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Review paper: The Arctic states and their energy resources

John Sau Chung*

Polar Research Institute, Spain

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Abstract

Although, Spain does not obtain an official arctic strategy, it was mentioned in the paper for Spanish Polar Strategy that the Arctic region has become one of the country's national interests. The government of Spain is also deeply concerned about the problem of climate change and how it affects economic and social aspects of life. When addressing the Arctic energy issue we must make a prior delimitation, since it does not propose to study in detail, and only in general description, the internal functioning of the Arctic energy systems, that is, the one that serves to supply their populations with lighting, water, gas or electricity.

Keywords: Arctic; Climate change; Energy resources.

1. Body

While, it should be noted that, in certain areas of Arctic societies, despite the great energy wealth that their territories host, serious supply interruptions are suffered – given the deficient infrastructure in some territories, the great distances that must be covered for their development. , and their high cost–, there is energy poverty in urban and rural areas –the latter usually have prices per kW/hour that are three to five times higher than in cities–, and it obviously affects consumers. domestic and industrial fluctuations in the prices of oil, which is largely imported into the region.

Arctic residents generally demand a high level of per capita energy consumption to maintain their economic systems and living conditions. The cost of transportation and taxes on energy fuels are a relevant component of the high cost of living standards in the area.

* Corresponding Author's Email: jschung@gmail.com

And, regarding the energy sources used, in addition to diesel generation, renewables such as wind, or mini-hydro, or biomass stand out.

In any case, the contemporary consideration of the Arctic as an "emerging energy region" is deduced from its potential for hydrocarbons, oil and gas, and mineral resources.

As Mariano Marzo recalls (Stokke, 2013) contrary to what is often believed, the exploration and exploitation of hydrocarbons in the Arctic has been a reality for more than a century. The Inuit of Alaska have long known of the presence of surface oil spills on the Arctic coastal plain. Likewise, under Russian domination of Alaska, which lasted until 1867, the residents of this region also noted the presence of traces of oil.

Currently, more than 400 oil and gas fields have been discovered in the Arctic, containing nearly 40 billion barrels of oil, 30.8 trillion cubic meters of gas and 8.5 billion barrels of natural gas liquids (Keil, 2014).

Most of the fields are located on dry land, while sedimentary basins located under Arctic waters, with great potential, have barely been investigated. For this reason, the United States Geological Survey (USGS) states that the Arctic continental shelves constitute one of the largest virgin areas in the world for hydrocarbon exploration and production. This is due to their remoteness, the environmental and technological challenges involved in the search for and exploitation of oil and gas in these areas, as well as the availability of abundant, lower-cost resources in other parts of the world.

According to the 2009 US Geological Survey, the Arctic could contain about 90 billion barrels of oil and 1.6 trillion cubic feet of natural gas, respectively 13 percent and 30 percent of the world's undiscovered reserves. both hydrocarbons. 84 percent of these reserves would be offshore. Other sources place potential oil reserves in the area at 6.7 percent and natural gas reserves at 26 percent, which would be recoverable with current technological means (Mayor *et al*., 2014).

The most important currently known energy resources in the Arctic region are located in Arctic Alaska, the Amerasias Basin, the Greenland State Fault Basin, the Pechora Sea (Russia), Bassi Bay (Canada) and the North Islet, in Alaska. 84 percent of these resources are located near the coasts. In relation to gas resources, important deposits have already been found in the Yamal Peninsula and in the Kara Sea (Russia), as well as in the Barents Sea. However, more than a third of the Arctic surface currently remains out of technical verification regarding its capacity to contain oil and gas resources (Figure 1). Even so, it is estimated that there is no area on the entire planet equivalent in possibilities for exploitation and exploration of energy resources that is more important than the one housed in the Arctic Circle.

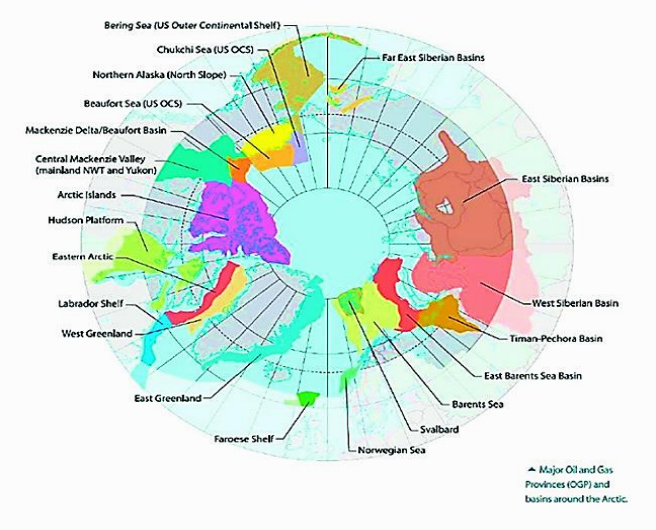

Figure 1. Major Oil and Gas Provinces and Basins around the Arctic (Mayor *et al*., 2014)

2. Discussion

It is worth remembering that marine oil production has gone from 16 percent of world production in 1977 to more than 30 percent since the late 1990s. On the other hand, offshore gas has not stopped growing since the 1980s, largely due to technological development, which has played a fundamental role in the extractive capacity of the seabed.

According to different sources, in the Arctic region we could find, as we previously pointed out, more than 20 percent of the world's hydrocarbon storage, currently undiscovered (around 20.5% oil and around 27.6% gas), and 25% of the total proven gas reserves. Approximately 10% of global oil production today takes place in the Arctic region. Likewise, extraordinary reserves of minerals would be found, such as tin, manganese, platinum, diamonds, nickel and others. Its possibilities of future accessibility and exploitation could change the geostrategic dynamics of the region, and even international energy relations, with obvious consequences for the economy and global security.

The basic energy structure of the countries of the Arctic region has the following characteristics. Canada is a nation of great importance in the energy field. It is the third country in the world in reserves, after Saudi Arabia and Venezuela, with reserves of 180,000 million barrels. Along with its extraordinary potential in the conventional field of oil and gas reserves and production, which places Canada as a great energy power, it is worth adding its notable degree of participation in the "American revolution" of unconventional hydrocarbons, where the Alberta tar sands. And, on the other hand, it is the third country in the world in uranium reserves.

In the Canadian Arctic, the main energy resources are found in the MacKenzie River delta and on Baffin Island, where one of the largest iron ore deposits in the world is located. The Canadian MacKenzie Valley gas pipeline project located in the northern territories is an extraordinarily important initiative in this context, which has extensive participation from energy multinationals, such as Shell, Exxon Mobil, or Conoco-Phillips, a project under the

supervision of the Aboriginal Pipeline Group (APG), which aims to transport natural gas across 1,196 kilometers from the Beaufort Sea and the MacKenzie River Delta to the province of Alberta, in southern Canada. The project crosses four regions and relies on three deposits: Taglu, Parsons Lake and Niglintgak. Likewise, in Canada, two provinces (Alberta and Saskatchewan, on the west coast) have the largest oil reserves. The east coast has 273 million m^3 of oil. And the largest reserves of natural gas are located in Alberta.

In Denmark, recoverable reserves of oil, natural gas and oil sand are the fourth largest in Europe, excluding the Russian Federation. Currently, three quarters of Danish oil production (concentrated in the North Sea) is exported mainly to Eastern European countries. The importance of oil and gas resources to Greenland lies in the potential for future development and realization of benefits from concessions and extraction. The official Arctic strategy estimates that 31 billion barrels of oil and gas could be found on the northeastern coast of Greenland, and 17 billion barrels in the western area of the country, although the probability of discoveries is greater in the northeastern area (Keil, 2014).

Since 2002, the Minerals and Petroleum Agency has been issuing rounds of concessions approximately every two years. More than 200,000 km^2 are currently covered by concessions held by Cairn, EnCana, Exxon Mobil, Chevron, DONG, Husky Energy, Shell, Statoil, GDF, Conoco-Phillips and Maersk. The next round of concessions in 2012/13 will focus on the marine region of northeast Greenland, and the Greenland Sea. The offered area has an approximate surface area of 50,000 km^2, and is divided into 19 blocks (Hammeken Holm 2012). The British Cairn Energy has shown its greatest interest in Greenland, where it so far holds 11 leases covering more than 100,000 km^2 off the coast (Ersoy and Fennema, 2020). In 2010, Cairn completed three offshore well drillings west of Greenland, two of which found hydrocarbons, albeit in barely marketable quantities. During the summer of 2011, Cairn drilled five more wells, which did not result in a commercial find, so they were closed and abandoned (Ersoy and Fennema, 2020). Given the considerable expenses, of around 965 million euros invested in the eight wells, and without credible results so far, Cairn's current plans are to share the financial risks with other companies. Cairn also plans to participate in a deep drilling program in Baffin Bay together with Shell, Conoco-Phillips, Statoil, GDF and Maersk (Mayer *et al*., 2012).

Overall, Greenland's continental margin is largely unexplored to date. The sea surface of western Greenland is comparable in size to the North Sea, where 15,000 wells have been drilled. The concession areas of northwest and northeast Greenland present very demanding situations during winter and summer, requiring reinforced ice equipment. If hydrocarbons are found, the limitations of Greenland's oil and gas export infrastructure, and the difficulties of offshore exploitation conditions, further increase the challenges (Rutland, 2015).

The United States has one of the world's leading oil exploitation industries. Today it is the third producer after Saudi Arabia and the Russian Federation, but it is expected that in 2015 it will regain the leadership lost four decades ago. Its oil consumption is 18,887 Mbd,

being the second country in the world after China. First consumer of gas and also first producer of this energy resource. It is the fifth country in the world in gas reserves, the first in coal (resources) and second in production.

The reality is that the United States maintains an ambivalent and, at times, low-profile or "reactive" position when it comes to formulating an express position in the international concert on the Arctic, despite being an undisputed leader in the region – The State of Alaska has part of its territory inside the Polar Circle – and the military presence inherited from the Cold War. We had to wait until 2013, under Obama's presidency, for the United States to adopt its security strategy towards the Arctic region, followed a year later by a plan for its execution. This document establishes as a priority the defense of the territorial integrity and sovereignty of the North American Arctic territories, within a framework of regional cooperation through the Arctic Council.

There is no doubt that a large part of the interest of the American country lies in the possible extraction of energy resources in Alaska (Cordesman and Al-Rodhan, 2006) and, eventually, in other areas, although the "revolution" caused by fracking for the extraction of gas and oil in various States of the country, has been able to temporarily reduce the urgency of this issue (Mayor *et al*., 2014).

Starting in 1960, the then USSR began to exploit gas and oil in the vicinity of Tyumen, in Western Siberia where occupies almost one million km^2, and similar activities were also carried out in Urengoy, at the mouth of the Obi River.

According to the Center for Strategic and International Studies (CSIS) in Washington D.C. (2006), there has been much debate about the size of reserves in Alaska, and their expected production (Berteau *et al*., 2012). Current technology and simulation models cannot predict exact reserves, cost of production, or the grade or oil in the Arctic National Wildlife Refuge (ANWR). At this point, all that is certain is that production in the ANWR also depends on the price of crude oil. The Energy Information Administration (EIA) has summarized its views on oil in the ANWR as follows:

Alaskan crude oil production originates mainly from the North Slope, which includes the National Petroleum Reserve-Alaska (NPR-A) and the State lands surrounding Prudhoe Bay. Because oil and gas producers are prohibited from building permanent roads in NPR-A, exploration and production are expected to be about 30 percent more expensive than is typical for the North Slope of Alaska. Because drilling is currently prohibited in the Arctic National Wildlife Refuge (ANWR), AE02005 does not project any production from ANWR; however, an EIA analysis of 142 projects stated that if drilling were allowed, production would start 10 years later and reach 900,000 barrels per day in 2025 if the area contains the mean level of resources (10.4 billion barrels) estimated by the U.S. Geological Survey. In the reference case, crude oil production from Alaska is expected to decline to about 810,000 barrels per day in 2010. After 2010, increased production from NPR-A raises Alaska's total production to about 890,000 barrels per day in 2014. Depletion of the

oil resource base in the North Slope, NPR-A, and southern Alaska oil fields is expected to lead to a decline in the State's total production to about 610,000 barrels per day in 2025.

As in the lower 48 States, oil production in Alaska is marginally sensitive to projected changes in oil prices. Higher prices make more of the reservoir oil-in-place profitable. In 2025, Alaska's production is projected to be about 100,000 barrels per day (Conley *et al*., 2013).

In the Russian Federation, recoverable reserves of oil, natural gas and bituminous sand are very relevant. Siberia concentrates 59 percent of the world's coal reserves, almost 40 percent of natural gas and 14 percent of oil, in addition to securing more than half of Russia's hydraulic resources. It is worth highlighting the Shtokman field, the largest marine gas deposit in the world, with an area of 1,400 square kilometers and an estimated reserve volume of 3.2 billion cubic meters. On the other hand, it cannot be ignored that the three macrofields (Yamburg, Urengoy and Medrezne) that generate a substantial part of the current Russian gas are in productive decline.

The effects of Western sanctions on the Russian Federation also affect the development of Arctic projects. (Mikkola and Käpylä, 2014). As an example, Indeed, technological, economic, and regulatory changes have positioned electricity (and the electricity sector) as one of the central axes in the transition to a low-carbon economy. Some of the fundamental drivers of the model change are the following (Gardner, 2014):

- The trend towards decarbonization of the electricity sector, with an important role for renewable energies and energy efficiency.
- Geographic integration of various electrical systems, with impact on the design of market rules and interconnections.
- Increasing interrelationship of the electricity sector with other sectors, for example, transportation or buildings. This will open the door to new business opportunities.
- Universal service projects have many of these drivers in their DNA long before they emerged in the first world.
- Use of renewables, not directly related to the fight against climate change as happens in the first world, but because they are the only sources available in many cases;

The authors conclude that the impact on climate change would be very limited since it would be below 0.1 °C of temperature increase with a high probability in most of the scenarios considered.

Although there has been some debate on this issue, there is a broad consensus around the reduced impact of universal access on climate change, highlighted by the International Energy Agency itself in its successive publications. In this sense, one of the most interesting analyzes is carried out by the World Economic Outlook (WEO) in 2013 that was called "Energy for all" in which it explicitly stated that providing universal access to energy services advanced technologies has a reduced impact on global energy demand and CO_2 emissions. The increase in demand would be around 120 Mtoe, barely 1% higher than

that of the base scenario called New Policies in 2030. According to this scenario, this increase in demand would be covered by 35% with fossil resources and the rest with renewable energies. The increase in CO_2 emissions compared to the scenario called New Policies is very small, just 0.7% in 2030 (260 Mtoe CO_2) (Berenguer Hernández, 2014)

In any case, there is no doubt that the central place for the future exploitation of Norwegian Arctic reserves is located on the coasts and near the Barents Sea. The USGS estimates that 85 percent of the resources mentioned are found under the seabed, most of them in areas not far from the thing, and that Arctic oil and natural gas resources represent, respectively, 13 percent. and 30 percent of the total volume still undiscovered in the world. Although this is, in general terms, the general disposition of energy resources in the area and the most relevant components by country, the legal position of the Arctic countries with respect to their maritime-coastal territorial rights is, in no way, peaceful. The various marine spaces regulated by international law include internal waters, the territorial sea, the exclusive economic zone, the continental shelf, the high seas and the international seabed and ocean floor zone, each of them with their respective legal status.

Strictly speaking, the concept of continental shelf refers to the continent submerged under sea water. In a broad sense, that is, in a legal sense, the continental shelf refers to the natural extension of the continental territory or up to 200 nautical miles, counted from the baselines of the territorial sea (Pérez and Yaneva, 2016)

Several Arctic border states have initiated complex research necessary to support their claims to expand the continental shelf in the Arctic. Perhaps the most paradigmatic case of the existing ones is the claim of the monumental Lomonosov Ridge, an underground mountain range that extends in the Arctic from Russia to Canada (Mayor *et al*., 2014)

Two-thirds of the undiscovered natural gas resources would be located in just four areas: northern Kara Sea, northern Barents Sea, southern Barents Sea and Alaska Shelf. The first of these areas, which represents the undersea extension of the Western Siberian basin, alone would house about 39 percent of the total, so that Russia, with 60% of the Arctic coasts, would take the lion's share. regarding potential natural gas resources. As regards oil, the largest accumulations would be located in the same sedimentary basins mentioned above, with the maximum potential located on the Alaska shelf and in Greenland, as well as in the south of the Barents Sea and adjacent regions, as before we aimed

USGS studies indicate, therefore, that the subsoil of the Arctic is richer in natural gas than oil and that the majority of hydrocarbons are located in geological basins located under marine waters.

It is necessary to underline, once again, the difficulties posed, in industrial terms, by energy development in the polar areas, given that the exploration of resources is very difficult due to the climate, as well as the absence of sufficient energy infrastructure to the transportation of these resources and the distance from markets. Therefore, in principle its exploitation does not seem foreseeable before 2020.

Now, despite the hostile conditions, the melting of the ice and new technologies will facilitate access to energy resources and open the possibility of establishing new navigation routes. Thus, in the Arctic zone, reserves of 20,000-46,000mbp of oil barrels and 36-83 billion Mg of gas are estimated, with 50 percent of the potential oil reserves and 90 percent of the Russian reserves (Bower, 2010)

Map 1. Pipelines in Central Asia. Source: US EIA. (http://www.eia.gov/countries/cab.cfm?fips=TX)

Furthermore, and this is most relevant for diversification purposes, in 2007 the Atasu (Kazakhstan)-Alashankou (Xingjian region of China) oil pipeline came into service, with a capacity of 400,000 barrels per day, owned by KMG and the Chinese state corporation. CNPC, which, as mentioned, acquired 8.4% of the Kashagan field and has the exploitation rights to 25% of the Kazakh fields. Regarding gas from Turkmenistan, its proven reserves at the end of 2013 were 17,500 bcm (9.4% of the world total), its annual production was 62.3 bcm (only 1.8% of the total world), and its internal consumption of 22.3 bcm, 47 which leaves a notable surplus for export, both to Russia (9.9 bcm in 2013) and Iran (4.7 bcm), as well as to its main client, which is none other than China (24.4 bcm). In comparison with Iran was the fifth-largest crude oil producer in OPEC in 2021 and the third-largest natural gas producer in the world in 2020.

In addition to all the infrastructure mentioned, there are additional projects to export Turkmen gas to new markets, mainly the TAPI (Turkmenistan, Afghanistan, Pakistan, India) and a gas pipeline that runs through northern Afghanistan and Tajikistan to reach the Chinese region of Xingjian. The TAPI is supported by the US, but it is difficult for it to find financing since it would pass through the most conflictive areas with a Pashtun majority, such as Helmand or Kandahar. On the contrary, the second project would cover northern Afghanistan, with a Tajik majority and much safer, and would have financing from China. At the Shanghai Cooperation Organization (SCO) Summit in June 2012, CNPC signed a framework agreement with Turkmengaz to increase supply up to 65bcm per year.

Conclusions

Geography and geopolitics, two sides of the same coin, in time and in physical and historical space, which today allows other essential elements to be incorporated into the analysis, given that the political also admits, in a geopolitical sense, some of the fundamental variables that condition its action, whether as attributes of its own conceptual perimeter – the economy, energy, the environment, migratory movements– or due to its relationship and interpenetration with said term, for example, the strategic aspects. Providing access to modern forms of energy to the millions of people who lack it is a key element in the fight against poverty, since it makes it possible to simultaneously address several problems that affect this group (health, education, development economic, women's development, etc.) and tackle some negative issues that affect the security of nations such as abandonment of rural areas, large migrations, epidemics, and etc.

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