for 2028 and 2030 (Arcticway, 2022). The other megaproject, *Leader,* an icebreaker called *Rossiya*, also nuclear-powered with a power of 120 MW, is under construction at the Zvezda shipyard near Vladivostok, owned by Rosneft. It is scheduled to be in service in 2027 and will be able to navigate through 3m pack ice to escort vessels up to 48m wide[15]. This should be the only one in his series. The Western technologies that will be lacking for these ships (cryogenic pumps in particular) would not be penalizing for the continuation of the project because they would be replaced by Russian manufacturers (Korabel, 2022g). According to the state-owned company Rosatom, the parent company of Atomflot, which manages the fleet of nuclear-powered icebreakers, it is necessary to provide for the construction of 6 additional icebreakers, as well as 16 emergency rescue vessels to ensure sustainable operation of the Northern Sea Route.

Due to the winter traffic flow that could shift from the West to Asia, Rosatom has already chartered the very powerful electric-powered icebreaker *Novorossiysk* for the benefit of the escort

[14]This data can be accessed via internet portals like MarineTraffic.com, Vesselfinder.com etc.
[15]Width of LNG Arc7 tankers.

on the Northern Sea Route, icebreakers *Krasin, Admiral Makarov* and *Kapitan Dranitsyn* being expected as reinforcements for de-icing the access roads to the ports of Sabetta and Novy Gate in the Ob river (Korabel, 2022h). Finally, the Kremlin ensures the security of the NSR through the recent renovations of the many military bases along the North-East Passage. However, these year-round armed bases benefit above all from infrastructures oriented towards the detection of airspace, even if there are platforms allowing the implementation of anti-ship missiles, with a range of approximately 300 km therefore a priori largely defensive vocation.

Western sanctions have little impact on commercial transit traffic on the NSR. Admittedly, the destination traffic volume targets of 80Mt for 2024 wanted by Vladimir Putin will not be achieved because they are directly linked to the development of hydrocarbon production plant projects, Arctic LNG2 in particular. However, the projects associated with the development of the NSR are continuing and should make the route safer, in particular for the winter transits of LNG Arc7 tankers which started on an experimental basis in 2019 (Staalesen, 2020) and which are expected to be regular from 2023. The Arctic development strategy for 2035 is also based on the creation and modernization of ports on the NMR (Staalesen, 2019), in particular the construction of terminals linked to hydrocarbon and mineral extraction projects by sea, Utrenniy for the Arctic LNG2 gas project in Gydan Peninsula, Bukhta Sever for the VostokOil oil project and Yenisey for the NorthStar -AEON mining project in Taymyr Peninsula and Nagleynyn for the Baimskiy copper mine project in Chukokta.

In reaction to Western sanctions, Russia has tightened the conditions for access to the NSR. If by regulation, article 234 of the United Nations Convention on the Law of the Sea grants a legitimate right to a coastal State to control in a non-discriminatory manner maritime traffic off its coasts covered by ice in the event of a risk of pollution throughout its EEZ[16], this right would perhaps no longer be applicable when the ice would no longer be present during "the major part of the year" (art. 234). This interpretation is not, however, accepted by the Northern Sea Route Administration, Russia and the administration responsible for Siberian maritime traffic, the NSRA[17] under the supervision of Atomflot, operate a maritime traffic control device on the entire passage of the NMR between the Bering Strait and the Novaya Zemlya archipelago. In particular, the NSRA imposes a request for a right of way, the inherent costs of which depend on the Ice class of the ship, the number of zones crossed on the NSR, the need or not for an escort by an icebreaker, an onboard pilot and of the time of year (NSRA, 2023). Already the federal law of December 29, 2018, on the "Commercial Navigation Code" of the Russian Federation requires that ships transporting hydrocarbons and coal from Russia be under the national flag. Vladimir Putin's goals in his accelerated development of Arctic projects through the "Arctic Development Plan 2035" have been hardened. A law passed in November 2022 (Vasilyeva, 2022) obliges state vessels to request permission to cross inland waters located in the waters of the NSR [18]no later than 90 days before the desired day of passage, it was not than 15 days earlier. It would also allow the passage of foreign warships and other government vessels to be suspended without further justification. Even if currently, no NATO military ship has thought of transiting the NSR[19], this Russian legislation

[16]Maritime area that extends 200 nautical miles from the coast, and in which the coastal State has sovereign rights over economic activities.
[17] NSAR: *Northern Sea Route Administration*.
[18]This concerns in particular the passage of the Sannikov and Vilkitsky straits, which Russia has appropriated as internal waters, whereas they are considered by Westerners to be international straits with a right of harmless passage.
[19]With the exception of one French Navy auxiliary vessel, the *Rhône,* in September 2018.

which is at the margin of the legality of international conventions on free movement on the high seas irritates the States very attached to freedom navigation, the United States first. If the geopolitical stakes are not equivalent to those that can be seen in the Indo-Pacific zone, we can nevertheless fear an increase in tension in the Arctic zone if the Americans were to claim their right to freedom of navigation by making incursions in the Russian EEZ alone or with its NATO allies. These FONOPS[20] would then be considered by Russia as a direct aggression in what it considers a stronghold, both in military and economic terms. Demonstrations of force with recurrent missile firing exercises, in the Barents Sea in particular, are a firm signal from the Kremlin to assert its sovereignty in this space. Western sanctions have also led to navigation restrictions in Russian ports, both in the Arctic and the Baltic. Norwegian cruise lines Hurtigruten Expeditions and American Regent Seven Seas Cruises have announced their intention to suspend calls at the Russian ports of Saint Petersburg, Murmansk, Arkhangelsk, and Solovki from their Arctic cruise tours. Russia wanted to develop the cruising of foreign ships in these free ports (Nilsen, 2022). All the container freight destination lines of the major Western companies, Maersk, CMA-CGM have suspended their services to Saint Petersburg. English ports have banned any stopovers by tankers from Russia. Maersk, which had been present in Russia since 1992, announced that it would sell all of its assets in Russia, including its 30.75% stake in Russian port operator *Global Ports Investments*.

Conclusion

While we have seen the direct consequences of Western sanctions on the Arctic space, we can wonder about the future of this region if the war with Ukraine drags on and relations harden between Westerners and Russia. Can we fear that tensions outside the Arctic, as is already the case between China and the United States, will also arise between the Arctic countries and Russia, which is even more determined to impose itself in this space which it has always claimed as its "bastion"? Then the specter of new tensions, however often advanced but not always credible, could emerge, Russia feeling attacked on all its flanks, advocating a legitimate attitude of safeguarding and even stronger affirmation of its regained sovereignty. From a security point of view, isn't the Arctic space in danger of tipping this region back into two bipolar blocks reminiscent of the Cold War? With the freezing of exchanges within the Arctic Council, one could fear that Russia would cease to align itself with the progress necessary for the sustainable preservation of the environment of the Arctic Ocean, which is already very impacted by global warming. The two circumstantial Chinese and Russian partners no longer seem to want to comply with a model of UN governance deemed too favorable to Western democracies. Thus, the Arctic, hitherto relatively preserved, could become an area of political struggle between the great powers, of which we know for certain that Russia will do everything to impose itself, its resources in the Arctic being a source of considerable income for decades to come, justifying its determination to oppose the Western powers.

References

ABB (2023). icegoing vessels, February 10, https://new.abb.com/marine/vessel-segments/ice

Adjin, A. (2022). Industry continues to pull out of Russia, *Splash247* , March 14, https://splash247.com/industry-continues-to-pull-out-of-russia/

[20] FONOPS: Freedom Of Navigation Operations. Transit through disputed international waters.

Alifirrova , E. (2022). Shell's decision to exit its Russian assets will result in an impairment charge in 2022. *Neftegaz* , 11 March 2022, https://neftegaz-ru.cdn.ampproject.org/c/s/neftegaz.ru/amp/news/companies/729417-vopros-na-3-4-mlrd-doll- ssha-shell-spishet-stoimost-svoikh-aktivov-v-rossii/ .

Arcticway.info. (2022). The government will allocate 118 billion rubles for two more LK-60, April 29 , https://www.arcticway.info/en/northern-sea-route-be-cleared-icebreakers

Baudu, H. (2018). The world fleet of icebreakers, *Geopolitical perspectives 4(4)* , https://cqegheiulaval.com/la-flotte-mondiale-de-navires-brise-glaces/

BBC (2023). Russia sanctions: what impact have they had on its oil and gas exports? January 26 , https://www.bbc.com/news/58888451 .

Bhaskar, U. (2022). No immediate plans to invest in energy assets in Russia: OIL, *Mint ,* February 25 , https://www.livemint.com/industry/energy/no-immediate-plans-to-invest-in-energy-assets-in- russia-oil-11645729871207.html .

Bockmann , M. (2022). G7 needs to mind the maritime gaps to enforce a Russia oil cap, *Financial Times* , September 2 , https://www.ft.com/content/5bdddbee-6dd3-4c8a-929a-18f0833e6e0d

BP (2022). BP to exit Rosneft shareholding, January 27 , https://www.bp.com/en/global/corporate/news-and-insights/press-releases/bp-to-exit-rosneft-shareholding.html .

Carter, D. (2023). Europe continues to import large amounts of Russian LNG. *Brussels Times* , January 11, https://www.brusselstimes.com/349852/europe-continues-to-import-large-amounts-of-russian-lng

European Council (2022). European Council conclusions on Ukraine, 31 May, https://www.consilium.europa.eu/en/press/press-releases/2022/05/31/european-council-conclusions-on-ukraine-30-may-2022

European Council (2023). EU gas supply. February 7, https://www.consilium.europa.eu/fr/infographics/eu-gas-supply/

Cooper, C. (2022). The West's oil war with Russia gets real. *Politico* , December 4, https://www.politico.eu/article/west-oil-war-russia-sanctions-oil-price-cap-g7-vladimir-putin-zelensky-opec-war-ukraine/

Corric , J. (2022). TotalEnergies wrote off $14.4 billion in Russian assets in 2022. *Agefi ,* December 12 *,* https://www.agefi.fr/corporate/actualites/quotidien/20221212/totalenergies-a-raye-144-milliards -dollars-d-355521

CREA (2023). EU oil ban and price cap are costing Russia EUR 160 mn /day, but further measures can multiply the impact. January 11 , https://tinyurl.com/CREA-oil-cap

Eiterjord , T. (2019). Checking in on China's Nuclear Icebreaker. *The Diplomat* , September 5 , https://thediplomat.com/2019/09/checking-in-on-chinas-nuclear-icebreaker/

Elijah, D. (2023). EU LNG imports reach all-time highs in December and 2022. *Kpler* , January 4, https://www.kpler.com/blog/eu-lng-imports-reach-all-time-highs-in-december-and- 2022

Enerdata (2023). Gazprom's exports of Russian gas to non-CIS countries almost halved in 2022. January 4 , https://tinyurl.com/Enerdata-gaz-russe

Energy Intelligence (2023). Russian gas output falls 16% in Fourth Quarter. January 9 , https://tinyurl.com/Energy-intel-gas-falls .

Equisis (2023). Electronic Quality Shipping Information System, February 12 , https://www.equasis.org/EquasisWeb/public/PublicStatistic?fs=HomePage

IPCC (2022). 6th report of the IPCC - practical kit, 1st part, February 12 · https://pour-un-reveil-ecologique.org/fr/articles/6e-rapport-du-giec-kit-pratique-1er-volet/

LNG Prime (2022). Saipem in talks to exit Novatek's Arctic LNG 2 project, August 9 , https://lngprime.com/asia/saipem-in-talks-to-exit-novateks-arctic-lng-2-project/58961/

Government.ru (2019). The plan for the development of the infrastructure of the Northern Sea Route until 2035 was approved, December 30 , http://government.ru/docs/38714/

Gunnarsson, B. (2021). Ten Years of International Shipping on the Northern Sea Route: Trends and Challenges, *Arctic Review ,* August 2 , https://arcticreview.no/index.php/arctic/article/view/2614/5113

Humpert, M. (2022a). Novatek Looks to Floating Turkish Power Plant to Save Its Arctic LNG 2 Project, *High North News* , August 12 , https://www.highnorthnews.com/en/novatek-looks-floating-turkish-power-plant-save-its-arctic-lng-2-project .

Humpert, M. (2022b). New Sanctions Hit Hard, EU Wants to Ban Insurance on Russian Oil Tankers, *High North News* , June 7 , https://www.highnorthnews.com/en/new-sanctions-hit-hard-eu-wants-ban-insurance- russian-oil-tankers

Humpert, M. (2023a). Russia reroutes Arctic Oil to China and India as a result of EU sanctions. *High North News ,* January 16 , https://tinyurl.com/High-North-News-Arctic-Oil

Humpert, M. (2023b). Massive LNG storage ship to travel N orwegian coast to Russian arctic , *High North News* , February 14 , https: //www.highnorthn e ws.com/en/massive-lng-storage-ship-travel-norwegian- coast-russian-arctic

Humpert, M. (2023c). French Engineering Company Exits Cooperation with Russian Shipyard, *High North News* , January 9 , https://www.highnorthnews.com/en/french-engineering-company-exits-cooperation-russian-shipyard

Jiang, J. (2022). MOL orders LNG carrier trio for Arctic LNG 2 charter, *Splash247* , November 2 , https://splash247.com/mol-orders-lng-carriers-trio-for-arctic-lng-2-charter/ .

Kennedy, C. (2023). Russian crude oil exports plummeted at the end of 2022. *Oil Price* , January 3 , https://oilprice.com/Energy/Energy-General/Russian-Crude-Oil-Exports-Plummeted-At-The-End-Of-2022 .html

Kommersant (2020). Compressor selected for Ob LNG, March 16, https://www.kommersant.ru/doc/4290335

Kommersant (2022a). Gaza was given a bear service, June 16 , https://www.kommersan t .ru/doc/5412128

Kommersant (2022b). Arctic LNG-2 replatforms contractors, July 28 , https://www.kommersant.ru/doc/5481770

Kommersant (2022c). Korean shipyard refuses to build vessels for Arctic LNG-2, May 25 , https://www.kommersant.ru/doc/5367711

Kommersant (2022d). Arctic LNG-2 to be powered from water, August 18 , https://www.kommersant . ru/doc/5503226

Kommersant (2022nd). Clouds liquefied over the gas, April 24 , https://www.kommersa n t.ru/doc/5304289

Korabel (2022a). Russian icebreakers in the mirror of Western analytics, December 12 , https://www.korabel.ru/news/comments/ledokoly_rossii_v_zerkale_zapadnoy_analitiki.html

Korabel (2022b). Finnish shipyard with Russian scope, March 18, https://www.korabel.ru/news/comments/finskaya_verf_s_rossiyskim_razmahom.html

Korabel (2022c). India Provides Safety Certification for Sovcomflot Subsidiary Vessels, June 24 , https://www.korabel.ru/ne w s/comments/indiya_obespechivaet_sertifikaciyu_bezopasnosti_dlya_sudov_docherney_kompanii_sofkomflota.html

Korabel (2022d). The cost of building and launching weather satellites for the Arctic was estimated at 44.2 billion rubles, June 28 , https://www.korab e l.ru/news/comments/stoimost_postroyki_i_zapuska_meteosputnikov_dlya_arktiki_ocenili_v_44_2_mlrd_rubley.html

Korabel (2022nd). Launch of 12 shipping monitoring satellites scheduled for spring 2023, November 11 , https://www.korabel.ru/news/comments/zapusk_12_sputnikov_dlya_monitoringa_sudohodstva_zaplanirovan_na_vesnu_2023_goda.html

Korabel , (2022f). Why might Russia suddenly run out of icebreakers?, November 25 , https://www.korabel.ru/news/comments/pochemu_rossii_vdrug_mozhet_ne_hvatit_ledokolov_2.html

Korabel , (2022g). A number of foreign companies refused to participate in the construction of the Ural icebreaker, March 25, https://www.korabel.ru/news/comments/ryad_inostrannyh_kompaniy_otkazalis_ot_uchastiya_v_stroitelstve_ledokola_ural.html

Korabel, (2022h). Rosmorport leases three diesel icebreakers from Rosatom for the Northern Sea Route, November 18 , https://www.korabel.ru/news/comments/rosmorport_arenduet_u_rosatoma_tri_dizelnyh_ledokola_dlya_sevmorputi.html

The Tribune (2022). Nord Stream 1 shutdown: Gazprom blames Siemens, September 6, https://www.latribune.fr/entreprises-finance/industrie/energie-environnement/arret-de-nord-stream-1-gazprom-rejette-the-fault-of-siemens-929286.html

La Tribune.fr (2023). Russian gas exports fell 25% in 2022. February 13. https://www.latribune.fr/entreprises-finance/industrie/energie-environnement/les-exportations-de-gaz-russe-ont-chute-de-25-en-2022-plombees-par-les-sanctions- international .

Lasserre, F. (2019). Modeling the profitability of liner Arctic shipping. In Lasserre, F. and O. Faury (eds.) (2019). *Arctic Shipping. Climate Change, Commercial Traffic and Port Development* . London , Routledge, p.40-56.

Lasserre, F. (2015). Simulations of shipping along Arctic routes: comparison, analysis and economic perspectives. *Polar Record* , 51(3): 239–259.

Malingre, V. (2022). The Europeans decide to cap the price of Russian oil at $60 a barrel. *Le Monde* , Dec. 2, https://tinyurl.com/Baril-russe-60dollars .

Mathonniere, J.; van Schalk, J. and Martelli , S. (2022). Price cap upends shipping, export impact less clear. *Energy Intelligence* , December 22, https://www.energyintel.com/00000185-35db-d582-a9ef-7fdfc1ac0000 .

Menon, S. (2022). Ukraine crisis: who is buying Russian oil and gas? BBC, December 6, https://www.bbc.com/news/world-asia-india-60783874

Nilsen, T. (2022). Cruise lines remove White Sea, Murmansk itineraries after Putin's invasion of Ukraine, *The Barents Observer* , February 27 , https://thebarentsobserver.com/en/travel/2022/02/cruise-lines-removed-white-sea-murmansk-itineraries -after-putins-invasion-ukraine

NSRA (2023). the Northern Sea Route Administration, February 2023, http://www.nsra.ru/en/home.html

PressTV.ir (2022). Iran signs deal to supply 50 gas turbines to Russia. October 24, https://www.presstv.ir/Detail/2022/10/24/691500/Iran-Russia-gas-turbines-deal-sanctions-mapna

Reuters (2023). Russia's oil output, exports hold up in early 2023. January 11, https://www.reuters.com/business/energy/russias-oil-output-exports-hold-up-early-2023-vedomosti-2023-01- 11/

Robinson, T. (2023). Gazprom in search of new natural gas markets after exports to Europe plummeted in 2022. *Natural Gas Intelligence* , January 10, https://www.naturalgasintel.com/gazprom-in-search-of-new-natural-gas-markets-after -exports-to-europe-plummeted-in-2022/

Rowles, G. (2022). Sovcomflot seals deal for Arctic LNG carriers, *Splash247*, October 29, https://splash247.com/sovcomflot-seals-deal-for-arctic-lng-carriers/

Sampson, P. (2022). Russia relies on older tankers to blunt sanctions. *Energy Intelligence* , Dec 5, https://www.energyintel.com/00000184-e28c-d95f-adc6-f2ddf6dc0000 .

Sanchez Molina, P. (2022). European Commission agrees on €180/MWh cap for Russian gas. *PV Magazine*, December 21, https://tinyurl.com/PV-magazine-Russian-gas

Saul, J. (2022). Ship Engine Makers Cut Ties with Russia as Maritime Pressure Mounts, *gCaptain* , March 25, https://gcaptain.com/ship-engine-makers-cut-russia-ties/

Schreiber , M. (2022). Major oil companies and investors pull back from Russian Arctic oil and gas, *Arctic Today*, March 5, https://www.arctictoday.com/major-oil-companies-and-investors-pull-back-from-russian-arctic- oil-and-gas/ .

Shell (2022). Shell intends to exit equity partnerships held with Gazprom entities, February 28 , https://www.shell.com/media/news-and-media-releases/2022/shell-intends-to-exit-equity-partnerships-held- with-gazprom-entities.html .

Shen, C. (2022). Sanctions impact raises concern among South Korean shipbuilders, *Lloydslist* , March 2, https://lloydslist.maritimeintelligence.informa.com/LL1140028/Sanctions-impact-raises-concern-among-South-Korean-shipbuilders

Solsvik, T. (2022). Equinor exits Russia joint ventures, transfers assets to Rosneft. *Reuters* , May 25, https://www.arctictoday.com/equinor-exits-russia-joint-ventures-transfers-assets-to-rosneft/ .

Staalesen , A. (2019). Moscow adopts 15-year grand plan for Northern Sea Route, *The Barents Observer* , December 31, https://thebarentsobserver.com/en/arctic/2019/12/moscow-adopts-15-year-grand-plan-northern-sea -road

Staalesen , A. (2020). A record-early convoy is breaking its way through Russian Arctic ice with course for China, *The Barents Observer* , May 19 , https://thebarentsobserver.com/en/2020/05/years-first-convoy-breaking-its-way -through-russian-arctic-ice-course-china

Staalesen , A. (2022). China's biggest heavy-lift carrier sails into Kola Bay, *The Barents Observer* , November 1, https://thebarentsobserver.com/en/arctic-lng/2022/11/chinas-biggest-heavy-lift-carrier-sails-kola- bay .

Stemler, D. (2022). War Leaves Russian LNG Ambitions in Tatters, *Energy Intelligence* , March 8, https://www.energyintel.com/0000017f-6497-d78a-af7f-e797776c0000 .

Mug (2023). Russia's LNG exports up to 46 bcm in 2022, says Novak. January 16, https://tass.com/economy/1562673 .

The Maritime Executive (2022). Sovcomflot Reduces Western Debt with Vessel Sales to Meet EU Sanctions, May 17, https://www.maritime-executive.com/article/sovcomflot-reduces-western-debt-with-vessel-sales-to-meet-eu-sanctions

Valle, S. (2022). Exxon to exit Russia, leaving $4 bln in assets. *Reuters* , March 2, https://www.reuters.com/business/energy/exxon-mobil-begins-removing-us-employees-its-russian-oil-gas-operations-2022-03-01/ .

Vasilyeva, N. (2022). Fedyaev : The draft law on permits for passage along the Northern Sea Route will be considered in the autumn session, *Federal Assembly of the Russian Federation* , September 8 , https://www.pnp.ru/politics/fedyaev-zakonoproekt-o- razresheniyakh-na-prokhod-po-sevmorputi-rassmotryat-v-osennyuyu-sessiyu.html

Wallace, J. (2022). Commodities Trader Trafigura Reviews Stake in Russian Arctic Oil Project, *The wall street journal*, March 2, https://www.wsj.com/livecoverage/russia-ukraine-latest-news-2022-03-02/card/commodities-trader -trafigura-reviews-stake-in-russian-arctic-oil-project-NteH6gXbEgDVW6TIOsqg

Zysk, K. (2017). Russia's strategic goals in the Arctic. *Foreign Policy*, 37-47, October, https://www.cairn.info/revue-politique-etrangere-2017-3-page-37.htm

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Alexeeva, O. and F. Lasserre (2018). An Analysis on Sino-Russian cooperation in the Arctic in the BRI era. *Advances in Polar Sciences* , 29(4): 269-282.

Baudu, H. (2019). The Northern Sea Route, reality and prospects, *Geopolitical Insights 5(3),* https://cqegheiulaval.com/la-route-maritime-du-nord-realite-et-perspectives/

Baudu, H. (2022). Arctic sea routes. Paris: L'Harmattan , https://www.editions-harmattan.fr/livre-les_routes_maritimes_Arctic_herve_baudu-9782140206160-72755.html .

Escude, C. (2022). What the war in Ukraine is doing to Arctic cooperation. LeRubicon, November 9, https://lerubicon.org/publication/ce-que-la-guerre-en-ukraine-fait-a-la-cooperation-Arctic/

IEA (2022). World Energy Outlook 2022, October , https://www.iea.org/topics/world-energy-outlook

Lasserre, F. (2022). Arctic Shipping in 2021: Driving Extractive Resources. *Notes de l'IRIS/Analyse* n°18, Institute of International and Strategic Relations (Paris), https://www.iris-france.org/notes/la-navigation-en-Arctic-en-2021-le-Moteur -extractive-resources/ , a. August 29, 2022.

Lasserre, F. (ed .) (2010). *Arctic Passages and Seas, Geopolitics of a Changing Region* . Quebec, Presses de l'Universite du Quebec.

Pic, P. and Lasserre, F. (2017). An Arctic Security Paradigm? For a geopolitical reading of the regional security complex, *L'Espace politique* , 33, https://journals.openedition.org/espacepolitique/4475

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