

CHALLENGES AND OPPORTUNITIES OF OIL AND GAS INVESTMENT IN THE ARCTIC

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ABSTRACT

With a rapidly changing climate, Arctic nations are now adjusting their policies to meet the more navigable and less hostile Arctic. Estimations indicate that the Arctic could hold 30% of the world's undiscovered gas, 13% of the world's undiscovered oil, and 44 billion barrels of natural gas liquids.

In this sense, the aim of this Capstone project is to illustrate the opportunities and challenges related to future Arctic oil and gas development. In particular, the group has chosen to focus on offshore oil and gas given that this is the main focus of future exploratory activity. Although Arctic drilling is not commercially viable at this time, and is not expected to be in the near future, a careful analysis of its expected costs and benefits remains relevant, since Shell and other industry leaders have continued their activity in the region. Taking a long-term view, the project outlines the key motivations for oil and gas development, focusing on geopolitical tensions; the interests of the three most important Arctic states, i.e. Russia, the U.S. and Canada; environmental challenges; shipping; technology; infrastructure; and tax regimes and investment activities. We look each of these aspects in turn, using the different Arctic countries as our unit of analysis where appropriate.

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ACRONYMS

B/D	Barrels per day
CARA	Circum-Arctic Resource Appraisal
CIT	Corporate Income Tax
CNPC	China National Petroleum Corporation
CSR	Corporate Social Responsibility
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
GDP	Gross Domestic Product
IBA	Impact Benefit Assessment
IFAW	International Fund for Animal Welfare
IMO	International Maritime Organization
IOC	International Oil Company
IRR	Internal Rate of Return
ITC	Investment Tax Credit
JIP	Joint Industry Programme
LNG	Liquefied Natural Gas
MET	Mineral Resource Tax
NATO	North Atlantic Treaty Organization
NGO	Non-Governmental Organization
NSR	Northern Sea Route
NWR	North West Route
ONGC	Oil and Natural Gas Corporation of India
OSRP	Oil Spill Response Plan
PSA	Production Sharing Agreement
R&D	Research and Development
RRT	Resource Rent Tax
SIA	Social Impact Assessment
SOLAS	Safety of Life at Sea
SSA	Social Sustainability Assessment
UAV	Unmanned Aerial Vehicle
UNCLOS	United Nations Convention on the Law of the Seas
US	United States
USGS	United States Geological Survey
WWF	World Wildlife Fund

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EXECUTIVE SUMMARY

With a rapidly changing climate, Arctic nations are now adjusting their policies to meet the more navigable and less hostile Arctic. The estimates from the United States Geological Survey (USGS) of Arctic hydrocarbons in 2008 underscored the importance the region can play as an energy intensive region. With the USGS estimating that the Arctic could hold 30% of the world's undiscovered gas (1,670 trillion cubic feet), 13% of the world's undiscovered oil (90 billion barrels) and 44 billion barrels of natural gas liquids, it is clear that the region's future could hinge on the proper exploitation of these resources.¹

Given estimates that show the Russian Arctic territories could hold 52% of the Arctic's energy resources, Russia has identified the transformation of its expansive Arctic territories into a significant economic, political and military powerhouse as the next step for a resurgent international actor.² Even with this vision, the technical, operational and financial challenges Arctic development poses has hampered Russian development. In addition, Arctic hydrocarbons in the Russian Arctic have tended to be primarily gas, which sell for a lower price and are less economical to develop. In the face of these challenges there was an expectation that Russia would allow private industry to step in to provide the needed resources.

It is clear that Arctic offshore development has been significantly affected by the implementation of Western sanctions against Russia as a consequence of the conflict in Crimea. With European geopolitics spilling into the Arctic region, tensions are expected to rise as the separate powers begin to recalibrate their policies to meet this new reality. This includes increased military activities in the Arctic. Thus, while the region has been considered a low risk area for conflict with a strong focus on cooperation and dialogue, the expansion and modernization of Russian forces have generated concern among the rest of the Arctic countries, particularly the Nordic ones. Therefore, it is expected that political risk in the area will increase, while the probability of an armed conflict still low.

As mentioned above, sanctions and increasing tensions have already had a major spillover effect for economic development in the Arctic. Future joint offshore projects between International Oil Companies (IOCs) and state-run Russian companies are frozen or cancelled leaving a wide gap in available investment, technology and manpower for offshore development. This will force the Russian state to reevaluate their plans to maintain their market share in the oil and gas industry. It is very likely that Russia will refocus on the development of brown fields using contemporary technologies allowing enhanced oil recovery. Current shipbuilding projects in Russia demonstrate that the nation is planning on developing its own internal supply chain, and shipping may be a low-hanging fruit the Russian state can support in order to push for economic development.

Should sanctions prevent Western companies from entering Russia in the next five years, generating an artificial divide, two separate but parallel Arctic offshore energy industries will emerge. There will be a Eurasian Arctic that will be primarily developed by joint ventures with state-run oil companies from developing countries like India, China and Vietnam. The technologies, finance and operational know-how will need to be developed from scratch, requiring real commitment to build these capabilities.

Norway will seek an expansion of offshore activity due to the need to maintain its market share as its non-Arctic production declines. Norwegian offshore oil and gas will creep eastwards to the

Russian border and northward towards the ice shelf, increasing the risk of geopolitical confrontation and hazardous environmental conditions. Yet, the warm waters of the Barents Sea, the established environmental and safety regulatory regime and a well-developed industry provide Norway with the tools needed for further development. However in addition to concerns that exploration will lead primarily to gas discoveries, Norwegian suppliers may be adversely affected by sanctions it may lose access to important Russian customers. This is most likely the biggest setback for the niche market that has developed in Norway.

United States development has the greatest chance of revitalizing the Arctic offshore industry. It is estimated that some of the largest reserves of oil, about 30 billion barrels, lie under the Alaskan Arctic.³ Due to the high estimates of liquefied oil products, a strong investment commitment by Shell and tacit support from the U.S. Government, we can expect the “turning point” in Western oil development to occur off Alaska’s frigid coast. Shell will need to find a field that is significant (at least 1 billion barrels) to justify the necessary infrastructure buildup to support offshore operations and should this occur, development of satellite fields would follow to increase the footprint of oil and gas operations.

In spite of companies shifting some of their prospective offshore operations to Canada, Canadian offshore projects are not likely to takeoff significantly, due to private industry focusing on oil sands. This coincides with a stringent Canadian environmental policy and a general government focus on oil sands development as a priority. Offshore Arctic projects in Greenland and Canada will both ride on the results of the large investments Shell has made in Alaska. This is because some of Canada’s potential fields are believed to be located near the U.S-Canadian border, which would benefit from infrastructure and investment nearby. Additionally, technologies developed from a commercialized offshore Arctic in the U.S. industry will likely decrease costs for other remote exploration and production projects. Finally, it is clear that the potential for finding oil resources is not as strong as it is in the Alaskan Arctic. Canadian Arctic resources are estimated to be relatively low compared to the U.S. Arctic, only holding 5% of the Arctic’s hydrocarbon, with about 2.5% (10 billion barrels) of the Arctic’s oil resources. Greenland meanwhile has an estimated 11% of all hydrocarbon resources with approximately the same amount of potential oil resources as Canada.⁴

Overall, investors should be cautious about offshore development in the next ten years. The risk of political fallout from an environmental disaster is real, and should a Eurasian Arctic be developed under a weaker environmental regime, it could have severe implications for the industry’s development in the rest of the world. Investors will need to approach local Non-Governmental Organizations (NGOs) and play an active role to promote effective regulations that will minimize social and environmental impacts, and therefore overall investor’s risk, as well as work together on research and development to ensure cleanup technologies are effective in Arctic conditions in the event of an oil spill. Investors should also push for continuing cooperation between major nation-states involved in the Arctic, which will be essential towards ensuring the peaceful and responsible development of our world’s final frontier.

Recommendations

For entities interested in investing in the Arctic regions, there are a number of recommendations that would reduce the risk of environmental, social and geopolitical fallout.

Establish Communications & Partnerships with Environmental NGOs

Purpose: To allow the firm to identify cost effective methods to protect local ecology and promote ecologically sensitive economic activities.

Advocate for Firm but Supportive Regulatory Regimes

Purpose: To minimize industry risk

Support Global Multilateral Dialogue

Purpose: To minimize geopolitical and environmental risks.

Rating System for Operators

Purpose: To identify the best practices & reward those who adopt them.

Social Development Plans

Purpose: To lower social risk and increase opportunities.

1 Introduction

1.1 *Scope of the report and methodology*

In December 2014 Barclays, a leading global investment bank, asked this Capstone group of graduate students from Columbia University's School of International and Public Affairs to balance the risks and opportunities presented by mineral and hydrocarbon development in the Arctic. Specifically, students were asked to assess and weigh energy security and commercial opportunities against the environmental, technical and geopolitical obstacles presented by resource extraction in the High North.

This report seeks to highlight some of the key geopolitical, environmental and technological challenges to oil and gas development in the Arctic, highlighting the contrasting growth patterns of the hydrocarbons industries in different Arctic countries. Based on research and interviews conducted, makes several recommendations designed to help investors to be mindful of important signals and indicators that may help them anticipate patterns of change as well as potential opportunities or risks to investments.

The methodology used to determine the recommendations in this report was a combination of desk-based research, expert interviews and independent analysis.

1.2 *Background*

Since the first attempts to produce oil from Arctic offshore fields in the 1950-80s, IOCs have approached the Arctic with long-term strategies. With the advent of remote technologies needed to operate in deep-water conditions in the 1980s, commercial offshore production in other remote areas has become a greater possibility. With the United States Geological Survey (USGS) stating that there is about 30% of the world's undiscovered gas (1,670 trillion cubic feet), 13% of the world's undiscovered oil (90 billion barrels) and possibly 44 billion barrels of natural gas liquids, many large IOCs viewed the arctic as a politically risk free opportunity.⁵

Now, with the Arctic ice receding at a rapid rate, it is clear that Arctic nations will be forced to establish their presence under the pressures of a shorter timeframe. An analysis of the extent of Arctic ice provides a clear example of how quickly the Arctic is evolving. In March 2015 the extent of Arctic ice averaged 14.39 million square kilometers, the lowest March ice extent in the satellite record. On average the 1981 to 2010 March ice extent as 15.52 million square kilometers. This represents more than a 1 million square kilometers of arctic ice below the average in recent history.⁶

Arctic resources are not evenly distributed amongst the different Arctic nations. Russia, with its expansive Arctic territories, is estimated that Russia's Arctic region may hold up to 52% of the world's resources. These resources are predominately estimated to be gas. Meanwhile the Alaskan Arctic only holds an estimated 20% of the Arctic's hydrocarbons, but 50% of the Arctic's oil resources (about 30 billion barrels of oil). Finally Canada, Greenland and Norway have relatively low potentials for hydrocarbon resources in the arctic with about 5%, 11% and 12% respectively.⁷⁸

Only two years ago, the Russian government and many IOCs were touting the Russian arctic as the next frontier for western oil and gas investment. The Russian government was interested in

seeing investments of up to \$500 billion to develop Russian Arctic fields.⁹¹⁰ There were optimistic expectations for the development of fields like the Shtokman gas field, a gas and condensate field in the central part of the Russian Barents Sea. Despite depths of 1000+ feet, accessing 3.8 trillion cubic meters of gas and 53.4 million tons of gas condensate was deemed lucrative enough to plan for the eventual development of the field.¹¹ By 2009, the project to develop Shtokman was already under shaky ground as gas in the U.S. plunged from the shale gas revolution. In 2012, the project was officially shelved by Gazprom and is not likely to see any further development in the near future.¹²

Partnerships between IOCs and Russian state run enterprises were also expected to hold much promise. There was great optimism for the Exxon-Rosneft partnership to jointly explore and exploit Rosneft's massive Arctic holdings. This partnership was scrapped as Exxon faced pressure from sanctions that were increasing in their severity.¹³

This combination of Shale oil and gas production in the U.S. with Ukraine sanctions has forced a drastic recalculation by major oil companies.

Now many major oil and gas companies have begun to withdraw from offshore projects in the Russian Arctic or reallocate investments to other Arctic regions, effectively ensuring a glacial pace for offshore development in Russia's Arctic. In both Canada and the U.S. arctic in Alaska, many companies wishing to stay in the Arctic are purchasing licenses and are planning to begin exploratory programs. Currently, resources off Alaska's Arctic coast have the highest potential for recoverable oil and gas and even with a recent failure of one of its rigs, Shell is still continuing with its offshore exploration program.¹⁴¹⁵

In Canada, Arctic offshore development has been mostly tabled in favor of the further development of oil sands fields. The current consolidation in the Canadian oil and gas market has been mostly driven by the major IOCs acquiring smaller oil companies invested in oil sands projects.¹⁶¹⁷

On the other hand, Norway is continuing to open up exploratory concessions closer to the Russian border and northwards. The nation's need to maintain its market share and to find additional fields for the future has driven it to be willing to face harsher environmental and geopolitical risks.¹⁸

Finally in Greenland, oil and gas exploration projects are still yet to yield any results. Expectations for a major find off Greenland's coast have been scaled down as oil companies have begun to look for other areas to conduct exploration projects.¹⁹

2 Towards a Riskier Arctic

After the Cold War, during which the Arctic was heavy militarized, the region has been perceived as a region with low political risk. The main focus of the circumpolar countries has been issues pertaining to environmental risks and climate change, and opportunities for economic development in the fields of energy and shipping. However, over the past few years there has been a distinct increase in the military activity in the Russian Arctic. The other Arctic countries are expressing concern about Russian military activity in the context of a Russia that is acting in a coercive manner towards many of its neighboring countries in Eastern Europe. Hence military

preparedness in all Arctic countries is getting higher. As the military activity is expected to increase tension and the risk of conflict between Arctic states in the future, we will address the issue in more detail in this section.

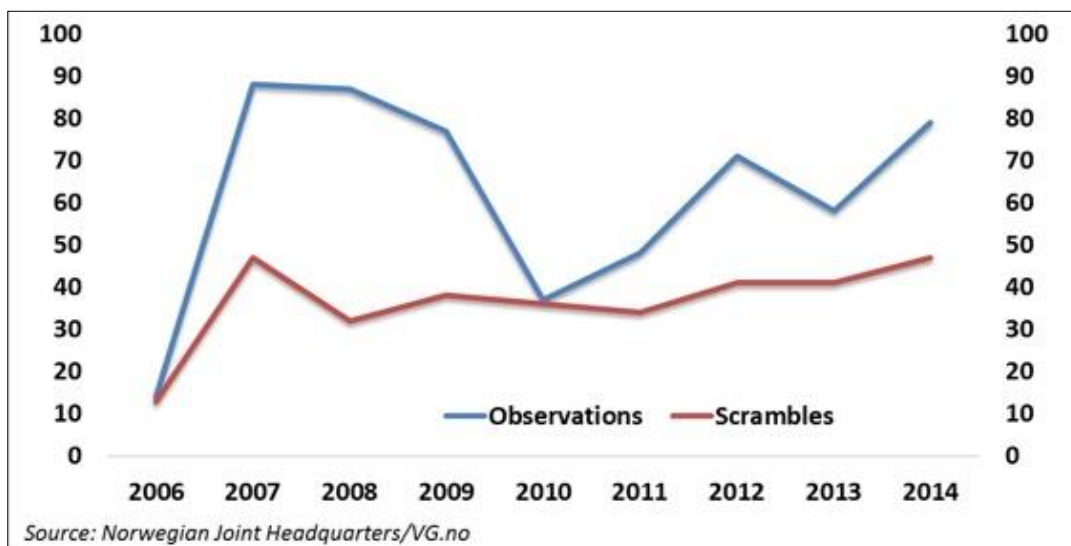
2.1 *Russia's military presence in the Arctic*

Russia is currently undergoing the process of upgrading its military presence in the Arctic. A map describing Russian military activity in the Arctic is included in an appendix.²⁰

Recent military activity in the Russian Arctic includes:

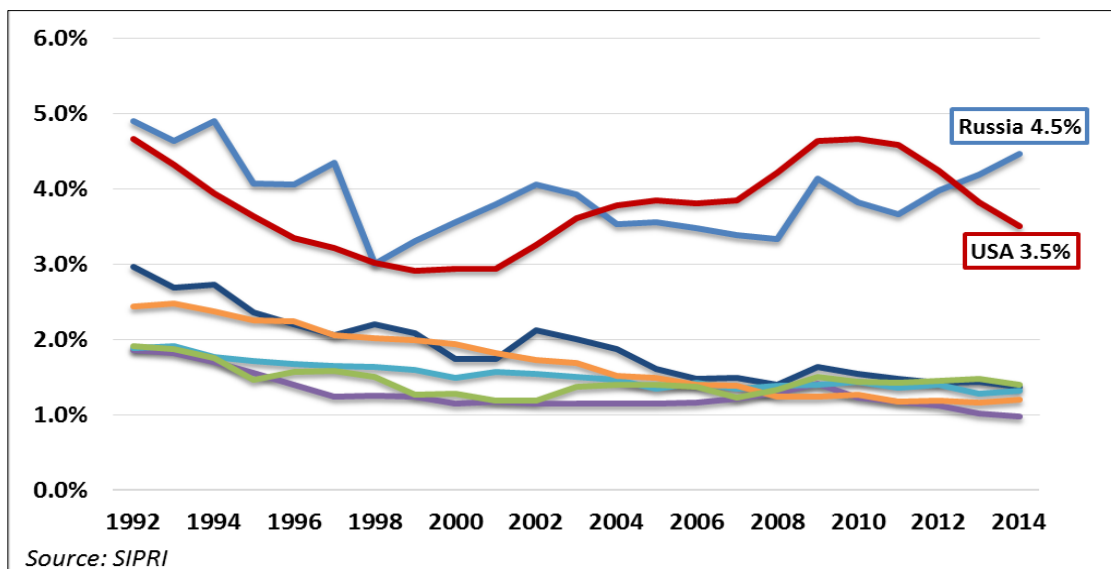
- The decision to reopen old Soviet-era bases along the Arctic coast;
- Military exercises of 100,000 men and 38,000 men in eastern and western Russia respectively. These are the biggest Arctic exercises since the end of the Cold War. Russia has also been performing “snap-exercises” (unannounced military drills).
- Claimed increases in submarine activity by 50% in 2014 relative to 2013.²¹
- Increased airplane activity demonstrated by an upsurge in observed Russian airplanes near Norwegian territory. As a reaction to this, Norwegian planes have performed a higher number of scrambles, that is, airplanes taking off as quickly as possible to intercept enemy planes (see Figure 1).
- The formation of the Arctic Joint Strategic Command in December 2014. The Command is placed in the Kola Peninsula, and will be in charge of coordinating the Arctic military activity. It has at its disposal the Northern Fleet, the biggest of the Russian navy, which includes two thirds of all Russian submarines.
- Deployment of more military manpower and equipment: two new Arctic infantry units have been established while four new nuclear-powered ballistic missile submarines are expected to be added to the Northern Fleet. A number of air-defense systems are also being placed along the coast.

Figure 1: Russian Air Activity near Norwegian Territories



The Russian military activity in the Arctic reflects the country's overall military investments. Military upgrades in the Arctic must be seen in context of the Russian armament program started in 2008. According to the plan 70% of the military will be modernized by 2020. By making a comparison of military expenditures for all Arctic countries (see Figure 2), it is clear that Russia is spending more as a percentage of Gross Domestic Product (GDP) than others, indicating a higher priority given to the military. According to a former economic policy advisor of President Vladimir Putin, the military expenditures have continued to rise in the first quarter of 2015, increasing to 43.3% of the federal budget and a 12.7% of the Russian GDP.²² Russian military activity in the Arctic is assumed to reflect the increase in overall military expenditure, although it is unclear the extent to which the Arctic benefits compared to other domestic regions. The armament program is focused on acquiring submarines, to the benefit of the Northern fleet, which holds the biggest Russian vessels and 2/3 of the submarine fleet, including 3/4 of the ballistic missile submarines.²³ According to the head officer of the Russian navy, the naval strategic focus for the coming year is the Crimea (Black Sea) and the Arctic.²⁴

Figure 2: Arctic Countries Military Expenditure (% of GDP)



2.2 Russia's motivations in the Arctic

Four interpretations of Russia potential motivations for its Arctic military program have been constructed. Each is plausible and may be given more or less importance over time.

2.2.1 Russia develops its Arctic infrastructure²⁵

The current investments in the Arctic address the needs of a changing Arctic, where Russia needs to develop infrastructure for its long Arctic coastline. This is necessary to improve search-and-rescue capabilities needed to increase economic activity in the area. However, this reasoning does not explain Russia's investment in missiles and air-defense equipment.

2.2.2 Russia feels threatened

Russia is interpreting Western joint military exercises, prospects of North Atlantic Treaty Organization (NATO) expansion,²⁶ and the economic sanctions aimed at hampering the Russian

Arctic development activity as hostile acts. Increasing Russian military activity is considered a way to assert Russia's global power and deter Western countries from taking further actions. As sanctions have slowed Russia's drilling activity, military exercises can also be a way to demonstrate the country's presence in the Russian Arctic.

2.2.3 Russia prepares to defend its national resources

As 20% of Russia's GDP is produced in the Arctic, Russia's policy is to transform the Arctic into "Russia's foremost strategic base for natural resources" by 2020.²⁷ For Russia it is important to assert its sovereignty over its rightful resources, and signal that it is prepared to defend its Arctic resources with military means if necessary.²⁸

2.2.4 Russia is expansionist

Russia prepares to expand its boundaries in the Arctic by creating circumstances similar to the Ukraine in 2014. Events such as the decision for Deputy Prime Minister Rogozin to post a picture on twitter holding a Russian flag with the text "The Arctic is Russian Mecca", while visiting the Norwegian island of Svalbard without giving prior notice to Norwegian authorities, feeds into this interpretation.²⁹

2.3 The geopolitical future of the Arctic

There are three scenarios that describe the potential short to long-term geopolitical climate with respect to the Arctic:

2.3.1 Short- to medium-term (-2020): More Arctic tension

There will be a continuation of Russian military exercises and military modernization, accompanied with provocative language. Western Arctic countries will increase their military preparedness in the form of military modernization, common exercises, and formal military cooperation. The 5 Nordic defense ministers have already initiated a Nordic defense cooperation, in response to the deteriorating security situation in the high north.³⁰ The major risks in this scenario is military escalation over misinterpretation of actions, as well as serious accidents stemming from military exercises "gone wrong".³¹

2.3.2 Long-term I (2020-): Moderate risk

This is a continuation of the previous scenario. Russia is not interested in any conflict with the West, and the main risks are similar to those above. At this point Russia has become the major military power in the Arctic. The U.S.S has not kept up its Arctic military presence as the region is not a top security priority and is falling behind.³² The situation continues and there are moderate levels of cooperation among the Arctic countries over issues of common concern such as environment and search and rescue.

2.3.3 Long-term II (2020-): High risk

Russia is expansionist and feels its national resources are threatened. Military means may be used to further its interests in the area around the North Pole, where Russia, Denmark and Canada have overlapping claims, and in the Barents Sea and the Svalbard zone where Norway and Russia previously have had disputes over fishery.

2.4 Factors driving geopolitical risks

2.4.1 Russian – Western relationship

Increased Russian military activity in the Arctic started before the Ukraine-crisis. But Russia's Crimea takeover has increased uncertainty about its intentions in the north leading other Arctic countries to view Russia as a more unpredictable player. The deterioration of political relations between the West and Russia will lead to countries taking action to deflect their perceived weaknesses. A severe breakdown in the Western-Russian relationship, such as a military invasion of the Baltic States, has the potential to turn the Arctic into a high-risk region.

By contrast better Western-Russian relations through a decision to lift the sanctions may ease tensions, but the sense that the relationship to Russia has changed fundamentally in a negative direction will likely remain.³³ This is partly based on the shift in Russian foreign and domestic politics, where Russia has become more confrontations in its approach to other countries and more authoritarian at home. This is not likely to change unless there is a regime shift in Moscow.

2.4.2 Arctic cooperation

Cooperation between Arctic states on issues of common interest mitigates Arctic risk. Putin stated in 2010, that the Arctic should be a “zone of people and cooperation”.³⁴ The Arctic Council, the most important regional inter-governmental forum dealing with issues like climate, environment, indigenous issues, and search and rescue, is expected to continue to provide a meeting place for the circumpolar countries, and other interested countries and organizations. However political tensions are impacting the Arctic Council.³⁵ The United Nation Convention of the Law of the Seas (UNCLOS) is likewise considered to mitigate Arctic risk, as it is regulating countries' legal rights in the region. To date the Arctic countries have always adhered to the UNCLOS.³⁶ However, if narrow national security interests take precedence in the Arctic these institutions will be of little consequence. If Russia concludes that its national security is at stake, it is expected that it will do what it takes to restore it.

2.4.3 Economic factors

As yet the defense budget of Russia has been left untouched by the economic problems facing the country, while every other sector has seen cuts.³⁷ Even when facing negative GDP growth, the military expenditures appear to continue to grow in the first months of 2015.³⁸ It is thus likely that Russia will continue its military modernization, including in the Arctic, over the next decade. Furthermore, the Russian government has broad popular support for its policies. Putin's approval rating hovers above 80%,³⁹ in part due to cultivation of Russian nationalism and anti-Western sentiments. This provides a favorable climate for high military expenditures. However, major future military plans may be affected by economic conditions. For example the next armament program, claimed to be the most expensive in Russia's history, has been postponed from 2015 to 2018.⁴⁰

3 National Development in Arctic Countries

This section examines the Arctic interests of the three most important Arctic states: Russia, the U.S. and Canada, in order to establish how important the region is for each country. The key

explanatory factors for countries' interests are market relevance of Arctic oil, overall standing of the Arctic in countries' policies, and the cultural relevance of the Arctic to each country.

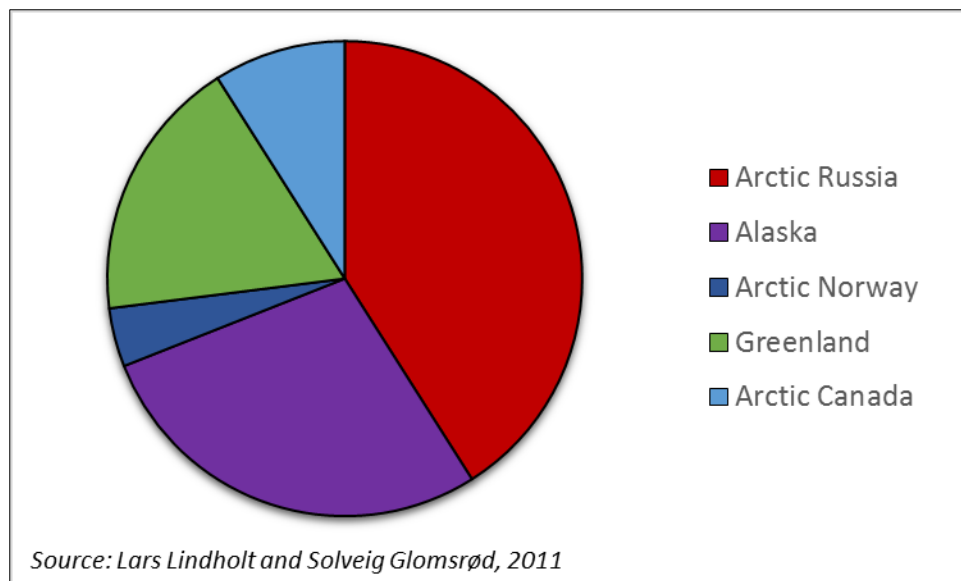
The empirical analysis shows that these three countries have different attitudes to the High North. From a strategic perspective the Arctic does not feature heavily on the U.S. political agenda, but the economic benefits of the region's oil are considered important. For Russia, steady domestic oil production and obstacles to Arctic production mean that it is a combination of security and identity reasons, which gives the Arctic significant strategic importance. Canada shows interest in the Arctic predominantly because of the hydrocarbons and determination to protect its sovereignty.

As previously noted, Russia's military modernization is considered one of the highest risks in Arctic. Nevertheless, growing military modernization does not mean the situation in Arctic has been hugely intensified. How other countries respond to Russia's provocation, and what effects this will have on oil industry will largely depend on how invested countries are in the "Arctic game".

The interests of each country can be explained by:

- 1) How eager are countries to put those abundant Arctic oil resources into production? Figure 3 indicates the distribution of estimated Arctic oil resources.
- 2) Is Arctic one of top national level topics on its political agenda?

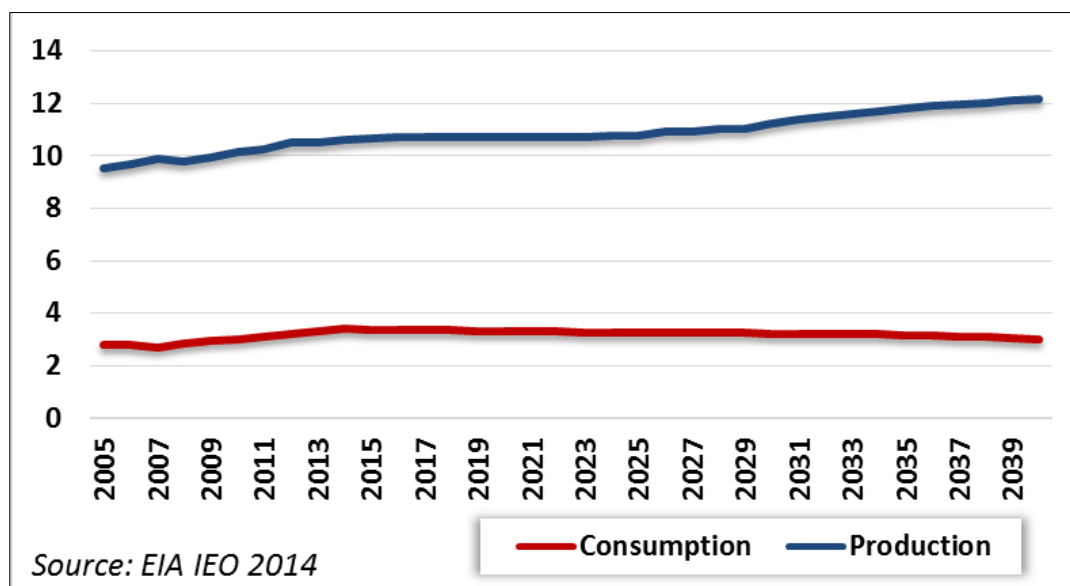
Figure 3: Distribution of Estimated Arctic Oil among the Arctic Five



3.1 Russia

Figure 4 shows Russia's total liquid fuels supply and consumption. The supply and consumption have remained stable in recent years and is project to rise slightly to 2040. In 2014, the production is 10.58 million b/d.⁴¹ The Russian Energy Ministry expects crude output to be around 10.513 million b/d in 2015.⁴²

Figure 4: Russia's Total Liquid Fuels Supply and Consumption (MMBD), 2005 - 2040



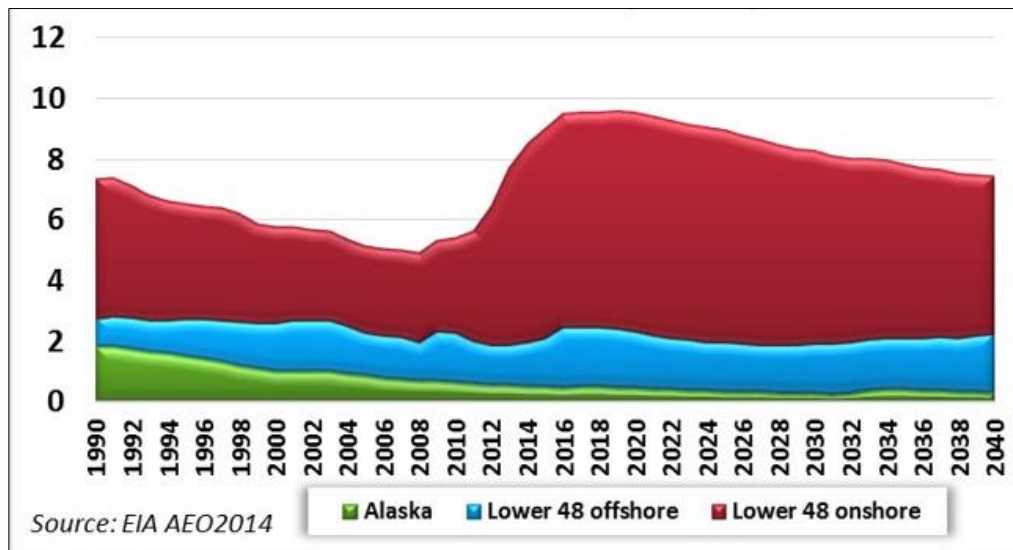
The key factor in Russia being able to maintain its output has been its ability to offset declining production rates at mature fields with new production at green field sites.⁴³ In addition the use of more advanced technologies and improved recovery techniques has resulted in increased oil output from existing oil deposits.⁴⁴

Even with the low prices and western sanctions, the output data over recent months has shown growth. Statistics from January 2015 showed that production increased to 10.657 million b/d, 0.7% higher than the overall 2014 average of 10.578 million b/d. Significantly the sector's major player, Rosneft, continues to see crude production decline, 1.7% in January, and an average of 1% over the course of 2014. For now, other producers are compensating for this drop. Western sanctions are not reflected in the positive forecasts for 2015 as they have mainly affected long-term projects, such as the partnership between Exxon Mobil and Rosneft in the Kara Sea, which were not due to contribute to output volumes in the near future.⁴⁵ In longer term, Russia regards the development of Arctic shelf reserves as an important means of maintain its oil production as oil and natural gas revenues make up on average 50% of Russia's federal budget.⁴⁶

The High North remains an important strategic region for Russia, upon which they are likely to want to assert their military dominance. Russia's detailed national plan, *The Foundations of the Russian Federation's State Policy in the Arctic until 2020 and Beyond*,⁴⁷ demonstrates the crucial role of the north by stressing the importance of the Arctic as a resource base for socio-economic development. It is claimed that Russian Arctic activities should be interpreted as a reflection national identification process as opposed to a pure military approach to alleged Russian possessions.⁴⁸

3.2 The United States

Figure 5: U.S. Crude Oil Production and Forecast to 2040



Crude production in US in 2014 is 8.7 million b/d and is projected to be 9.3 million b/d in 2016.⁴⁹ This is still below the 1970 peak, and it is forecasted to fall after 2020 (Figure 5).

In 2014 approximately 44% of the crude oil processed in U.S. refineries was imported and net imports accounted for 27% of the petroleum consumed in the U.S.⁵⁰

Better technology and relatively favorable conditions mean Arctic oil may have larger market relevance to U.S. than for Russia. Strategically, since the end of the Cold War, U.S. military interests in the region have declined. In early 2012, Alaska set up the Alaska Arctic Policy Commission to draft Alaska's Arctic strategy by 2015.⁵¹ In the near future the Arctic is likely to climb higher on the U.S. agenda as the government has begun to focus on the U.S.'s stake in the region. Despite this U.S. citizens do not identify with the Arctic to the same degree as their Canadian neighbors.⁵²

3.3 Canada

In contrast to the U.S., the Arctic is more prominent on Canada's political agenda. Prime Minister Stephen Harper has made the Canadian North a central issue of his government's policies and public speeches.⁵³ Safeguarding Arctic sovereignty is a pivotal motivation for Canada. Although only a fraction of the Canadian population lives in the North, many are attracted by the conservative agenda of economic development, military reinforcement and aggressive assertions of sovereignty.⁵⁴ However, Arctic oil is not currently attractive to Canada. The country has a relatively smaller share of Arctic oil and gas reserves (Figure 3) and output from oil sands is forecasted to triple.⁵⁵ By 2020, 80% of Canadian oil production is projected to come from oil sands.

In conclusion, the market relevance of Arctic oil for Canada is relatively low, yet Arctic oil and gas offer an attractive means to increase Canadian activities in the North, and thus increase the importance of the Arctic.

4 Environmental Challenges of Developing Arctic Resources

Global warming affects all Arctic countries opening for exploration across the region; the Arctic cannot be discussed as a whole as there are a multitude of different temperatures, ice conditions and climates across the Arctic nations. Greenland and Canada's Arctic seas have some of the largest and oldest concentrations of multi-year sea ice and shortest summer open water seasons. Icebergs that plague the Atlantic Ocean originate from Greenland's glaciers and increase the difficulty in transportation, drilling and pipelines in the seas surrounding Greenland and through Baffin Bay.⁵⁶ In the neighboring Beaufort and Chukchi Seas summer open water seasons usually fall between August to October,¹ with few occurrences floating ice more land fast ice. Ice across the Chukchi Sea in particular is more mobile and changeable reacting to winds and currents even in the winter season, creating openings in the ice that would allow high ice-class vessels to pass through even in mid-winter.⁵⁷

One of the most severe Arctic climates is found in the Kara and Laptev Seas along the Russian coast, where extreme conditions can result in temperatures as low as -50°C and snowfall even in the summer months.⁵⁸ By contrast, the North Atlantic Drift brings warmer currents to the Barents Sea along the Norwegian coast, bordering Russia with average January sea temperatures of 0°C due. This makes for ice-free waters all year around and air temperatures up to 30°C in the summer months.⁵⁹

Differing ice conditions mean that the opportunities and challenges in each Arctic country varies, but many of the environmental concerns are shared. Among the greatest environmental concerns is the risk and potential impacts of an oil spill. Despite the increasing amount of research, data and literature focused on the Arctic⁶⁰ there is a lack of detailed mapping of the Arctic and still significant uncertainty regarding ice movements and patterns, as well as the impact of oil spills on Arctic eco-systems. From the perspective of oil companies wishing to proceed with exploration and development of Arctic resources, this is the greatest environmental challenge.

4.1 *The Arctic lobby*

There are several environmental organizations working in the Arctic, with different strategies, visibility, and levels of institutionalization. While their activities will not prevent oil and gas exploration and production, they are certainly delaying and increasing the costs of drilling.

The World Wildlife Fund (WWF) has offices in 7 Arctic countries and is an observer in the Arctic Council. It was heavily involved in the Canadian offshore drilling regulation, and it presses governments to implement their commitments. The WWF opposes drilling arguing that there are no sufficient risks assessments nor technology to effectively address spills. It claims that oil and gas exploration in the Arctic cannot be achieved by "learning by doing", for mistakes and accidents would be incommensurably high and irreversible. The 2010 Deepwater Horizon blowout in the Gulf of Mexico inspired Canada's National Energy Board to launch a comprehensive review of offshore Arctic oil and gas drilling regulations. The WWF participated in this round table discussion, providing key insight and research on the risks of offshore drilling in Arctic waters,

¹ It is worth noting that summer seasons in the Chukchi Sea are usually slightly longer (by 2-3 weeks than in the Beaufort Sea.

focusing largely on the importance of being able to control a blowout before the sea ice re-froze over the winter.

Greenpeace is described by other environmental organizations as an army whose sole intention is to raise public awareness. While its actions in July did not suspend Shell's drilling activity, it did break the company's longstanding partnership with Lego on corporate social responsibility (CSR) grounds. Less than a year later it "invaded" an Arctic-bound Shell rig in the middle of the Pacific Ocean. Greenpeace is expected to continue to conduct this type of disruptive, risky, and highly visible action that result in high reputational costs for oil companies, and even legal actions.

Other organizations base their strategies on influencing and collaborating with companies on the development of sustainable practices, and favor the construction of a talking bridge with them. In an interview with Ms. Masha Vorontsova, Regional Director for International Fund for Animal Welfare (IFAW), she suggested that companies investing in the development of fossil fuels in the Arctic should have a pro-bono Advisory Board composed of environmental experts and reputable organizations to advise, warn and guide companies about the risks, implications and externalities associated with their activities.⁶¹

4.2 Operating guidelines and regulatory regimes

The Equator Principles provide a framework for financial institutions to assess and manage social and environmental project risks,⁶² while the hydrocarbons sector will look to the International Finance Corporation's Performance Standards, which offers a similar framework to companies seeking to take on large projects across the world.⁶³ Both these frameworks will likely be deployed for the majority of exploratory and production projects in the Arctic, however as with all areas of resource development there are a variety of regulatory regimes guiding oil companies as they pursue licenses, drilling permits and approval to develop, with varying levels of environmental requirements. Table 1 details the key environmental regulations for Arctic development.

4.2.1 Canada

Canada's current regulatory regime is a hurdle too great for operators. In addition to requiring a detailed environmental and social assessment report (ESIA) as part of the permit application for drilling and discharge permits and an oil spill response plan (OSRP) in case of an accident,⁶⁴ regulations insist on same-season relief well capabilities. With Canada's drilling season little more than 100 days, this effectively prevents any exploratory activity before 2020, due to drilling time constraints.⁶⁵ In contrast to several Arctic nations Canada's regulations state that oil companies are liable for up to CAN\$1 billion in criminal damages unless negligence is discovered.⁶⁶ This was increased in 2013 from CAN\$40 million due to increasing awareness of the potential damages following the Deepwater Horizon, Macondo spill. However this applies only to criminal damages and there is no cap on civil damages for which oil companies can be sued.²

² It is worth noting that \$25 billion of damages paid by BP following Deepwater Horizon accident were litigations and settlement costs.

Table 1: Key Arctic Environmental Regulations by Country

U.S.	Canada	Greenland	Norway	Russia
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Relevant bodies	Department of Interior (DOI) Bureau of Ocean Energy Management (BOEM) Bureau of Safety and Environmental Enforcement (BSEE) Environmental Protection Agency(EPA)	National Energy Board (NEB) Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) Aboriginal Affairs and Northern Development Canada (AANDC)	Bureau of Minerals and Petroleum (BMP) Greenland Institute for National Resources (GNIR) National Environmental Research Institute(NERI)	Norwegian Ministry of the Environment (MD) Norwegian Climate and Pollution Agency (Klif) Norwegian Ministry of Health and Social Affairs (SHD) Norwegian Pollution Control Authority (SFT) Norwegian Petroleum Directorate (NPD)	Ministry of Natural Resources and Environment (MNRE) Rosnedra (federal agency for subsoil usage) Rosprirodnadzor (federal service for the supervising of the use of natural resources)
EIA	YES	YES	YES plus SSA, IBA	YES	YES
Permits	Permits awarded through Clean Water Act, Clean Air Act	Given after submission of EIA and OSRP	Drilling and environmental permits required	Discharge permits required	Emissions permits required
Relief wells	Same season relief well capabilities proposed*	Same season relief well capabilities required	n/a	n/a	n/a
Oil spills	OSRP, containment equipment on-board*	OSRP, response equipment on board	Emergency response plan part of EIA, response equipment on-board	Emergency preparedness plan required	No clear requirements
Liability	Civil and criminal damages capped at \$134m	Criminal damages capped at CAN\$1bn. Civil damages unlimited	Unlimited	Unlimited unless force majeure	Unlimited
Dispersant usage	National policy defers to states; Alaska is undecided	No clear policy or guidance	Case-by-case policy, second response after net environmental benefit assessment (NEBA)	Expedited with net environmental risk and damage assessment (NEDRA) and permits	Expedited if meets conditions
In-situ burning usage	Documented procedure for use in the Arctic and acceptable as a primary response method	No formal process currently exists. Work is underway to establish guidelines for Arctic development projects	Accepted as a response option in some contingency plans, however want more research on the effects of burning before determining full policy	Not currently used	No clear policy at the moment. Regulations are under consideration

*** Proposed regulations published in February 2015**

Sources: Arctic Opening: Opportunities and Challenges in the High North, Arctic Response Technology, The Oxford Institute of Energy Studies

4.2.2 United States

Requirements include detailed Environmental Impact Assessments (EIAs) and OSRPs, as well as appropriate response technology on board vessels. However, the liability cap, which includes both criminal and civil damages, is set at only \$134 million, which was raised from \$75 million in December 2014.⁶⁷ Stricter Arctic specific regulations, which were published in February 2015 include requirements for an onboard Arctic Containment System to cope with oil spills and same-season relief well capabilities.⁶⁸ Although these regulations have not come into-effect yet Shell is complying with the requirement for a containment system. Due to the longer drilling season on the U.S. Beaufort and Chukchi Seas, the same-season relief well capabilities are not expected to restrict exploration prospects to the same extent as in Canada.

4.2.3 Russia

Russia follows the same patterns as the other Arctic countries with respect to requirements for an EIA and permits for release of air emission or marine discharges, which can result in heavy fines if it is discovered permits are exceeded.⁶⁹ However, despite unlimited liability on oil companies in the event of an oil spill,⁷⁰ there are no clear regulations determining response requirement leading to concerns about the robustness of the regulations.⁷¹ Multiple sources have suggested that while Russia attempts to proclaim a strict regulatory regime, particularly with respect to liability, the strategic interests in exploring the Arctic dominate environmental concerns, and therefore enforcement of regulations is limited.⁷²

4.2.4 Norway

Warmer waters in the Norwegian Arctic create a different scenario for environmental risks. While there are strict rules regarding ESIA, OSRPs and emissions and discharge limits, there are no requirements for Arctic specific cleanup response technologies.⁷³ In the event of an oil spill responsibility is clearly placed upon the oil company involved and unless a 'force majeure' is deemed to have occurred, both civil and criminal damages are unlimited. Norway has a reputation for environmental concerns featuring heavily on the agenda both in government and across the oil sector. Enforcement of permits and oversight of operations is very strict to ensure the highest degree of risk mitigation, as well as a hydrocarbons tax to offset emissions.

4.2.5 Greenland

In addition to the EIA, Greenland demands a Social Sustainability Assessment (SSA), an Impact Benefit Assessment (IBA) and a separate Social Impact Assessment (SIA). Regulations also require an OSRP and response equipment onboard and specific drilling and emissions permits. As a small state within Denmark looking increasingly to gain more powers, Greenland has introduced a local content requirement to extract greater economic gains. Like Norway and Russia liability over oil spills is unlimited, particularly as Greenland is considered to be an area of considerable natural beauty and its environment is of high priority to many environmental campaign groups.⁷⁴

4.3 Oil spill response

Despite even the strictest of regulations it is impossible to completely eliminate the risk of an oil spill. The costs associated with oil spills are significant. The Exxon Valdez oil spill in 1989 resulted in damages in excess of \$7 billion for Exxon Mobil,⁷⁵ while the damages from Deepwater Horizon currently stand at \$42 billion, with potentially a further \$18 billion to be awarded.⁷⁶ An oil spill in the Arctic would be potentially catastrophic to an oil company. The region is relatively untouched, lacks infrastructure and is home to a huge variety of mammals, fish and organisms that have lived mostly undisturbed to date. Even with ongoing research the impact of an oil spill of any significance is incredibly uncertain and the related damages and reputational costs could be extensive.

Several research programs focused on cleanup technologies have been set up through the U.S. government, the API and a Joint Industry Program among others. These programs focus on a range of containment and cleanup technologies available to oil companies approaching oil spills. They include a containment system, mechanical booms and skimmers, dispersants and in-situ burning.

Table 2: Marine Non-U.S. Oil Spill Cleanup Costs by Method (1999 US\$)

Primary Clean-up Method	US \$/liter
Manual	21.03
Mechanical	8.64
Dispersant	5.06
In-situ burning	2.81
Natural	1.15
<i>Source: Dagmar Schmidt Etkin, 2000</i>	

4.3.1 Containment systems (including domes)

In the event of loss of well control, containment systems are designed to be positioned over the leak to contain the oil and pump it back to a vessel to be separated from the water.⁷⁷ This technology aims to limit the amount of oil, which escapes into the water while a relief well is completed.⁷⁸ Superior Energy Services developed the only system specific to the Arctic. The first attempt to develop the \$400 million system was unsuccessful, which prevented the system from joining Shell's 2012 operations, effectively limiting the company's scope of drilling.⁷⁹ After the 2012 summer, another system was developed and built in just 9 months,³ increasing initial capital expenses from \$75 million to approximately \$220 million for this model.⁸⁰ The system was granted approval in November 2013 and was successfully tested in March 2015 ahead of expected deployment in the 2015 summer season.

4.3.2 Mechanical recovery

Even with a containment system some oil will flow into the water. The least environmentally damaging, but relatively more expensive cleanup technology is the use of mechanical booms and skimmers to remove the oil from the water's surface.⁸¹ A study in 1999 modeled the various costs

³ Usual timing for this scale of project is approximately 2 years.

related to oil spill cleanup found that holding all else constant, the use of mechanical recovery as the primary technology was on average 70% more costly per liter than the use of dispersants and 200% more costly per liter than the use of in-situ burning.⁸² The process of skimming the oil from the surface is complicated by the presence of ice, which can catch in the skimmer and prevent the pickup of oil particles. There are multiple types of boom and skimmer including ones designed specifically in icy conditions, though using them will increase costs further.

Given its relatively limited impact on the environment, mechanical recovery is often considered the first/ideal response and current limits/restrictions on the use of dispersants and in-situ burning would make this technology the primary response in countries such as Canada, Greenland and Norway.⁸³

4.3.3 Dispersants

The use of dispersants to break down oil particles in the water column that cannot be collected through mechanical recovery is somewhat controversial. Environmental groups have raised concerns that the chemicals used will have uncertain effects upon the ecology and wildlife in the Arctic. Considerable research is underway by organizations such as the JIP (Arctic Response Technology) to fully test and understand the effectiveness and impact of these chemicals in icy environments. One general agreement is that the toxicity of dispersants is lower than the toxicity of oil and therefore the usage of dispersants is expected to cause less damage than allowing the oil to remain.⁸⁴

Regulations across Arctic countries over the use of dispersants vary widely. The U.S. has a clear process for the use of dispersants, although it should be noted that states have their own rules and Alaska remains undecided about the use of dispersants.⁸⁵ Both Norway and Russia have expedited processes for the use of dispersants for spill response, while Greenland works on a case-by-case basis and Canada does not have a policy on dispersant use.⁸⁶

Despite the potential environmental concerns about the impact of dispersants, their use as the primary method of cleanup is relatively less costly than mechanical recovery. The lack of air emissions relative to in-situ burning may make this a more desirable cleanup technology, particularly in conditions with floating ice where mechanical recovery is more complex.

4.3.4 In-situ burning

Relative to mechanical recovery and dispersants, in-situ burning is the least costly technology and has the highest cleanup efficiency at 98%. However the process of burning a oil slick on the surface of the water carries its own risks including health and safety concerns while igniting the burn, difficulties in using the method in strong winds and high waves, the release of damaging emissions and currently unknown environmental impacts of chemical herders that gather the oil create sufficient thickness of the slick for successful burning.⁸⁷ As a result in-situ burning is not favored by Norway and Canada.

Nevertheless, the presence of ice may make in-situ burning the most effective cleanup response. Colder temperatures and ice restrict the spread of oil and can limit emulsification. This helps to more naturally ensure the thickness of the slick is sufficient for burning.⁸⁸

4.4 Conclusions

Looking to Deepwater Horizon as an example, spill response costs made up just 33% of overall damages to date suffered by BP, while litigation and legal fees accounted for 60%.⁸⁹ Cleaning up a spill of the same scale in the Arctic is estimated to cost up to \$27 billion and may cause irrevocable reputation damage.⁹⁰

One country of concern from an environmental perspective is Russia. Weaker regulations and the impact of sanctions, as well as collaboration with Asian investors with lower environmental standards (discussed later), will inhibit methods that can address an oil spill and increase the environmental risks of operating in Russian waters. The reputational damage and impact of a spill in Russian waters will be felt across the sector and region, regardless of the companies involved.

5 Arctic Shipping Routes

5.1 About the routes

Climate change has not only resulted in new opportunities for oil and gas exploration and development: receding and thinner ice and longer ice-free summer periods have also opened up the possibility of increased international shipping activity offering faster sea routes for commercial cargo, and the promise of increased trade for once icebound ports. In fact, projected future ice losses have the potential to make the Arctic dramatically more navigable. More investments in infrastructure, navigation, communications, and the nascent field of ice forecasting offer potential for long-term growth in Arctic shipping. These changes are happening at a time of growing international trade driven by the rise of Asian economies, which require increasing imports of energy and raw materials.⁹¹

Three trans-Arctic routes have been identified:

The **Transpolar Sea Route**, traversing the North Pole, encounters thick and persistent ice. At this point this is a hypothetical seaway, as navigation requires ice-free conditions that are not yet observed. Even aggressive climate model scenarios project extensive sea ice in winter in the central Arctic for decades to come.

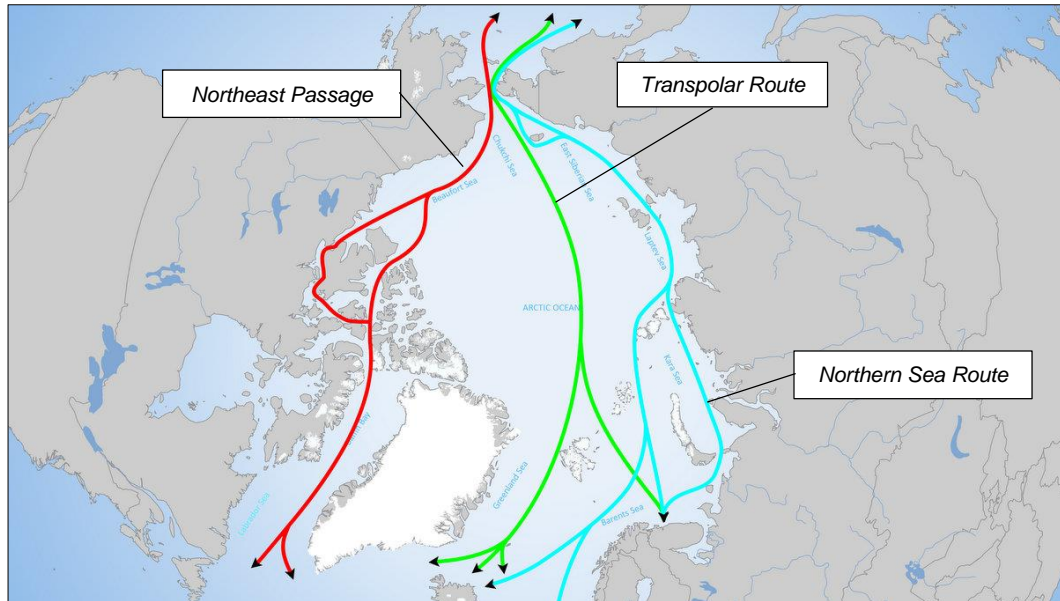
The **Northwest Passage** (NWP), crossing Canada's Arctic Ocean, could become usable on a regular basis by 2020. The journey between East Asia and Western Europe would take about 7,343 nautical miles using the NWP,⁹² while taking 12,959 nautical miles through the Panama Canal. Thick multiyear ice, complex straits, and pingos (underwater ice formations protruding from the seabed) make navigation especially arduous.⁹³

In October 2013, the Nordic Orion, a Danish ice-strengthened bulk vessel, completed the first-ever commercial transit of the NWP, conveying 73,000 tonnes of coal from Vancouver to Finland. The Nordic Orion was escorted by a Canadian Coast Guard Heavy Arctic Icebreaker in the Peel Sound waterway. In September 2014, the Nunavik delivered 23,000 tons of nickel concentrate from Deception Bay (Quebec) to Bayuquan in China. It was the first cargo ship to sail through the NWP without an escort from icebreakers. There were no other commercial transits of the passage in 2014.^{94 95}

The **Northern Sea Route** (NSR) runs along the Arctic coast of Russia.⁹⁶ While mainly limited to summer, navigation is relatively easier owing to lower overall ice extent and open water in the

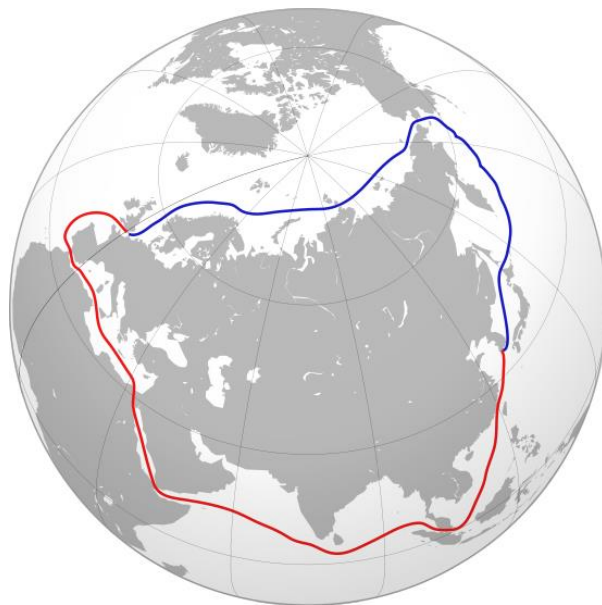
Barents Sea. This is the maritime route that is likely to be free of ice first and would reduce a maritime journey between East Asia and Western Europe by 10-15 days.⁹⁷ According to the Intergovernmental Panel on Climate Change, projections suggest that by 2050, the NSR will have 125 days per year with less than 75% sea-ice cover.⁹⁸

Figure 6: Arctic Shipping Routes



Source: The Arctic Institute

Figure 7: The Northern Sea Route (blue) vs the Journey through the Suez Canal (red)



Source: Wikimedia

Table 3. Sailing distances between Europe and Asia

From Rotterdam, via (in nautical miles)			
To	Suez Canal	NSR	Difference (%)
Yokohama	11,133	7,010	37
Busan	10,744	7,677	29
Shanghai	10,557	8,046	24
Hong Kong	9,701	8,594	11
Ho Chi Minh City	8,887	9,428	-6

Source: Buixadé Farré, Albert, et al. (2014).

It is the NSR where the most activities have taken place. Indeed, this corridor is already a reality for a small but increasing number of merchant ships during the summer months.

Up from only four transits in 2010, the NSR Information Office lists 71 transits for 2013.⁹⁹ Of those, 41 vessels traveled the entire length of the NSR and qualify as true transits. The remainders were vessels either departed from or arrived at ports inside the NSR that did not fully transit it, or vessels that traveled exclusively within the NSR. In 2014, due to delays in oil drilling on Alaska's north coast as well as the "chilling" effect of Western sanctions against Russia,¹⁰⁰ transit numbers were down to 53 and 32, respectively.¹⁰¹

In contrast to the Suez and Panama Canals, the NSR largely represents a one-way traffic route. Much of this traffic was one-way shipments of fossil fuels from Northern Europe to Asia, with oil constituting the vast majority of all the eastbound volume (cargo and ballast)¹⁰² from Western Europe. On the contrary, most of what comes from Asia is ballast. A significant amount of the vessels delivering oil products supplied local communities and ports along the NSR.

Table 4. Transit in the NSR and Suez Canal, 2012-2014

Route	Transit					
	Vessels			Million tons		
	2012	2013	2014	2012	2013	2014
NSR ¹⁰³	46	71	53	1.26	1.397	0.668
Suez Canal ¹⁰⁴	17,225	16,596	17,148	928.5	915.5	963.7

Sources: Northern Sea Route Information Office; Government of Egypt - Suez Canal Authority.

5.2 Recent developments

Recent developments suggest strong defense and commercial objectives along the Arctic coast. The following list offers a clear perspective of the interest and type of investments associated with a more navigable Arctic:

- * While there is no commercial navigation through the NWP, the **Canadian government** is preparing both for navigation and defense and, as early as 2008, it announced that it would build Arctic patrol ships for the navy. Finally, last January it signed a contract for the construction five of the vessels for a total of \$3.5 billion dollars.^{105,106}
- * The **Russian Maritime Registry of Shipping** confirmed that there are over 60 vessels of higher Arctic categories being built, including dual-draft nuclear icebreakers, Arctic LNG carriers, Arctic offshore vessels, Arctic tankers, and Salvage Vessels. Ice-class yards involved are DSME (Daewoo), Samsung Heavy Industries, Arctech, Baltic Shipyard, Vyborg Shipyard.¹⁰⁷
- * Last year, Russian authorities approved plans by **Rosneft** to begin production of Arctic seagoing vessels and platforms at two separate facilities, for its push to exploit Russia's Arctic regions.¹⁰⁸
- * In **Alaska**, deep-water ports have been proposed for vessels in Arctic waters.¹⁰⁹ In 2014, the U.S. Army of Engineers presented a feasibility study aimed at identifying "Arctic navigation improvements in support of multiple maritime missions that include national security, search and rescue, support of Alaska Native communities, resource extraction, and international cargo transport".¹¹⁰
- * Investment comes also from Asian countries with no direct access to the Arctic. **China and Japan** are investing around one billion dollars on three LNG carriers equipped with ice breakers to transport LNG from Yamal to Asia, which, in turn, serves the Russian objective of further developing links to Asia to compensate for the sanctions.¹¹¹ Thus, as the latter deter Western companies, the primary users of the sea routes are likely to be Russian firms exporting their energy and minerals to Asia, and particularly to China.

5.3 Challenges

Back in 2011 Russian President Vladimir Putin argued that Arctic shipping would have the economic importance of the Suez Canal.¹¹² However, for the time being the advantage of navigating Arctic waters and achieving a significant distance reduction is offset by many factors:

- * **Harsher weather** requires more expensive ship construction and winterization investments.
- * **Remoteness**, lack of broadband communications, and limited search and rescue capabilities increase the risk of Arctic operations.
- * **Shallow** waters limit vessel size.
- * **Arctic routes are mutable** owing to seasonal variability in ice extent and local ice drift. As a consequence, ice movements lead to **unpredictability of the ships' arrival time**. Container ships operate under a just-in-time system, which relies on precise schedules to maximize the efficiency of logistics and push costs down. As maritime shipping companies look for regular and consistent services, **seasonality has no commercial appeal**.
- * **Lack of a dense coastal population** lessens the value of the NSR as a trading route. There is very small commercial activity at this point in time, with **no potential for**

transshipment hubs and revenue generation for shipping lines. Under these circumstances, it is difficult to imagine how the eastbound/westbound imbalance could be reverted by an increase in the number of Asian container-shipping products to Europe.

For these reasons, the NSR is a less reliable alternative not only to the Suez Canal but also to the Panama Canal, especially for container transport. Moreover, the Panama Canal is also joining the competition for supertankers in the near future. Its expansion, currently underway and to be completed by 2016, will double the Canal's capacity, having a direct impact on economies of scale and international maritime trade. Upon completion, the project will handle post-Panamax ships - including supertankers (Suezmax liquid-bulk tankers), the largest container ships, and liquefied natural gas carriers- that are now unable to transit the Central American seaway.¹¹³

Unlike container ships, bulk cargo ships do not require such precise schedules and can better cope with variability of the NSR. **Since Arctic shipping is suitable for point-to-point services, the value proposition is good for transportation of oil and gas.** In addition, it must also be noted that as bulk cargo shipping is less sensitive to timing, it has the potential to adopt super-slow sailing. This means using the shorter distance of the NSR to sail at slower speeds and still arrive within the same time frame as if using the Suez route but achieving greater fuel efficiency, lowering fuel costs and emissions.¹¹⁴ In line with this, while environmental organizations the size of the WWF adamantly oppose the development of oil and gas in the region, they believe it is possible to develop a sustainable shipping industry in the Arctic based on best practices and guidelines readily available.¹¹⁵

In this sense, the WWF is making representations to the International Maritime Organization (IMO) to ensure a stringent set of rules to govern the increasing Arctic shipping. Moreover, the organization looks forward to an Arctic Council capable of evolving as an organization, making decision and commitments, incorporating accountability and reporting, and defining a clear, common view of how the member countries would like to see the Arctic in 2050. The WWF is overall optimistic about the perspectives of the Arctic Council.¹¹⁶

5.4 Shipping geopolitics

While the possibility for future jurisdictional disagreements owing to differences of interpretations of international law could discourage/affect the development of international shipping, it is also true that the developments in the region have led the Arctic states, and the international community at large, to work on new regulation that addresses new challenges and opportunities.

In this sense, in November 2014, the IMO adopted the International Code for Ships Operating in Polar Waters (Polar Code), and related amendments to the International Convention for the Safety of Life at Sea (SOLAS) to make the Polar Code mandatory. The expected date of entry into force is 1 January 2017.¹¹⁷ While ships trading in the polar regions already have to comply with all relevant international standards adopted by IMO, the Polar Code highlights the potential hazards of operating in polar regions, including ice, remoteness and rapidly changing and severe weather conditions, and provides goals and functional requirements in relation to ship design, construction, equipment, operations, training, and search and rescue, relevant to ships operating in Arctic and Antarctic waters.¹¹⁸

Yet to be addressed are some key principles beyond polar safety matters, with respect to the governance of maritime activity in the Arctic, and the regulation of ships navigating its waters. The question of who owns the Arctic has taken, and will likely take, a large amount of the attention.

The Arctic littoral states have sought to use UNCLOS to establish borders and assert their primacy over much of the Arctic Ocean and the seabed below (with the exception of the U.S., which has not ratified the convention). Canada and Russia have also used the special provisions provided by Article 234 of UNCLOS -which allows a coastal state with traditionally ice-covered waters to regulate shipping for protection of the environment- to strengthen their authority over emerging Arctic shipping routes. The language allows Russia to regulate shipping on the NSR within their 200-mile limit, and Canada to require notification before vessels come through the NWP, and registration of all ships weighing more than 500 tons.¹¹⁹

The claims over Arctic territories revolve around the UNCLOS definition of “territorial waters”, “internal waters”, and “strait used for international navigation”. Together with the interpretation of the principles of “innocent passage” and “freedom of navigation”, they are at present a legal complication and will likely be the source of mounting controversy between states in the near future.

Currently, they are at the core of the American disagreement with Canada over navigation through the NWS, as the United States insists that all ships, but especially those of the U.S. Coast Guard and the U.S. Navy, have a right to navigate what Canada considers to be its “internal waters”. Even though these close allies continue to muddle through with the “agreement to disagree” as their only legal disposition of the passage, this diplomatic compromise is unlikely to last once this previously impenetrable shortcut transforms into a viable seaway.¹²⁰

Russia’s Northern Sea Route is open for business and, so far, offers the only regular icebreaker ship escort service. Rates are set to recover costs of the nation’s nuclear icebreakers, while leaving clients some savings from shorter times and distances. A company seeking to transport goods through the NSR would have to contact Russia’s Northern Sea Route Administration several months in advance. Then, it would have to pay a tariff that can reach up to \$500,000 a voyage. The especially high level of fees for some ice-breaking and other navigational services needs to be examined if Arctic sea routes are to provide a commercially viable alternative to the Suez Canal or trans-Pacific sea routes.¹²¹

5.5 Shipping remarks

Considering all the issues at play with respect to the shipping routes through the Arctic, there are several conclusions to be made. First, commodity shipments out of the Arctic and delivery of supplies to communities and resource extraction sites in the Arctic are currently dominating Arctic shipping. Second, as Arctic shipping is suitable for point-to-point services, the value proposition is good for transportation of oil and gas. Currently, the NSR primarily carries oil, with much of the cargo involving Russia. Industry experts suggest that this seaway will become fully operational in 10 to 30 years from now.¹²²¹²³

Looking forward, markets in Asia are likely to drive Arctic resource development along the NSR. At present, the investment environment is more dynamic in shipping than in the oil and gas

sectors, and relates both to short-term and long-term goals of the parties involved, including Canada, Russia and Asia.

However, there are fundamental obstacles to overcome, including jurisdictional disputes that create political uncertainties; lack of modern deepwater ports and search and rescue capabilities that requires ships to have higher standards of autonomy and safety; harsh weather conditions and free-floating ice, which make navigation more difficult and schedules more variable; and more expensive ship construction and operation costs that lessen the economic viability of the route. Technological advances and infrastructure investments may ameliorate navigational challenges, enabling increased shipping of natural resources from the Arctic to global markets. At this point in time, these conditions will only enable the NSR to become a seasonal complement, rather than competitor, to the Suez Canal.

Finally, it is usually ship-owners and ship-builders from China, Korea, Singapore and Norway who speak with vision for bringing about regular continent-to-continent container trade. Thus, when it comes to predicting which mariners will truly pioneer regular trans-Arctic shipping, it is sensible to bet on the upstart rather than the big firms.¹²⁴

6 Technology in the Arctic

Energy companies face monumental technological challenges in their quest for offshore arctic resources. Development vessels must be able to reliably operate in one of the harshest climates on the planet. Regions of the arctic are characterized by frigid temperatures that approach -40 degrees Fahrenheit, high winds that can reach 100 miles per hour, long periods of near-total darkness, and an ocean that is covered by layers of ice for most of the year.¹²⁵ In fact, ice conditions alone can largely determine the development plan for a region, including the operating window, platforms design, ship reinforcements, and pipelines burial depths.

Regional conditions within the Arctic Circle can vary widely, which can significantly influence each country's development plan. For example, Norway's current arctic activities are located in a nearly ice-free region of the Barents Sea, allowing the country to operate all year using mostly conventional offshore technologies. On the other side are extreme areas like the Pechora Sea, where thick layers of ice limit Russian operations to 4-5 months per year. In between is a range of varying conditions that necessitate different technologies. For example, the Beaufort Sea is infested with pack ice, which necessitates the use of upgraded ice class vessels and icebreakers. However, the area is mostly free of icebergs, which diminishes the need for deep pipeline burial.

Despite being under development for decades, there are no technologies specifically designed for Arctic operations. So far, developments in the Arctic have been performed through conventional means that were modified to withstand harsh conditions. All Arctic drilling activities have been carried out to date have used upgraded rigs that were built over 30 years ago. This is not surprising given the industry's limited experience in arctic waters. In essence, offshore Arctic drilling is in a similar position to conventional offshore drilling nearly a century ago, with substantial opportunities for technological improvements to address the need for safer operations, environmental protection and cost effectiveness. To reach the commercial stage, the industry

must undergo evolutionary advances (through experience) and achieve technological breakthroughs (through research and investment) in all stages of development.¹²⁶

6.1 Exploration and development stage

The majority of current activities in Arctic waters are in the exploratory phase. Commonly reported figures on the size of Arctic resources are obtained from the US Geological Survey's Circum-Arctic Resource Appraisal (CARA), which utilized a geology-based probabilistic methodology and analog modeling to estimate the occurrence of undiscovered oil and gas resources.¹²⁷ The first step in developing a field is to obtain a better picture of underground conditions and resource size, which is carried out through seismic surveys. Like most arctic activities, seismic imaging is performed using conventional technologies modified to handle arctic conditions. The presence of ice represents the main challenge to seismic surveys, as it can distort the sound waves and create an inaccurate picture. As a result, seismic surveys have been limited to conventional 2D and 3D techniques, as most advanced seismic technologies have not been adapted for utilization in the Arctic (including time-lapsed seismic, which is essential for managing geological risks and increasing drilling and production success).¹²⁸

Drilling operations in the Arctic is also challenged by the ice conditions. Platforms must be capable of withstanding substantial ice loads, which are generally stronger than loads caused by wind or waves. As a result, fixed exploration rigs must be reinforced to resist sea ice, while floating rigs will also require a rigorous ice management plan to detect oncoming ice and the capability to quickly disconnect from a well in case of unavoidable icebergs. Current exploration activities are predominately performed using floating vessels due to the industry's gradual movement into deeper arctic waters. There is a limited number of rigs available today capable of operating in the arctic, as the industry lacks the economic incentive to invest in building new ones. Once newly constructed arctic-class rigs are in demand (which are estimated to cost \$1.5 to \$2 billion), they will greatly benefit from three decades of experience that will target improvements in the areas of winterization, automation, ice load resistance and station-keeping.¹²⁹ For example, an Arctic-specific platform design will maximize the efficiency of heating the rig through improved insulation of machinery. Overall, platform upgrades are expected to target technologies that can safely extend operating periods in ice infested waters, which will have a direct impact on project feasibility.

6.2 Production stage

Current production of Arctic oil and gas is mostly limited to onshore fields. The only exceptions are Norway's Snøhvit gas field in the Barents Sea and Russia's Prirazlomnoye oil field in the Pechora Sea. Norway was the first country to unlock offshore Arctic resources. Despite being located in ice free water, Snøhvit was marred by technological challenges, regulatory hurdles, environmental opposition and costs overruns that resulted in substantial delays (it took 18 years from the discovery of the field to reach a final development decision).¹³⁰ Ultimately, Snøhvit started producing in 2007 using subsurface facilities that piped the gas 143 kilometers to the shore where it is liquefied and shipped on LNG tankers.¹³¹ Russia's foray into arctic production was even more challenging, as Prirazlomnoye suffered from multiple delays caused by political interference, design changes, technical difficulties, construction problems and environmental protests. Estimates for capital expenditures nearly quadrupled from \$1.1 billion in 2003 to \$4

billion in 2011.¹³² Ultimately, the field started producing at the end of 2013 and is expected to peak by 2020 at a meager 120,000 b/d (roughly 1% of Russia's current oil production).¹³³ Exports totaled 2.2 million barrels in 2014, which were shipped using an ice-class tanker to northwestern Europe.¹³⁴

The choice for production method for offshore fields is typically limited by the distance to the shore. However, arctic conditions present new challenges that could sway the decision one way or the other. The use of floating production ships will require measures similar to those for exploration platforms, including ice-class upgrades, disconnection capabilities and an ice management system. In addition, tankers will have to be accompanied by icebreakers during a limited operating schedule. However, fields that are close to the shore can be produced throughout the year using subsurface pipelines, which are susceptible to damage by Arctic conditions. Threats to pipelines include ice scour (damage by icebergs), strudel scour (damage by water drainage through the seabed), and upheaval buckling (damage from differences between installation and operating temperatures).¹³⁵ While the main prescription to address these (and other) challenges is to bury the pipeline "deep enough," it can be prohibitively costly, impractical, and impossible to accomplish in some areas due to the presence of permafrost, complications with trenching and a limited operating period.¹³⁶

6.3 Unmanned aerial vehicles (UAVs)

The utilization of Unmanned Aerial Vehicles (commonly referred to as drones) in developing the arctic will provide immense technical and logistical benefits that can improve project safety and economics. UAVs are a relatively mature technology that can be implemented today in some regions of the Arctic. For example, they can cost-effectively provide real-time imaging and mapping data to petroleum engineers and ship navigators that were previously unavailable due to limited satellite coverage in the region.¹³⁷ Ultimately, drones can carry out activities in all stages of resource development, such as inspecting pipeline infrastructure, monitoring oncoming ice conditions, detecting oil leaks, and even making deliveries to remote oil rigs.

Naturally, UAVs must be capable of withstanding the considerable challenges that arise from flying in Arctic conditions. One such challenge is ice fog, which consists of ice crystals that envelope all objects in their path.¹³⁸ While this represents a problem for all aircrafts, it is especially troublesome for drones as they are too small to carry the de-icing equipment traditionally used in commercial airplanes. Other potential issues facing drone use include partial satellite coverage, short operating periods and limited flying range. However, the main factor impeding the industry's adoption of UAVs are not technical, but rather regulatory (particularly in the U.S.). Use of drone in the U.S. Arctic has been mostly limited to strategic and academic institutions, which in some cases carried out operations on behalf oil and gas companies. Over the past 2 years, the Federal Aviation Administration (FAA) has been slowly relaxing its ban on commercial drone use, and continuous demonstrations of safe arctic UAV operations is expected to prompt the FAA to institute new regulations for commercial drone use in the arctic. In fact, the first permit allowing commercial UAV operation over land was issued to BP in June 2014, which authorized the company to survey its pipelines, roads and equipment at Alaska's Prudhoe Bay.¹³⁹ Eight months later, the FAA proposed new regulations that would allow companies to fly drones, but it could take years before they are enacted.¹⁴⁰

6.4 Conclusion

The allure of the Arctic is not only its size, but also that it is virtually untapped. Compared to oil and gas resources in the rest of the world, Arctic developments are still in their infancy. The next decade should see the industry undergo evolutionary advances through increased operating experience and achieve technological breakthroughs through research and investment. Project economics will be boosted once new arctic-class rigs that benefit from three decades of experience are constructed. Newly developed technologies are expected to primarily target means of extending the window of operations in the harshest regions, as they have the potential of unlocking large resources that were considered uneconomical.

7 Arctic Infrastructure

The Arctic suffers from a lack of existing infrastructure due to its remote location and the harsh conditions. The lack of population centers and, until recently, low economic activity, has meant that much of the Arctic has insufficient infrastructure including, but not limited to:

- Transport infrastructure (roads, ports, airports);
- Power supply and communication networks;
- Ice-breaking and ice-capable vessels;
- Modern charting and surveying;
- Oil-spill response infrastructure.

Despite this, there is an optimistic view of infrastructure build-up going forward, as it is expected that significant investment in these structures will grow hand-in-hand with successful exploration of oil and gas resources in the region. Our outlook for future investment in Arctic infrastructure by country is summarized in the table below.

Table 5: Infrastructure Outlook by Country

	<i>Ports, airports, and roads</i>	<i>Oil spill response infrastructure</i>	<i>Ice-breakers and ice-capable vessels</i>
<i>Russia</i>	<i>Strategic build-up of infrastructure underway, particularly in Yamal region</i>	<i>Weak historically but showing signs of improvements</i>	<i>Fleet of 34 ice-breakers, plans to add more</i>
<i>U.S.</i>	<i>No large ports, few airports</i>	<i>Willingness to improve existing infrastructure</i>	<i>1 operational heavy-duty ice-breaker, unclear plans to add more</i>

Greenland	<i>No large ports, several airports. 80% of land covered by ice-sheets</i>	<i>Stated intention to improve oil response capabilities</i>	<i>Denmark has limited ice-breaking capability (4 light-duty)</i>
Canada	<i>Few cities & ports. Building up considered costly, no major development projects planned</i>	<i>Strong existing regulation but remoteness poses serious problem</i>	<i>Several operational ice-breakers</i>
Norway	<i>Several large ports and airports</i>	<i>Strong existing regulation and infrastructure</i>	<i>Ice-breaking not necessary in areas where drilling is allowed</i>

In areas where commercial production is ongoing, or expected in the medium term signs of infrastructure investment are visible. Russia and Norway stand out as two countries that are leading Arctic infrastructure development. In part due to their ongoing Arctic offshore activity and milder conditions in the Barents Sea, Norway already has over fifteen airfields, three medium- and large-sized ports and one population center near its Arctic coastline. Russia has made infrastructure a strategic priority, approving a “Strategic Programme for Arctic Development to 2020” which includes the establishment of search and rescue stations as well as transport and communications infrastructure.

The bulk of the infrastructure deficiencies in the U.S., Russia, and Norway to be overcome in the next 5-10 years as more exploratory activity is observed in these countries. Private-public partnerships are likely to be the preferred method of financing capital-intensive projects such as airfields, ice-capable vessels and deep-water ports. One such example of this is construction of the Sabetta LNG Port, designed to support the Yamal LNG project, which was funded by a partnership with the Russian government, who contributed 65% of the capital needed to cover construction costs. Although public partnerships in Russia are no surprise given the close relationship between energy companies and the state, this is a good example of how Arctic governments will lead infrastructure investments. In Canada, for example, Iqaluit International Airport in Nunavut is also being re-developed via a public-private partnership between the Government of Nunavut and a consortium of private companies.¹⁴¹

What follows is a short analysis of key issues facing some or all of the Arctic nations and their future outlook based on our research.

7.1 Transport infrastructure

Russia and the U.S. have a relatively favorable outlook for transport infrastructure, with Norway building on its existing infrastructure development program. As part of its strategic Arctic plan and the modernization of its military, Russia has announced that it is constructing sixteen deep-water ports and thirteen airfields along its lengthy coastline.¹⁴² Although we do expect Russia to invest significantly in its infrastructure in the coming years, experts have questioned the financial feasibility of this scale of development under Russia’s current economic conditions, so these

claims must be partly discounted as rhetoric. In the U.S., plans to build Alaska's first deep-water port in Nome, Alaska are viewed as a sign of renewed commitment to this region's development.¹⁴³ Policy-makers and analysts have also called for a comprehensive Arctic Strategy that would include government-supported infrastructure development,¹⁴⁴ but the likelihood of such a programme is still uncertain.

The outlook is less optimistic for Canada and Greenland, where a mixture of very high costs, reluctance to use public funds, and particularly harsh conditions will, in our view, prevent a significant build-up. Canadian policy-makers have long considered improving port infrastructure and other transport infrastructure in their Arctic territories, but high costs have thus far hampered their efforts and restrained government spending is expected to continue limiting infrastructure build-up in Canada.¹⁴⁵

7.2 Oil-spill and emergency response

Oil-spill and emergency response infrastructure is another important requirement for further off-shore exploration in the Arctic. Norway is well-prepared for this already, with guidelines and regulations in place as well as a year-round helicopter base in Svalbard, to ensure a speedy response. Other countries are less well-equipped. It would take Canadian responders, for example, over two-days to reach a search-and-rescue incident.¹⁴⁶ Similarly, in the U.S. a report by the National Research Council on *Responding to Oil Spills in the U.S. Arctic Marine Environment* found that the U.S. is severely unprepared to respond effectively to an oil spill in the Beaufort or Chukchi Seas.¹⁴⁷ Distance from the shore remains an impediment: the closest U.S. Coast Guard base to offshore sites, in Kodiak, Alaska, is over 1,000 miles away from the northernmost town of Barrow and even further from where drilling would take place.

7.3 Charting & surveying and ice-breaking capabilities

Research has shown that only 1% of the U.S. Arctic navigable waters have been surveyed and charted with modern technologies,¹⁴⁸ and this figure is similar for the Canadian and Russian Arctic. Despite this, we found that all Arctic nations have plans to modernize the charting and surveying of their waters in the future, particularly given the increased maritime traffic expected as the ice recedes. Increased activity will also require effective icebreakers and/or a fleet of ice-capable vessels. Although ice-breaking is not required in much of the milder Barents Sea and some parts of the U.S. Arctic, exploration and production around Canada, Greenland, and Russia will need this capability to ensure safe and successful exploration and production activity. Russia has an extensive ice-breaking fleet, with more ice-breakers than all other Arctic nations combined, and is expected to remain a leader in this aspect. The U.S., on the other hand, only has one operating icebreaker and no concrete plans to add to its small fleet due to government budget constraints.^{149,150}

7.4 Asian investment in the Russian Arctic

Russian Arctic development has been significantly hindered by Western sanctions triggered by the crisis in Ukraine. Sanctions prevent Western companies from investing in Russian oil and gas companies and exporting oil industry technology, equipment and services. Asian capital investments have in part made up for the reduction in U.S. and European investments, and Chinese interest in the region has drawn attention. This interest is not surprising given the large

size of China’s economy and the vulnerability inherent in its large reliance on energy imports. China considers itself a “near-Arctic state” and it made repeated attempts to be admitted to the Arctic Council before finally gaining observer status in 2013. Interestingly, the Chinese views the Arctic as an international zone, whose issues should be considered by the global community as a whole.¹⁵¹ Partly as a result of this geostrategic concern, Chinese state-owned companies have invested in Russian Arctic projects and have obtained 20-30% stakes in several joint ventures. Although Russia has historically been reluctant to accept major investment by Chinese players, the pressure of sanctions has persuaded them to consider giving majority stakes to Chinese companies in key strategic fields.¹⁵² Other Asian nations, namely India and Vietnam, have also made significant agreements, as summarized in the Table 6 below.

Although these investments partly compensated for the decline in available capital from the U.S. and Europe, it is important to note that there are significant differences in the quality of these partnerships¹⁵³. Firstly, financing from Asian sources is considerably more expensive than the Western counterparts, which may limit the financial feasibility of some projects. Secondly, the technical and operational expertise of these partners is much less advanced, constraining the strategic rationale for the partnership. More importantly, the lower environmental standards that Asian partners adhere to relative to Western companies may expose Russian Arctic projects to greater environmental risk.

Table 6: Asian Arctic Investment

<ul style="list-style-type: none"> ● CNCP owns a 20% stake in Yamal LNG (January 2014) ● Rosneft and CNCP have an umbrella agreement to explore part of Barents Sea and Pechora Sea (May 2013)¹⁵⁴ ● Sinopec owns 25.1% of Veninsky block of Sakhalin-3, 74.9% owned by Rosneft 	<ul style="list-style-type: none"> ● Putin and Modi agreed to work together on projects on the Russian Arctic Shelf (December 2014)¹⁵⁵ ● ONGC Videsh owns 20% stake in Sakhalin-1 	<ul style="list-style-type: none"> ● PetroVietnam has a 49% stake in Gazpromviet, a joint company with Gazprom to jointly develop two oil, gas, and condensate fields in Yamal-Nenets¹⁵⁶ ● Petrovietnam has signed an agreement to develop the Dolginskoye offshore field with Gazprom Neft (November 2014)¹⁵⁷
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8 Tax Regimes and Investment Incentives

There are two major fiscal arrangements used in the taxation of oil and gas producing activities: those which are **Concession** based and as such focus on a tax and royalty system; and those which are contract based and as such represent a defined contractual arrangement between the resource holder and the contractor, most commonly in the form of **Production Sharing Agreement (PSA)**.

Within the arctic nations, Russia has both concession and PSAs, besides Russia, Canada, US (Alaska), Norway and Greenland have concession based taxation. At its most basic, concession regimes describe a system where the oil industry is granted the rights to prospect for resources within a defined onshore or offshore acreage. The concession holder takes ownership of all minerals found on that acreage, but pays a percentage of their value upon extraction to the government together with a modest annual fee to retain the acreage. Where under a concession system the concession holder has the economic right to all of the oil produced within the concession but is liable to pay tax and royalty on the proceeds, in PSC the mineral resource remains the property of the state.

8.1 Canada

The fiscal regime that applied to the oil and gas industry in Canada consists of a combination of royalties and income taxation (concession); profit-based. These include:

- Crown royalties applicable to crown lands, at a rate of 10% to 45%; special regime for oil sands and offshore production; freehold royalties vary from lease to lease;
- Federal corporate tax rate at 18% in 2014 for income; state tax at 10% to 16% will be imposed, depending on the province;
- Depreciation is 4 years. Depreciation, depletion or amortization recorded for financial statement purposes is not deductible; rather, tax-deductible capital allowances specified in the Income Tax Act are allowed;
- Investment incentives include investment tax credits (ITCs), research and development (R&D). Federal income tax payable may be reduced by ITCs of 10% of qualifying expenditures in the Canadian Atlantic (including the offshore area of the Canadian Atlantic). This ITC was reduced to 5% for 2014 and 2015 and then to nil after 2015. Qualifying expenditures include, among other things, the acquisition of machinery, equipment and buildings primarily for use in oil and gas exploration or production. Generally the R&D ITC is used to offset taxes otherwise payable. Unused R&D ITC may be carried backward for up to 3 years and forward for up to 20 years. (Also for business losses referred to as non-capital losses)

8.2 United States

The fiscal regime that applies to the petroleum industry in the U.S. consists of a combination of corporate income tax (CIT), severance tax and royalty payments. Royalties are revenue based while CIT is on profits. Consequently, as the oil price rises, government's share of the barrel remains broadly constant, with full upside accruing to the contractor.

The U.S. regime includes:

- An offshore royalty of 18.75% effective for 19 March 2008 auction,¹⁵⁸ 16.667% in certain previous lease auctions and 12.50% for older leases;
- A competitive bidding process for offshore license blocks;
- A CIT rate of 35%,¹⁵⁹ which is the highest among arctic nations. It is important to be aware that the U.S. does not apply ring fencing in the determination of CIT liability. Profit from one project can offset losses from another project held by the same tax entity, and similarly, profits and losses from upstream activities can offset downstream activities or any other activities undertaken by the same entity;
- Depreciation years are 5 years for offshore contract drillers and 7 years for offshore oil and gas producers; Offshore platform is also 7 years;
- Incentives of the U.S. are favorable, including capital allowances such as accelerated depreciation standard (D), accelerated write-off for intangible drilling costs (E), and investment incentives such as carrying forward losses for 20 years (L), and R&D incentives (RD).

8.3 Norway

Norway has high but efficient taxes with relatively low risks. A company involved in extractive activities is subject to a marginal tax rate of 78% (27% ordinary corporate income tax and 51% resource rent tax (RRT), with zero royalty. Costs are deducted before corporate income tax is paid and a part of the profit is shielded from the RRT through an uplift (5.5% *4=22pst of the investment). However extractive companies are subject to a high Hydrocarbon tax of up to 50% - 70%, which is deducted before corporate tax is imposed.

If the company does not have any profit to deduct from then the company can be reimbursed by the Ministry of Finance, meaning it only has to pay 27% of the cost to drill a hole. In addition, there is no auction or upfront cost for Production Licenses – this is part of the Government Take and favorable for the companies;

The incentives within the system allow losses from offshore activities to be carried forward indefinitely with interest (L); capital allowances include that offshore investments are depreciated over 6 years, and an additional 22% uplift applies against RRT for upstream activities.

Table 7: Norwegian Taxes Formula

Taxes Formula
Operating income (norm prices)
Operating expenses (-)
Linear depreciation for investments (6 years)(-)
Exploration expenses, R&D and decom. (-)
CO2-tax, Nox-tax and area fee (-)
Net financial costs (-)

Corporation tax base (27%)
Uplift (-)
RRT (51%)

8.4 Russia

Russia has a totally different fiscal and taxes regime, which consists of a combination of Mineral Extraction Tax (MET), corporate profits tax and export duty. Russian tax-resident companies are subject to profits tax on their non-exempt worldwide profits. Foreign companies operating in Russia through permanent establishments are subject to profits tax on profit received through those permanent establishments. The system involves:

- Variable MET (is typically revised annually) depends on
 - Crude Oil – RUB 493 (US\$14) per tonne adjusted by coefficients
 - Natural Gas – RUB 700 (US \$21) per 1,000 cubic meters
 - Gas Condensate – RUB 647 (US\$19.40) per tonne
 - In 2014, MET is partly or fully not payable on oil extracted from oil deposits located to the north of the Arctic Circle within the boundaries of the internal sea waters and the territorial sea and on the continental shelf of the Russian Federation up to a cumulative extraction level of 35 million tonnes, but not for more than 10 or 15 years, depending on the type of the license issued to an extracting company.
 - According to Ernst& Young's Oil and Gas Tax Guide 2014, "*deposits lying at least 50% within the Kara Sea, the northern part of the Barents Sea (at or above 72° latitude) and the eastern Arctic – the MET rate is 1% for extracted natural gas; 4.5% for other hydrocarbons extracted by companies who do not have the right to export LNG to world markets that is produced from natural gas produced at the North Offshore Hydrocarbons Deposits (NOHD); and 5% in other cases. These rates apply for 180 months after begins but no later than March 31, 2042.*"¹⁶⁰
- Export Duty (is changed every month) is high:
 - Crude Oil – 35% to 59%, linked to oil price
 - Natural Gas – 30%
 - LNG – 0
 - Ernst& Young note that: significant changes exempt crude oil (including condensate mixtures), natural gas condensate, liquefied and gaseous natural gas and natural gas liquids.¹⁶¹
- A profits tax rate of 20%. This rate can be reduced for particular categories of taxpayers but not to less than 15.5%. Losses can be carried forward for 10 years;
- No ring fencing like the U.S.

PSAs, such as in Sakhalin II, contracts are structured such that, depending upon the Internal Rate of Return (IRR) that the project has achieved, the share of per barrel oil profits will vary. As with most PSAs they typically allocate a higher share of revenues to the contractor through the early phases of a project but a greater share to the state as the contractor's capital is recouped and the rate of return on the project rises. The advantages of IRR based contracts are that they are generally geared towards rewarding the contractor first and directed at the achievement of an acceptable level of return. As such they are very protective of a company's upfront capital investment (particularly at times of cost inflation). The disadvantage is that once that return has been achieved the change per barrel allocation tends to be quite severe. Additionally, depending on the proportion of initial revenues that are available for cost recovery they can mean that the state receives little by way of revenue through the early years of a project. This has led to conflicts between state and contractor, particularly where cost increases have also been evident.

Table 8: Sakhalin II Tax Structure

Royalty	6% revenues
Capex uplift	None
Cost oil	Capex over 3 years with c/f
Cost recovery	100% revenues
Profit oil split	IRR based
Max (contractor/State)	90/10 @ <17.5%
Min (contractor/State)	30/70 @ >24%
Tax rate	32%
Companies	RDS, XOM
Comments	State revenue is negligible. Very favorable for contractors

Source: Deutsche Bank, Wood Mackenzie

There is a group of experts (including Andrey Konoplyanik) who are trying to encourage Russian government to turn to the PSA formula, which they see it as beneficial for Russia. However, if this happens all the PSA terms will be different, bringing them more in line with international standards. Meanwhile, on March 11, 2015 Russia's Deputy Prime Minister Arkady Dvorchich led discussions about the introduction of a tax on financial results (TFR) for the oil industry to replace the MET. The new tax would be placed on profits from oil sales. Pilot project will test this new format from 1 January 2016.¹⁶²

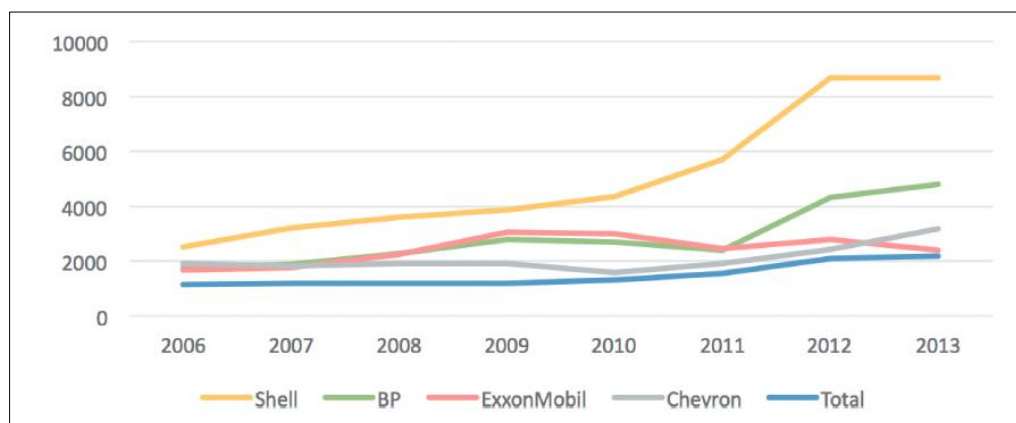
Thus there are dynamic changes in Russia's fiscal regimes with regard to offshore drilling especially in the arctic. Exemptions and deductions depend on the negotiation between parties and countries. Therefore investors should pay close attention to this quickly changing area of Russian tax law.

8.5 Capital expenditures

On 29 Jan. 2015, Royal Dutch Shell confirmed that it intends, subject to regulatory approval, to resume its U.S. Arctic drilling program at a cost for 2015 of at least \$ 1 billion.¹⁶³ Industry attitudes towards Arctic drilling have changed. Statoil,¹⁶⁴ Conoco-Philips,¹⁶⁵ and Total¹⁶⁶ have stepped back from U.S. Arctic oil projects for cost and regulatory reasons. In Dec. 2014, Chevron put its plans to drill in the Canadian Arctic “on hold indefinitely” owing to economic uncertainty in the industry.¹⁶⁷ Yet, despite announcing cuts to capital expenditure, Shell remains committed to its intensely scrutinized and high-cost, high-risk Arctic program.

Shell’s on-going commitment to the Alaskan Arctic is part of a company-wide strategy with a heavy focus on exploration. Shell has consistently outspent its peers in exploration. According to Shell’s annual reports, between 2010 and 2012 the company doubled its exploration spend to US\$8.7 billion.

Figure 8: Exploration Expenditures by Company (US\$ Million)

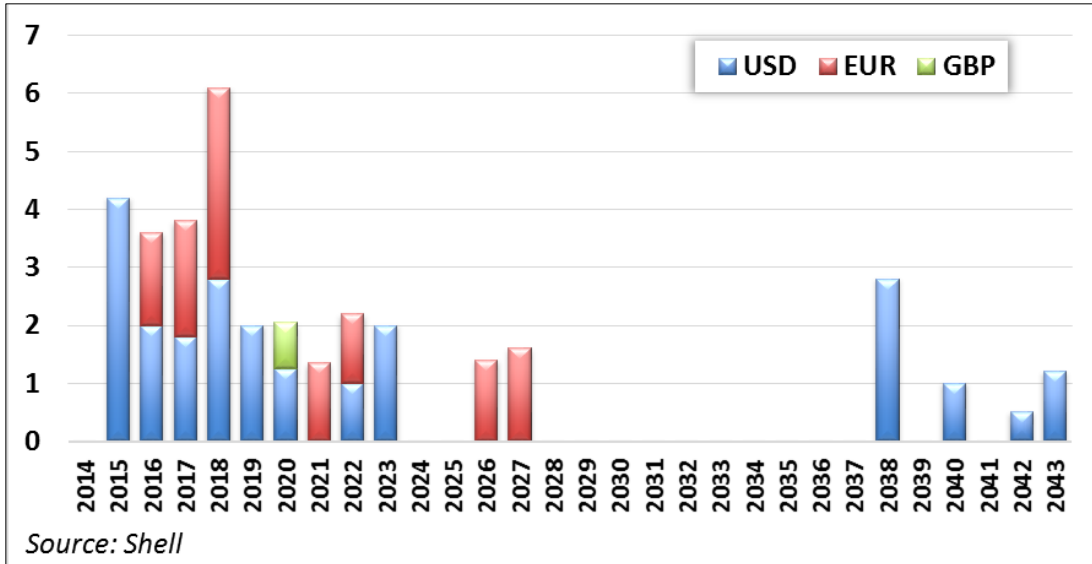


Source: IOC’s Annual Reports

8.6 Project financing

There are two ways to finance for arctic especially oil projects.¹⁶⁸ The first uses a company’s own money, the free cash flow, while the second is to source debt. Usually companies can borrow the money from financial institutions with interest rate. Because of potentially high risks no financial institution is going to provide capital. So the only other way for companies to finance Arctic projects is to issue corporate bonds Shell’s current outstanding corporate bonds issues are up to \$34 billion.¹⁶⁹ The maturity of the bonds issues by Shell are in Figure 9.

Figure 9: Maturity profile of Shell bonds (\$ Billions)



Companies also need to keep in mind that junk bonds (corporate bonds with low credit ratings) will increase financing cost in the future. For example, corporate bonds issued by Rosneft are rated as negative by S&P (the highest rating is BB+ by Bloomberg). However unfortunately it details on the finances committed for specific exploration projects are not available.

9. Conclusions

This study sought to assess and weigh the energy security and commercial opportunities in the Arctic against the environmental, technical and geopolitical obstacles presented by resource extraction in the region, describing the characteristics of the hydrocarbon industries in the different Arctic countries.

With a rapidly changing climate, the circumpolar nations are now adjusting their policies to meet the more navigable and less hostile Arctic. The allure of the Arctic is not only its size, but also that it is virtually untapped. Compared to oil and gas resources in the rest of the world, Arctic developments are still in their infancy. The next decade should see the industry undergo evolutionary advances and achieve technological breakthroughs through operation experience and research and development. Project economics will be boosted once new Arctic-class rigs are constructed and newly developed technologies are expected to primarily target means of extending the window of operations in the harshest regions, as they have the potential to unlock large resources that are currently uneconomical.

The Arctic suffers from a lack of existing infrastructure due to its remote location and the harsh conditions. Nonetheless, provided there are new resource discoveries and development, it is sensible to expect that infrastructure will follow. With respect to the transportation of fossil fuel products, Arctic shipping is suitable for point-to-point services, offering a good value proposition for transportation of oil and gas. However, further development of the Arctic seaways depends on a number of complex technological, climatological, and legal factors that would only make them fully operational in decades to come.

It is clear that there is not, nor there will be, a unified Arctic. Instead three distinctly different Arctic regions based on climate conditions, stage of technological development, and resource prospects will emerge: the Russian Arctic, the “New World” Arctic, and the Norwegian Arctic. Furthermore, Western sanctions against Russia are likely to result in the emergence of two separate, yet parallel offshore energy industries: an Eurasian industry and a Western Industry.

The Eurasian Arctic industry will be primarily developed by joint ventures with state-run oil companies from developing countries like India, China and Vietnam. There, technologies, finance and operational knowhow will need to be developed from scratch, requiring real commitment to build these capabilities. The Western industry will be led by Norway and the United States. While the former will seek to see an expansion of offshore activity to maintain its market share and benefit from its solid regulatory regime and industry, the latter has the greatest chance of revitalizing the Arctic offshore industry: estimations indicate that the largest amounts of oil lie under the Alaskan Arctic. In fact, even though from a strategic perspective the Arctic does not feature heavily on the U.S. political agenda, the economic benefits of the region’s oil are considered important.

Contributing to this divide are the deteriorating political relations between Russia and the other Arctic countries, which is being compounded by mounting Russian military activities. Despite the technical, operational and financial challenges of Arctic development, Russia is preparing to transform its expansive Arctic territories into a significant economic, political and military powerhouse.

From an environmental perspective a divided approach raises concerns. The lower environmental standards expected in the Eurasian Arctic will increase the risk of an oil spill in Russian waters. In addition, a lack of coordination will inhibit response efforts and may lead to greater environmental damage. A focus on more stringent regulations and efforts to improve prevention and response technologies are expected in the Western Arctic and will help to reduce environmental risks.

9.1 Recommendations

For entities interested in investing in Arctic regions, there are a number of recommendations that would reduce the risk of environmental, social and geopolitical fallout.

Establish Communications & Partnerships with Environmental NGOs

Purpose: To allow the firm to identify cost effective methods to protect local ecology and promote ecologically sensitive economic activities.

Oil and gas operations can have a variety of effects on local ecology. It is in the interest of major investors to hold dialogue with local wildlife experts to ensure that if there are cost effective methods to prevent a project from harming the local ecology, the financier advocates for the implementation of such methods. This would involve stakeholder meetings with a variety of environmental NGOs that are dedicated towards protecting wildlife and are willing to work with investors to report on possible solutions that can at least alleviate or eliminate any damages to local ecology.

These stakeholder meetings should include representatives from an accredited international wildlife organization, representatives from a local wildlife advocacy group and local individuals.

For major oil and gas projects, meetings should be held to build a consensus on future plans for exploration or exploitation and to develop an action plan that will minimize environmental damage. Monitoring the implementation of the plan and the effects of the project should be reported at a yearly basis.

Each mitigation program or solution the bank promotes should be reported by the company to build its credentials as an environmentally sensitive organization and should be a part of its PR portfolio.

Advocate for Firm but Supportive Regulatory Regimes

Purpose: To minimize industry risk

The risk of oil spills and the disastrous political fallout that may follow should make any investor wary of a poorly regulated industry. Investors should recognize that by promoting and supporting strong regulatory bodies, they are protecting themselves from the risk of an industry-wide disaster that could severely disrupt their investments. Deepwater Horizon has demonstrated how an oil spill thousands of miles away can drastically increase the price of operations in the arctic region and force major delays in offshore projects. It therefore would be best that major financial institutions support a firm regulatory body that is well staffed, equipped and trained to be able to not only monitor oil and gas activities but provide the support necessary to ensure a safe and low risk operation. This could come in the form of advocacy for increased funding of training projects and equipment for regulators or providing financial support directly.

Support Global Multilateral Dialogue

Purpose: To minimize geopolitical and environmental risks.

Because of rising tensions in Europe, the arctic may become a more risky region politically and environmentally. Investors should recognize a lack of dialogue between arctic states could have adverse impacts on economic development in the Arctic. Two key areas of danger includes the risk of oil spills in a more lax regulatory state increasing costs and hurting public perception in other states and the risk of geopolitical incidents harming economic growth.

Organizations like the Arctic Council have been created to ensure a multilateral platform for dialogue amongst different stakeholders. So far, the Arctic Council has managed to build consensus on low hanging fruit such as search and rescue. Investors should promote stronger cooperation amongst state actors with focus on both environmental regulations and settling geopolitical disputes. They can accomplish this by a) building teams of analysts who can identify opportunities to increase global cohesion and methods to ease international tensions; and b) endorsing states to commit more substantial powers towards multilateral forums like the Arctic Council.

Rating System for Operators

Purpose: To identify the best practices & reward those who adopt them.

Social Development Plans

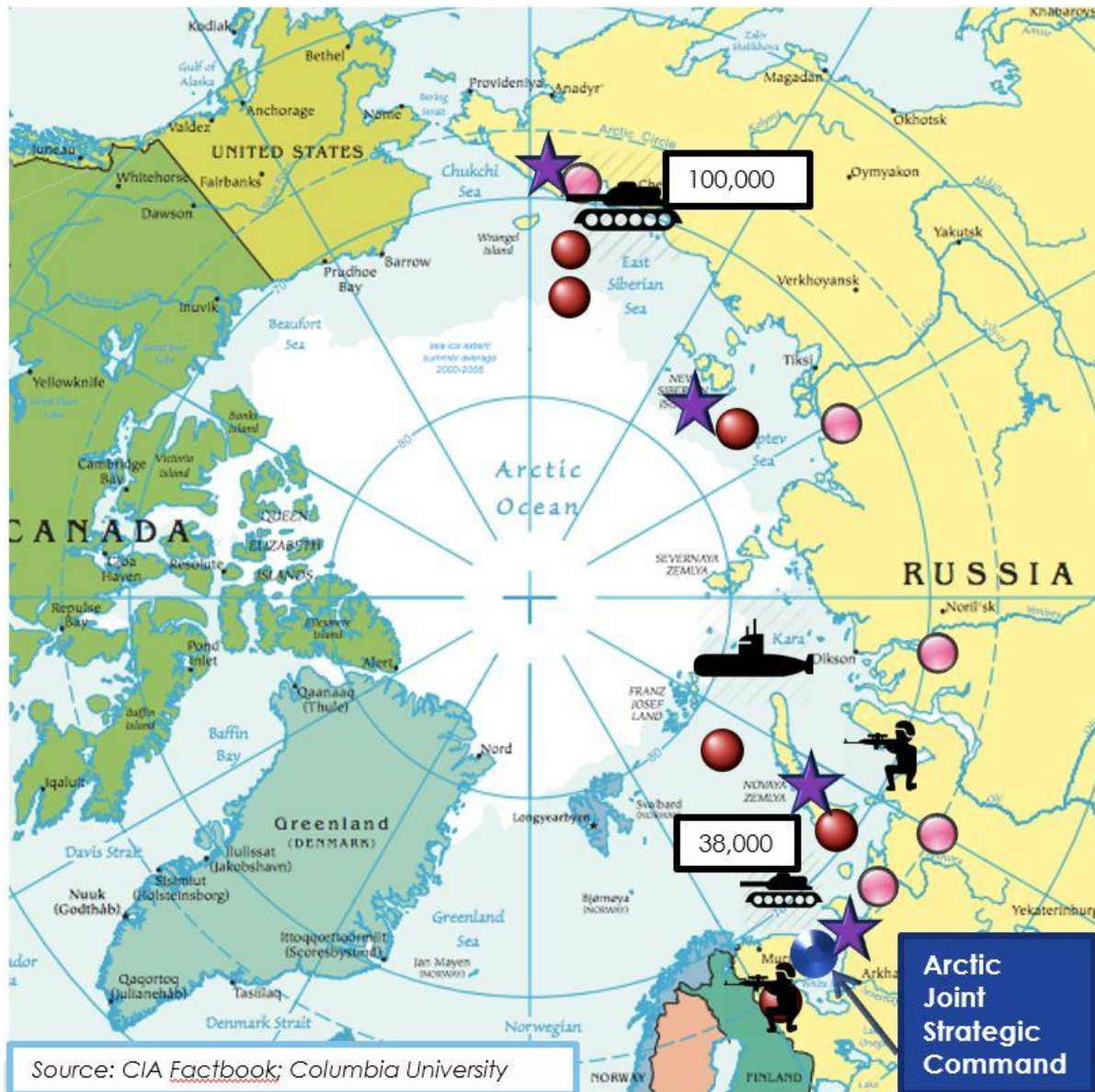
Purpose: To lower social risk and increase opportunities.

Major investors who plan to become involved in resource extraction should also be interested in ensuring sustainable economic development in the region of operation. In many cases, resource extraction has resulted in unbalanced economic development that prevents the area from functioning properly once the industry leaves. Major financial institutions should identify ways to see that economic activity increases the value of the local region. This is important as it not only decreases the risk of social unrest, but it also provides investors with additional economic opportunities.

Major financiers should focus on building development teams that are meant to identify areas of sustainable economic growth that could be built on revenues from resource extraction and should make strategic moves to finance these industries.

APPENDICES

Appendix A: Russian Military Activity in the Arctic



Explanation: The red dots (Rogochovo at Novaya Zemlya, Ostrov Greem Bell and Nagurskoye at Franz Josef Land, Kotelny at the New Siberian Islands, Wrangel, Cape Schmidt), are air bases that are claimed to have been reopened. The pink dots (Naryan Mar, Tiksi, Vorkuta, Alykel, Anadyr) are expected to open during 2015. The tanks indicate major military exercises with the number of participant soldiers in the white boxes. The two soldiers represent two Arctic infantry brigades, one established in Alakurtti by the Finnish border, and one will be established in 2016 in Jamalo Nenets. The submarine shows the new nuclear engine ballistic missile submarines that will be placed in Arctic waters. The violet stars are installed/planned air defense systems (MiG-31 'Foxhound' interceptors by Murmansk, S-400 anti-aircraft at Novaya Zemlya, Pantsir-S1 air defense systems at Kotelny, drone base at Anadyr). The blue dot is the headquarters of the new Arctic Joint Strategic Command in Severomorsk, which is also the home of the Northern fleet.

Appendix B: Tax Regime Framework

		Canada	US (Alaska)	Norway	Greenland	Russia (onshore)	Russia (offshore)
<u>Fiscal Basis/Agreements</u>		Profits-based Concession				Revenue-based Concession/PSC	Profits-based Concession/PSC
<u>Key Taxes Features</u>	<u>Royalty</u>	10-40%	18.75%	0 (51% RRT)	NA	Variable (MET)	Reduction of MET
	<u>Corp tax</u>	18%	35%	27%		24%	
	<u>Depreciation</u>	4 yrs	7 yrs	6 yrs with 4 yrs uplift		Variable(case by case)	
	<u>others</u>	10% state tax	NA	50%- 70% HC tax		Up to 65% export tax	Exemption of export taxes
<u>Investment Incentives</u>		RD	D, I, RD	O, U	E	G, TH	Capital allowances & uplifts; royalty reductions, no export duty, exemptions for import duties & property tax
<u>Loss carryforward /carryback period (yrs)</u>		20/3	20/2	Indefinitely/0	Indefinitely/0	10/0	70/0

Notes: RD-research and development expenditures deductible; O-offshore investments depreciation over 6 years; G-exploration expenditures deductible over 12 months; D-accelerated depreciation; E-immediate write-off of exploration expenditures; U-additional 30% uplift on offshore investments in computing the RRT; I-accelerated write-off for intangible drilling costs; TH-10-15 year tax holidays for certain arctic deposits
 Source: Global oil and gas tax guide, 2014, Ernst&Young

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LIST OF INTERVIEWEES

Name	Organisation
Kristian Åtland	Senior Senior Research Fellow, Norwegian Defense Research Institute
Richard Hawkins	Formerly Manager (Administration/Project Management, Operation), Superior Energy Services: Marine Technical Services
Dr. Joseph Mullins	Programme Director, Arctic Reponse Technology
Dr. Prof. Andrey A. Konoplyanik	Adviser to Director General, Gazprom Export & Professor, Gubkin Russian University of Oil and Gas
Rod Allan	Former Manager, Transocean
Sharon Burke	Former Assistant Secretary of Defence
David Anderson	Barclays, North America E&P Research
Thomas Driscoll	Barclays, North America E&P Research
James Henderson	Senior Research Fellow, The Oxford Institute of Energy Studies
Venu Krishna	Barclays, Equity Research Management
Maryann Løcka	Energy Counselor, Norwegian Embassy
Theodore Roosevelt IV	Barclays, Chairman of Cleantech Initiative
Ann Rybak	Barclays, Head of Citizenship
Captain Patrick deQuattro	Military Fellow at Council of Foreign Relations, U.S.Coastguard
Anatoly Zolotukhin	Research Director, Institute of Arctic Petroleum Technology, Gubkin Russian University of Oil and Gas
Alexander Shestakov	WWF's Global Arctic Program
Masha Vorontsova	International Foundation for Animal Welfare
James Streeter	Corporate Social Responsibility, Hess
Andreas Kravik	Legal Advisor, Norwegian UN Delegation
Halvor Sætre	Minister Counsellor, Norway's Missions to the UN
Ander Engeset	Fearnley Offshore Supply
Ramus Gjedssø Bertelsen	Barents Chair in Politics, University of Norway

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