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Arctic Energy Resources and Global Energy Security[1]

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Introduction

In recent years the world has become gripped with concerns about climate change and its impact on Arctic ice as well as the perception that increasing global energy consumption might surpass the capacity of energy markets. These seemingly unrelated issues come to a nexus in the Arctic region[2] since melting ice coverage has led some analysts to believe that previously inaccessible oil and gas deposits may now be accessible permanently or periodically.[3] Successful development of these reserves

[1] The reported results, their interpretation, and any opinions expressed herein, remain those of the author and do not represent, or otherwise reflect, any official position of the Department of National Defence or the government of Canada.

[2] For the purposes of this paper, the Arctic region is comprised of all landmass and ocean/sea situated north of the Arctic Circle. Countries with territory and/or territorial waters in this region include Canada, Finland, Denmark (Greenland and the Faroe Islands), Norway, Russia, Sweden, and the United States. Of these countries, Finland and Sweden do not lay claim to any offshore boundaries in the Arctic region, whereas the others do.

[3] See for example Scott G. Borgerson, "The Great Game Moves North," *Foreign Affairs*, 25 March 2009. Accessed at http://www.foreignaffairs.com/articles/64905/scott-g-borgerson/the-great-game-moves-north. See also George Kolisnek, "Canadian Arctic Energy Security," *Journal of Energy* Security. December 2008. Accessed at http://www.ensec.org/index.php?option=com_content&view=article&id=172:canadian-arctic-energy-security&catid=90:energysecuritydecember08&Itemid=334. See also Barry S. Zellen, "Viewpoint: Cold Front Rising — As Climate Change Thins Polar Ice, A New Race for Arctic Resources Begins," *Strategic Insights*, (Bi-monthly online journal published by the Center for Contemporary Conflict at the Naval Postgraduate School, Monterey, California), February 2008. Accessed on 10 December 2009 at http://www.nps.edu/Academics/centers/ccc/publications/OnlineJournal/2008/Feb/zellenFeb08.pdf.

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would help to alleviate the pressure on the global oil and gas markets and potentially enhance energy security as a result.

This paper will examine the energy potential of the Arctic by first highlighting the projected quantity and location of oil and gas reserves. It will then consider the challenges posed by the environment on developments, review current Arctic operations, and examine the potential of resource conflicts attributable to unresolved border disputes. The paper will conclude with an assessment of future prospects for energy extraction in the region.

Arctic Energy Resources

While there are deposits of uranium and coal scattered throughout the area north of the Arctic Circle, the main energy resources of interest for commercial operators are oil and gas. The precise quantities of these resources remains unknown however a study conducted in 2008 by the United States Geological Survey (USGS) suggests that the untapped oil and gas reserves in the Arctic region are substantial. The report notes that "the sum of the mean estimates … indicates that 90 billion barrels of oil, 1,669 trillion cubic feet of natural gas, and 44 billion barrels of natural gas liquids may remain to be found in the Arctic, of which approximately 84 percent is expected to occur offshore."[4] Given that the study used a geology-based probabilistic methodology, the actual reserve amounts lie somewhere within a broad range. For oil, the amount of undiscovered reserves is estimated to lie between 44 billion barrels of oil (BBO) (>95% chance) and 157 BBO (5% chance). The study suggests that the Arctic may contain approximately 13% of the global mean estimate of undiscovered oil, which is approximately 618 BBO.[5]

[4] "Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle," *USGS Fact Sheet 2008-3049*, (2008).

[5] Donald Gautier, Kenneth J. Bird, Ronald R. Charpentier, Arthur Grantz, David W. Houseknecht, Timothy R. Klett, Thomas E. Moore, Janet K. Pitman, Christopher J. Schenk, John H. Schuenemeyer, Kai Sørensen, Marilyn E. Tennyson, Zenon C. Valin, and Craig J. Wandrey, "Assessment of Undiscovered Oil and Gas in the Arctic," *Science*, Vol. 324, No. 5931, 29 May 2009. pp. 1177-1178.

The estimated amount of undiscovered gas is more significant — approximately three-times as much as the estimated oil on an energy-equivalent basis. The range of potentially undiscovered gas lies between roughly 770 trillion cubic feet (TCF) (>95% chance) and approximately 2,990 TCF (5% chance). The median estimated amount represents some 30% of global estimated undiscovered gas.[6] Of course, the existence of these resources does not mean that they will all be exploited. Ultimately, this will most likely be decided by the price of the resource weighed against the extraction, processing, and transportation costs of getting it to market.

It is also important to note that the USGS study excluded conventional oil deposits smaller than 50 million barrels and conventional gas deposits smaller than 300 billion cubic feet. The study also excluded non-conventional hydrocarbons such as oil shales, heavy oil, tar sands, coal bed methane, and gas hydrates.[7] Gas hydrates may prove particularly useful in the future since it is estimated that there may be 6-600 times more gas hydrates than conventional gas globally. The Arctic region is known to possess significant amounts of gas hydrates although the technology needed to safely and profitably extract the resource on a commercial basis is not expected to be available before 2030.[8]

To put the quantities of potential conventional resources in perspective, it is useful to compare the estimated reserves in the Arctic with the proven reserves of major oil and gas producing countries. Saudi Arabia's proven oil reserves for 2008 sat at approximately 264.1 BBO ranking it first in the world while Canada was second with a total of 179.3 BBO (including oil sands) of proven reserves.[9] The comparison for gas is more promising for the Arctic. The current leading state for proved gas reserves is Russia with a total of 1,529.2 TCF in 2008 followed by Iran with 1,045.7 TCF.[10] Of course, the geographic expanses of these countries and the Arctic region differ substantially — Saudi Arabia's reserves are concentrated in an area of 2,149,690 sq km vice 1,648,195 sq

[6] Ibid. p. 1178.
[7] Ibid. p. 1176.
[8] R.A. Dawe and S. Thomas. "A Large Potential Methane Source — Natural Gas Hydrates," *Energy Sources Part A: Recovery, Utilization & Environmental Effects*. Vol. 29, Issue 3, February 2007. pp. 217-229.
[9] *BP Statistical Review of World Energy: June 2009*, (www.bp.com/statisticalreview) p. 6.
[10] Ibid, p. 22.

km for Iran, and approximately 21,000,000 sq km for the Arctic region. The more concentrated reserves of Saudi Arabia and Iran facilitate easier exploration due to the relatively small area in comparison to the Arctic region. More importantly, as noted previously, approximately 84 percent of the Arctic's potential resources are estimated to lie offshore whereas the reserves of Saudi Arabia, Canada, Russia, and Iran are situated primarily onshore facilitating easier exploitation than is the case in the Arctic offshore.

Arctic Energy Resource Extraction Pros and Cons

Clearly the anticipated amount of resources in the Arctic region is attractive to oil and gas companies searching for development opportunities. In recent years, the percentage of oil reserves held by nationalized oil companies (NOCs) has increased significantly. This has effectively reduced the access that independent oil companies (IOCs) have to these reserves thereby limiting their potential development opportunities and challenging their ability to generate growth. For the IOCs, the Arctic offers an opportunity for expanding their operations.[11] However, access to Russia's Arctic waters may be restricted given Moscow's propensity to ensure that Russian companies have controlling shares of oil and gas operations within its territory.

A similar challenge exists for independent natural gas companies in that a large proportion of global gas reserves are controlled by countries that restrict their access. Russia, Iran, and Qatar control 23.4%, 16%, and 13.8% of global proved gas reserves respectively. The remaining reserves are dispersed globally in less concentrated fields.[12] The major potential natural gas reserves in the offshore Arctic, roughly 30% of global estimated undiscovered gas as noted previously, is significant in this context. Granted, some of these resources lie within Russian waters where access can be more limited. Opportunities for independent companies exist nonetheless.

Strategic decisions amongst the big oil companies may also lead to increased activity in the Arctic given the amount of gas that is likely present there. Recently, both Exxon Mobil and British Petroleum have indicated that they are going to increase the component of their businesses that focuses on gas extraction and reduce their oil

[11] Jon Rytter Hasle, Urban Kjellén, and Ole Hagerud, "Decision on oil and gas exploration in an Arctic area: Case study from the Norwegian Barents Sea," *Safety Science*, Vol. 47, (2009), p. 832.
[12] *BP Statistical Review of World Energy: June 2009*, p. 22.

operations. Their decision to refocus their operational emphasis is due to the perception that oil operations will be increasingly taxed under carbon emissions caps, the belief that gas will begin to replace oil products in some markets, particularly automotive, and the projection that electrical demand will rise dramatically in the coming decades necessitating an increase in the number of natural gas electrical generation plants.[13] Other major petroleum companies may follow suit and increase their gas operations. Given the estimated preponderance of gas in the Arctic region, these strategic shifts on the part of the oil majors could portend increasing activity in the region.

Russian interest in its Arctic offshore hydrocarbons, particularly gas, is also likely to increase in coming years. Russia, through its nationalized Gazprom, has controlled the gas coming out of the Central Asian republics, Turkmenistan, Uzbekistan, and Kazakhstan, for decades. Until recently, this gas has been purchased by Gazprom at a discounted rate and then resold to European customers for a higher price. In July 2008, these producers were able to increase the price that Gazprom must pay when existing long-term contracts were renegotiated. At the time, global gas prices were high however with the global economic downturn and subsequent drop in demand for hydrocarbons, the prices that Gazprom sells its gas for are less than it is contractually obliged to purchase it from the Central Asian suppliers. Complicating matters for Russia is the recent construction of a gas pipeline from Turkmenistan to China. This development will undercut Russia's hold on the region by providing the producer states another export option and thus introducing increased competition in these markets. The official opening of the pipeline, on December 15, 2009, marked the first time that a major gas export corridor left Central Asia and did not transit through Russia. At full capacity, the new pipeline will carry 40 billion cubic metres of gas or roughly "…half of China's current consumption of natural gas."[14] Given that

[13] Tony Hayward, "The Role of Gas in the Future of Energy." Speech delivered at *the World Gas* Conference, Buenos Aires, Argentina. 8 October 2009. Accessed at http://www.bp.com/genericarticle.do?categoryId=98&contentId=7056854. See also Jennifer Laston, "Exxon Mobil bets $31 billion on natural gas," *Houston Chronicle*, 15 December 2009. Accessed at http://www.chron.com/disp/story.mpl/energy/6770279.html. See also "Unconventional," *The Economist*, 17 December 2009. Accessed at http://www.economist.com/businessfinance/displayStory.cfm?story_id=15127518&source=hptextfeature.

[14] Pavel K. Baev, "China Trumps Gazprom," *The Moscow Times*, 17 December 2009. Accessed at http://www.themoscowtimes.com/opinion/article/china-trumps-gazprom/396292.html. See also Andrew

Turkmenistan's production level in 2008 stood at 66.1 billion cubic metres,[15] the Chinese pipeline could account for approximately two-thirds of current production capacity. While there has been no suggestion that Turkmenistan will reduce its currently agreed gas supply to Russia,[16] it is not clear that it could increase this supply in the future if Moscow needed more gas. Consequently, Russia may be forced to find alternate sources of gas to offset lost sales from Central Asia. Its Arctic reserves may be the source of this supply.

Russia is not the only country that will see its gas supply impinged upon by the new pipeline to China. For several years, the European Union (EU) and the United States (US) have been pushing for a gas pipeline corridor from Central Asia that bypasses Iran and Russia. However, their insistence on democratic reforms and, in some cases, basing rights for US military units along with Russian pressure on Central Asian gas producers has stalled progress on this system. The Chinese did not make any political or military demands and were able to get a deal done quickly as a result.[17] While the existing Turkmenistan-Russia and Turkmenistan-China pipelines do not preclude an export corridor to the West, the ability of Turkmenistan to fill all of these networks is questionable. They may not have the capacity to do so and they may also lack the desire to do so. From a strategic economic perspective, Turkmenistan may decide that it is better to sell their gas endowment over a longer term rather than sell it quickly to an increased number of customers. Should it choose this option, Turkmenistan will not likely expand its production or export capacity thus making a new Central Asia to Europe gas pipeline system less viable. Uncertainty regarding future natural gas supply to Europe from Central Asia will likely fuel interest in Arctic gas operations in the coming years.

The presence of the resource is not the only consideration oil and gas companies will make when contemplating investment decisions. There are several factors that must be taken into account before the decision to undertake a project in the Arctic

E. Kramer, "New Gas Pipeline From Central Asia Feeds China," *The New York Times*, 14 December 2009, Accessed at http://www.nytimes.com/2009/12/15/world/asia/15pipeline.html?_r=1

[15] *BP Statistical Review of World Energy: June 2009*, p. 24.

[16] M K Bhadrakumar, "Russia, China, Iran Redraw Energy Map," *Asia Times Online*, 8 January 2010. Accessed at http://www.atimes.com/atimes/Central_Asia/LA08Ag01.html.

[17] Kramer, op. cit.

region is made. Amongst the most relevant are the technical challenges of extracting, processing, and shipping the resource from the field to the consumer. The challenges will dictate the cost of getting the product to market. If the cost is higher than the anticipated price for the resources, then development is not cost effective and the project will not proceed.

Other challenges are posed by the Arctic climate and topography. While it is true that much of the interest in the region is attributable to the increased access potential due to melting, there is still the problem of ice flows and in some cases, permanent ice cover. These conditions wreak havoc on infrastructure such as drilling platforms, offshore oil rigs, the ships that service them, and on pipelines. Large pieces of ice travelling at pace can easily damage or destroy the offshore oil or gas infrastructure unless it is strengthened to overcome this challenge.[18] Improving the durability of these structures involves increased engineering and construction thereby driving up the operating costs.

Canada's Hibernia project is a case in point. The Hibernia field is located in an area known as Iceberg Alley and the rig was constructed with a concrete ice belt that is 15 m thick along with an external ice wall 1.5 m thick and fitted with teeth to absorb the impact of icebergs.[19] In addition to these engineering improvements, Hibernia and other nearby oil rigs are protected by a network of private and publically funded surveillance, forecasting, and, for smaller icebergs, ships to steer them away from rigs. This is an extensive undertaking and increases the operating costs of Hibernia. It is noteworthy that Hibernia is located over 3,000 km south of the Arctic Circle and in only 80 m of water. This reduces the size and amount of ice that can approach the area.[20] According to the USGS study, much of the prospective Arctic oil and gas reserves lie in water as deep as 500 m.[21] Water this deep will accommodate much larger ice in more significant quantities than Hibernia is designed to withstand. It seems likely that the engineering

[18] Matt Hilburn, "Trans-Arctic Shipping?" *Seapower*, August 2008, pp. 34-36. See also "Experts question viability of year-round Arctic shipping," *Canadian Sailings*, 2 March 2009, pp. 9-10.
[19] Peter Kenter, "Next Hibernia will employ concrete gravity base structure technology," *Journal of Commerce*, 13 October 2008.
[20] "Hibernia Ice Management," accessed at http://www.hibernia.ca/html/about_hibernia/ice_management.html.
[21] Gautier, et. al., p. 1175.

solutions and operational procedures that will be necessary to protect energy infrastructure within the Arctic region will be more elaborate and costly than those in place at Hibernia and the other sites offshore of Newfoundland.

A similar iceberg related problem is posed by deeper ice structures gouging the sea-floor. This occurs in the Arctic so any pipelines located underwater must be built to guard against this eventuality, either by digging them deep under the sea floor, encasing them in concrete, or by other engineering fixes.[22] These options come with higher costs. Another climate-induced challenge is the icing of superstructures, be they on rigs or the ships that service them. The icing in the Arctic can render these surfaces unsafe and inoperable necessitating a variety of methods, and subsequent added costs, to overcome this challenge.[23] Uncertainty regarding access to the undersea resources will continue to underlie decision-making — particularly in light of the high development costs associated with offshore oil and gas operations.

Another significant operating cost will accrue from the infrastructure necessary to transport the oil or gas to markets further south. In some cases, rudimentary infrastructure exists that could be expanded. This is particularly the case with operations in Alaska's North Slope as well as the pipeline networks that send oil and gas from Russia's Yamal region to Europe via the Baltic Pipeline System (oil) or the Yamal-Europe pipeline (natural gas). Other infrastructure will need to be developed if the region is to be opened for hydrocarbon extraction operations. These developments come with a substantial price-tag and given concerns regarding the fragile nature of the Arctic environment, are controversial as well.[24]

Climate change is also affecting the existing onshore infrastructure. In recent years, the permafrost in some parts of the Arctic tundra that supports the overland infrastructure has thawed. The melting in some places has resulted in dramatic erosion, buckled roads and broken pipelines.[25] Should this climate trend continue, the costs to

[22] Arash Nobahar, Shawn Kenny, and Ryan Phillips, "Buried Pipelines Subject to Subgouge Deformations," *International Journal of Geomechanics*, May/June (2007), p. 207-208.
[23] Charles C. Ryerson, "Assessment of Superstructure Ice Protection as Applied to Offshore Oil Operations Safety," *US Army Corps of Engineers® – Engineer Research and Development Center, ERDC/CRRL TR-08-14*, (2008).
[24] Hasle, et. al., p. 833.
[25] Fred Pearce, "Meltdown," *New Scientist*, Vol. 201, No. 2701, 28 March 2009, p. 34.

hydrocarbon companies will increase as they will be forced to repair or replace infrastructure located onshore in the Arctic region.

Weather may provide another challenge to Arctic hydrocarbon extraction operations in the future. While it seems that there may be more open water in the coming decades, this comes with a risk. Climate scientists recently released a study suggesting that open water is a necessary precursor for violent storms that allows them to generate strength. The report predicts that the Arctic may be the scene of more extreme weather events in the near term as ice cover becomes less pervasive.[26] The possibility of increasingly destructive storms in the Arctic will influence the investment decision-making of many oil and gas companies.

The difficulties imposed on hydrocarbon operations by the environment are underscored by the fragile nature of the Arctic ecosystem. The water is relatively shallow compared to larger oceans and seas to the south. This, combined with the ice-cover, results in an ecosystem that is more sensitive to disruption than many other bodies of water. Moreover, Arctic waters and tundra host unique flora and fauna that could be endangered or become extinct if development occurs without due concern for environmental protection. Generally, operations in this environment will require more robust, and thus expensive, environmental protection equipment and protocols. The exact mitigating measures for operations in the region will need to be decided on a case by case basis, thus it is not possible to estimate the added costs until site specific planning occurs. A recent study released by the WWF acknowledged that there is considerable research underway to deal with oil spills in the Arctic. However, the report demonstrated that existing methods for dealing with spills are severely hampered by ice and other Arctic conditions.[27] Concerns about environmental damage might cause many oil and gas companies to reduce the scale of Arctic operations or avoid them outright in favour of less environmentally challenging opportunities in other parts of the world. A contemporary example is the November 2008 US court ruling that Royal Dutch Shell must await the completion of environmental impact

[26] Alister Doyle, "Worsening Arctic storms to threaten oil, shipping industries," *USA Today*, 4 February 2009. Accessed at http://www.usatoday.com/weather/climate/globalwarming/2009-02-04-arctic-storms_N.htm.

[27] *Oil Spill Response Challenges in Arctic Waters*. WWF International Arctic Programme. October 2007.

studies of the effects of its operations on the bowhead whale in the Beaufort Sea before developing properties it has leased offshore of Alaska.[28]

A significant component of the operations cost for oil and gas operations results from the chemical composition of the resources. The chemical composition of crude oil varies significantly resulting in major differences when comparing various grades. Briefly, crudes are graded on their viscosity and sulfur content. Crudes that are more fluid are referred to as light while less fluid grades are known as heavy. Oils that are high in sulfur content are called sour while low sulfur content crudes are known as sweet. The more fluid and lower sulfur content crudes are known as light sweet oils and are transported and refined much more easily and thus cheaply.[29] Natural gas often also contains a variety of other gases and naturally occurring substances such as water that must often be removed before it is pipeline ready. The gas we burn to heat and generate electricity is primarily methane but this must be separated from the non-desirable substances before the gas is commercially suitable.[30] Some gas deposits also contain large amounts of sulfur producing what is known as sour gas. The sulfur must be stripped from the gas before it can be commercialized. Contemporary processes for separating the sulfur release it into the environment leading to ecological and human health risks.[31] The amount of deleterious substances and water that must be removed from the gas dictates the economic feasibility of prospective extraction projects. The quality of the oil and gas deposits in the Arctic region is unknown in many cases. While there has been some prospective drilling and there are some operations, particularly on Alaska's North Shore or offshore from Norway where the quality of the oil and gas is acceptable for operations, it remains to be seen if all of the potential reserves highlighted in the USGS study will be commercially viable.

In the current economic climate where demand is down and prices have followed suit, oil and gas companies are being more cautious about investment decisions and some major projects have been delayed. Also, it is more difficult for oil and gas companies to attract investors or creditors to support ambitious long-term

[28] Borgerson.
[29] Peter Tertzakian, *A Thousand Barrels a Second*, (New York: McGraw-Hill, 2007) pp. 94-100.
[30] http://www.naturalgas.org/naturalgas/production.asp accessed on 8 December 2009.
[31] http://www.ucalgary.ca/ensc/files/ensc/ENSC502%2003-04%20SGImpacts.html.txt accessed on 8 December 2009.

developments.[32] This situation has already affected the long-awaited development of the Shtokman gas field in Russia's Barent Sea sector. The initial plan was for the consortium, controlled by Gazprom and including France's Total and Norway's Statoil, to begin marketing Shtokman gas in 2013 but this date has been pushed to 2015 with a possibility of more delay if global demand does not increase considerably.[33]

Contemporary Arctic Oil and Gas Operations

Russia currently has Arctic region oil operations located in the Timan-Pechora area where the Baltic Pipeline System originates. Russian Arctic gas extraction occurs in the Yamal Peninsula area and also the Yamburg field and pipeline that connects it to Norilsk on the northwest edge of the Central Siberian Plateau. All of these operations are located onshore. To date, there are no Russian offshore Arctic hydrocarbon extraction operations.[34]

Russian oil shipping operations in the Arctic region are substantial and Moscow has committed to make more use of its Arctic ports to ship oil, refined products, and, eventually, Liquefied Natural Gas (LNG). The Russian use of Arctic waters is already well established and the country possesses the world's largest fleet of Arctic icebreakers — 28 in total including 7 nuclear powered vessels. Its Arctic region oil terminals located in Arkhangelsk, Kolguev, Mokhnatkina Pakhta, Murmansk, Ob Bay, Varandey, and Vitino have undergone expansions and improvements in recent years and have witnessed an increase of oil shipments from approximately 4 million tons of crude in 2002 to 10 million tons in 2008. These shipments transited the Barents Sea for destinations in Europe and North America. It is anticipated that these and other planned Arctic facilities will have the capacity to export approximately 100 million tons of liquid hydrocarbon products — to include LNG at the planned Teriberka LNG

[32] Peter Truscott, "European Energy Security – Facing a Future of Increasing Dependency?" *Royal United Services Institute Whitehall Paper*, No. 73 (2009), pp. 8-11.
[33] "No need for haste on Shtokman project," *Barents Observer*, 26 November 2009. Accessed at http://www.barentsobserver.com/index.php?id=4657561.
[34] "Russian oil and Natural Gas at a Glance," United States Energy Information Administration. May 2008. Accessed at http://www.eia.doe.gov/cabs/Russia/pdf.pdf.

terminal and more refined products — by 2015.[35] In addition to the development of these hydrocarbon loading terminals and its ample icebreaker fleet, Russia has also taken steps to deal with the ice hazard to shipping with the December 2009 launching of the world's first icebreaking oil tanker. The 280 m long Kirill Lavrov is capable of breaking through ice 1.2 m thick. The Russian's hope that this new vessel, and the others slated for construction, will facilitate the export of crude oil extracted from a planned Arctic oilfield.[36]

The increased emphasis on Arctic seaport hydrocarbon exports is part of a strategic decision by the Russians since it will reduce the requirement to ship or pipe products through other countries or through busy waterways such as the Dardanelle Straits. Another likely, unspoken, objective is that it will increase the ability of the Russians to cut off hydrocarbon shipments to consumer states for political objectives.[37] If the oil and gas can be diverted from existing pipeline routes, it allows Russia to be more selective about the countries that consume its products.

Norway also possesses major oil and gas operations within its Arctic region. While most of the Norwegian extraction operations and pipelines are located in the northern North Sea, there are some fields being developed or already producing in the Norwegian Sea and also in the uncontested portions of the Barents Sea. These latter two bodies of water are located in whole or part above the Arctic Circle.[38] Norway's oil production has declined year to year since its peak of 3.418 million barrels per day in 2001. Its production in 2008 was 2.455 million barrels per day, accounting for 2.9% of the global total. Its gas production has been steadily increasing over the past decade to reach 99.2 billion cubic metres in 2009 accounting for 3.2% of overall global production.[39] Most of this production comes from below the Arctic Circle however more is likely to originate from the Arctic region in the future.[40] The bulk of Norway's oil and

[35] Alexei Bambulyak and Bjørn Frantzen, *Oil Transport from the Russian Part of the Barents Region. Status per January 2009,* (Norway: The Norwegian Barents Secretariat and Akvaplan-niva, 2009), pp. 31-39.
[36] Gleb Bryanski, "Russia launches icebreaker to boost Arctic oilfield," *Reuters*, 16 December 2009. Accessed at http://in.reuters.com/article/businessNews/idINIndia-44848120091218.
[37] Uffe Ellemann-Jensen, "Defusing Russia's Energy Weapon," *The Moscow Times*, 16 December 2009.
[38] *Facts: The Norwegian Petroleum Sector 2009*, (Norway: Ministry of Petroleum and Energy / Norwegian Petroleum Directorate, 2009), pp.80-91.
[39] *BP Statistical Review of World Energy: June 2009*, pp. 8 & 24.
[40] Bjørn Rasen, "Home Sweet Home," *Norwegian Continental Shelf*, Vol. 6, No. 1 (2009), pp. 15-16.

gas is shipped to Europe via a network of pipelines located primarily in the North Sea. The major export facility north of the Arctic Circle is the Snøhvit Gas Liquefaction plant located in Melkøya, Norway, that is connected via an undersea pipeline to a producing gas field in the Barents Sea. This plant was the first of its type in all of Europe and is significant since most of its infrastructure is located on the seafloor thereby sheltering it from the harsh Arctic storms that characterize the area's climate.[41] Snøhvit became operational in mid-2007 and in 2008 exported approximately 77 billion cubic feet of LNG that was loaded on tankers for shipment to consumers, primarily in Spain, France, and the US.[42]

Arctic region oil and gas operations do take place in the US Alaska area both onshore and offshore.[43] While developments in the region have been controversial owing to concerns about their negative impact on the environment, the US desire to reach "energy independence" has increased the pressure to open up more Alaskan reserves, particularly offshore.[44] It seems likely that US Arctic offshore operations will increase within the coming years although concerns about the environment will likely slow the expansion.

While the Alaska North Slope (ANS) oil and gas reserves are located in the Arctic region, they do not increase the amount of Arctic shipping significantly since the oil produced is piped south overland through the Trans-Alaska Pipeline System and loaded onto tankers in southern Alaska — outside of the Arctic region. The gas produced in ANS is not sold commercially aside from some local sales but is used to

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[41] *Snøhvit - Unlocking resources in the frozen North*. Accessed at http://www.statoil.com/en/OurOperations/ExplorationProd/ncs/Pages/SnohvitNewEnergyHistoryInTheNorth.aspx.

[42] "Norway," *Country Analysis Briefs*, United States Energy Information Administration, August 2009. Accessed at http://www.eia.doe.gov/cabs/Norway/pdf.pdf.

[43] "Alaska," *State Energy Profiles,* U.S. Energy Information Agency, 17 December 2009. Accessed at http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=AK#.

[44] Elizabeth Bluemink and Dan Joling, "Shell gets conditional OK for Beaufort Sea drilling plan," *Anchorage Daily News*, 19 October 2009. Accessed at http://www.adn.com/money/industries/oil/story/979077.html. See also Erika Bolstad, "Offshore oil drilling gets go-ahead in Alaska's Arctic," *McClatchy Newspapers*, 7 December 2009. Accessed at http://www.mcclatchydc.com/251/story/80196.html. See also Tom Dogget, "U.S. government oks Shell's Chukchi Sea drilling plan," *Reuters*, 7 December 2009. Accessed at http://uk.reuters.com/article/idUKTRE5B642720091207.

increase the pressure of oil fields to aid extraction. It seems likely that once these oil fields become depleted the government of Alaska will need to replace the oil revenue and natural gas seems a logical choice.[45] In the near term, it is not anticipated that operations in ANS will significantly increase hydrocarbon shipping in the Arctic.

There has been some interest in development of offshore reserves in Canada's Beaufort Sea in recent years as well. In 2007 the Canadian government sold a large lease for exploration and development to Imperial Oil Ltd and ExxonMobil. In 2008 the government sold five leases in the Beaufort Sea to several oil and gas majors including BP, ConocoPhillips Canada Resources, Phillips Petroleum Canada, and MGM Energy.[46] These leasing agreements might open up Canada's Arctic to production although it remains to be seen whether they contain commercially viable oil and gas deposits and also whether these companies will have the necessary money to invest in developing them if they do.

Another area of potential offshore Arctic oil and gas operations that may open up during the next decade is in an area known as Dreki offshore. This field lies predominantly within Iceland's maritime economic exclusion zone but spills over to an area jointly managed by Norway and Iceland. This area is believed by some analysts to hold oil and gas reserves although the exploratory data is limited so it may not be commercially viable. The site is attractive in that it has not been generally affected by sea ice in recent years thus the risks posed by this threat to operations is considered low.[47] Iceland's government solicited bids for exploratory drilling applications in May 2009. Only two companies bid on leases although the low interest was partially due to

[45] Charles P. Thomas, David D. Faulder, Tom C. Doughty, David M. Hite, and Gregory J. White, *Alaska North Slope Oil and Gas – A Promising Future or an Area in Decline? DOE/NETL-2007/1280*, United States Department of Energy/National Energy Technology Laboratory, August 2007.
[46] "Ottawa awards BP $1.2B in exploration permits in Beaufort Sea," *CBC News*. June 9, 2008. Accessed at http://www.cbc.ca/money/story/2008/06/09/beaufort-leases.html. "BP's $1B bid points to Arctic oil rush," *The Calgary Herald*. June 10, 2008. Accessed at http://www.canada.com/calgaryherald/news/calgarybusiness/story.html?id=b598cd35-1e32-4ce0-9cd6-86d0c67dd6fe
[47] Bente Bergøy Miljeteig, "Those who seek, find — perhaps," *Norwegian Continental Shelf*, Vol. 6, No. 1, (2009), pp. 8-9.

the global economic crisis and the consequent dearth of investment funds.[48] It is possible that there will be more interest in this area once the global economy recovers.

Borders and Political Uncertainties

Much attention has been devoted to maritime boundary disputes involving the Arctic states, Canada, Denmark, Norway, Russia, and the US. Some analysts believe that the Arctic might witness conflicts between the littoral states caused by the quest for energy resources.[49] This assessment is perhaps overstated however considering that, as the USGS study suggests, the Arctic region is roughly divided into thirds with one-third onshore, one-third continental shelf, and one-third deep ocean basin. The report suggests that the deep ocean basin areas, those most contested in terms of border disagreements, contain little hydrocarbon resources. Most of the resources lie on the continental shelves or onshore.[50] The report notes that 60% of the estimated oil resource is located in six locations: the Alaska Platform, the Canning-Mackenzie basin, the North Barents Basin, the Northwest Greenland Rifted Margin, the South Danmarkshavn Basin, and the North Danmarkshavn Salt Basin. Of these, the Alaska Platform is most significant in that it is estimated to contain approximately 31% of the undiscovered Arctic oil. Similarly, approximately 66% of undiscovered gas is believed to lie in just four areas: the South Kara Sea, the South Barents Basin, the North Barents Basin, and the Alaska Platform. Of these, the South Kara Sea, a Russian possession, is believed to contain nearly 39% of undiscovered gas.[51] The borders claimed by the Arctic states are generally not disputed in the areas anticipated to contain the hydrocarbon deposits hence neither are the resources that lie within them.

[48] "Results of the First Licensing Round 2009 for the northern Dreki area," *News Release*, National Energy Authority of Iceland , 18 May 2009. Accessed at http://www.nea.is/Apps/WebObjects/Orkustofnun.woa/1/wa/dp?detail=27343&id=10587&wosid=dW6SmpAFOgtdfKxN3ra7p0.
[49] Zellen.
[50] Gauthier, et. al., pp. 1175-1176.
[51] Ibid. p.1178.

Moreover, a framework to resolve boundary disputes in the Arctic exists in the form of the United Nations Convention on the Law of the Sea (UNCLOS). This agreement contains provisions regarding the delineation of the outer limits of continental shelves and maritime boundaries. It obliges states to submit their boundary claims to the UN Commission on the Limits of the Continental Shelf (CLCS) within ten years of ratifying UNCLOS.[52] Russia and Norway have already submitted their claims while Canada has until 2013 and Denmark has until 2014 to do so. The US has not ratified UNCLOS because of the concern on the part of some senators that doing so would cede too much power to the UN. The perception that the US might lose out on its claims if it is the only Arctic state not to file a submission to CLCS may lead the Senate to agree to ratification in the near-term although this remains to be seen.[53] Despite not ratifying UNCLOS, the US joined the other four Arctic states in issuing the Ilulissat Declaration on 28 May 2008, affirming that each state would remain committed to the legal framework of the law of the sea to resolve any overlapping claims.[54] While the declaration did not refer to UNCLOS by name, it did note that the law of the sea is the overarching framework to resolve any disputes. The agreement by the Arctic states to resolve their disputes through this framework suggests that the overlapping boundary issues will be settled amicably although it is likely that they will take some time to be finalized.

In addition to the rights and obligations vested through UNCLOS, Arctic states regularly cooperate on issues related to the region through their membership to the Arctic Council. The Council was formally established with the release of the Ottawa Declaration in 1996. Its members include the Arctic states, in addition to Finland, Iceland, and Sweden. The Council also has several observer members including other countries and various international organizations. Its purpose is to facilitate "cooperation, coordination and interaction among the Arctic States, with the involvement of the Arctic Indigenous communities and other Arctic inhabitants on common Arctic issues, in particular issues of sustainable development and

[52] Vsevolod Gunitskiy, "On Thin Ice: Water Rights and Resource Disputes in the Arctic Ocean," *Journal of International Affairs*. Spring/Summer 2008, Vol. 61, No. 2. p.261-262.
[53] Jessa Gamble, "Arctic Landgrab," *Scientific American Earth 3.0*. Vol. 19, Issue 1, 2009. pp. 58-63.
[54] "The Ilulissat Declaration," *Arctic Ocean Conference*. Ilulissat, Greenland, 27-29 May 2008.

environmental protection in the Arctic."[55] The periodic interaction of member states through the Arctic Council might aid the resolution of boundary issues and development of resources in the region.

One continental shelf dispute concerning an area rich in natural gas exists between Russia and Norway in the Barents Sea. Both countries dispute the other's interpretation of where their borders extend into the offshore Economic Exclusion Zone (EEZ).[56] While it is possible that there could be a conflict between the two countries over this area, it seems highly unlikely given the potential costs versus the potential benefits. Both countries have substantial reserves within the undisputed areas of their continental shelves so to risk conflict over what would be an incremental increase in total reserves would be nonsensical. Indeed, on June 5, 2009, Russia and Norway signed a Memorandum of Understanding to explore ways to jointly develop the contested areas.[57] There is already cooperation between the gas companies of the two countries in that Statoil is one of the partners with Gazprom in the anticipated Shtokman gas field development as noted above.

Indeed, while there are disagreements between the Arctic states as to the precise location of some boundaries, there is no reason to conclude that these disagreements cannot be resolved amicably. Joint management of resource fields is another option that might come into play as countries involved in a dispute might see more advantage in approaching the disagreement this way rather than losing a claim in an international tribunal. Cooperation between Norway and Iceland regarding the development of the Dreki field could serve as a model for similar arrangements in the future.

Looking to the Future

It is clear that the Arctic region offers the potential to develop new sources of oil and gas to contribute to the energy needs of the global economy. The precise amounts of these resources are not clear although it is possible that the region might make a

[55] "About Arctic Council." Accessed at http://arctic-council.org/article/about.
[56] Zellen, p. 5.
[57] "Norway," *Country Analysis Briefs*.

significant contribution particularly with regards to natural gas. Should the opening of longer shipping seasons continue, it seems likely that Arctic waters, particularly Russia's, will witness increased use as a transportation route for oil and gas resources.

It is more challenging to forecast the level of offshore hydrocarbon extraction in the future. As noted above, operating in the Arctic environment is made more challenging by the presence of ice and the generally severe weather conditions. Regardless of global climate trends, this is not likely to change significantly over the next decade. In order to manage the risk that flows from these conditions, hydrocarbon extraction operations must design safety and protection into their infrastructure and procedures. Moreover, given the more fragile nature of the Arctic environment in comparison to other hydrocarbon producing areas of the world companies will be expected to operate with increased environmental safeguards in the Arctic. Together, these higher standards will result in increased operating costs for the oil and gas companies. These costs may convince some companies that the potential gains are not worth the risks of investing in the region.

Another concern for some companies may stem from unresolved boundary disputes. Although as noted above, there are ample investment properties in non-disputed areas so it is not likely that IOCs will enmesh themselves in political imbroglios. As well, a framework to resolve these disputes exists and discussions are ongoing.

Oil and gas prices over the long-term will be crucially influential toward the speed of Arctic developments. It is difficult to say where prices are going, although most forecasts suggest that they will continue to rise. Under this model, the Arctic may be a more attractive option to oil and gas companies. However, there are still other places in the world that might be more attractive — more oil sands investments, shale oil and gas, new deep water offshore reserves such as those being explored in Brazil's waters, and deep water in the Gulf of Mexico are some examples. Ultimately, IOCs will make their decisions based on where they think the profit-margin is best. It is not clear at what price point the Arctic entices these companies to commit in a significant fashion. The same may not be true for NOCs, particularly Russia's given its large claim in the

Arctic. Many of these companies are not beholden to shareholders like the IOCs[58] and they can generally rely upon their governments to provide them with funding to develop projects that make more political than economic sense. Some NOCs may be willing to increase their Arctic operations regardless of the profit margins. Given Russia's controversial claims in some Arctic regions and their substantial territories in the region, it is more likely that their firms will begin operations than it is that IOCs will unless the profit margins improve.

China is another country that might get active in the Arctic. Even though it does not possess territory in or border the Arctic region, Beijing has expressed an interest in taking advantage of the region's potentially increased navigability for shipping purposes and has obtained observer status on the Arctic Council.[59] Given China's pattern of purchasing overseas oil and gas developments, it is conceivable that they might attempt to seek energy resources in the region, although none of their companies seems suited to operating in this environment at this time. Moreover, they will have to compete with other companies, some more suited to operate in the environment, when any of the Arctic states open bidding for development leases.

Over the longer term, the situation in the Arctic may change as global demand for oil and natural gas regains momentum. The current global credit crunch has resulted in the delay of projects that would have increased the market capacity. The delay is not a problem so long as demand is reduced, as it is currently. However, once the global economic recovery gains momentum, demand for oil and gas will increase and likely push past the high levels experienced prior to the collapse. When this occurs, the contemporary restraint on new infrastructure investments will have a significant negative impact on supply and might lead to a dramatic surge in new oil and gas projects.[60] Under these circumstances, the technological and environmental challenges inherent to Arctic operations might become less of a cost factor and the region could

[58] For example, Norwegian owned Statoil operates more like an IOC than NOCs such as Russia's Gazprom or China's nationalized oil and gas companies.

[59] Joseph Spears, "China and the Arctic: The Awakening Dragon," *China Brief*, Vol. 9, Issue 6, 18 March 2009. Accessed at http://www.jamestown.org/programs/chinabrief/single/?tx_ttnews[tt_news]=34725&tx_ttnews[backPid]=25&cHash=1c22119d7c

[60] Truscott, pp. 8-11.

experience a major surge in development. However, this is not likely to transpire in the near-term.

Conclusion

The Arctic region continues to interest countries concerned about energy security for its promise of increasing oil and gas supply. At the same time, the topographical conditions of the region impose distinct technological and environmental challenges on those companies that might attempt to harvest the resources. The technology required to overcome these challenges does exist and is being used at the few contemporary oil and gas developments operating in the region. However, there are increased costs associated with these operations and given the current economic situation, it is not likely that many independent companies will be interested in embarking on large-scale Arctic projects when there are still other options available in less demanding regions. NOCs, particularly Russian ones, may be less deterred by the financial considerations, although even these companies have to have funds to operate. This suggests that in the near- to mid-term Arctic energy operations are unlikely to increase rapidly. Developments will occur, but the pace and scope is likely to be limited. Russian plans to increase shipments of energy resources via the Arctic will have a greater impact as the shipping traffic will increase.

The prospect for conflicts relating to unresolved boundary disputes also seems remote. As noted, the marginal potential return on investments in areas that are disputed does not seem likely to justify conflicts. The existing vehicles for dispute resolution and cooperation in the region, UNCLOS and the Arctic Council, will also help to reduce tensions. Indeed, there are already examples of cooperation between states regarding the development of contested and non-contested areas. It seems that the countries in question realize that they stand to gain more through cooperation than through confrontation.

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15 January 2010

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