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Arctic Energy Development and China's Engagement

Chuan Chen*

Abstract: Climate warming has drawn increasing attention to Arctic energy development. In view of the important strategic significance of Arctic energy resources to China, China has also been actively participating in the development and utilization of Arctic energy resources in recent years. Currently, Russia, which is subject to Western sanctions, is vigorously promoting the eastward shift of Arctic energy cooperation and further deepening Arctic energy cooperation with China. Faced with Russia's enthusiastic cooperation, this is undoubtedly a good opportunity for China. But at the same time, Arctic oil and gas development is difficult and costly, and it is under long-term environmental pressure. Coupled with the cooling of international cooperation, these have added many uncertainties and risks to China's Arctic energy development. Therefore, on the one hand, China needs to seek synergy between Arctic energy science and technology research and energy cooperation, and pay attention to environmental protection and the interests of local Arctic people. On the other hand, while strengthening energy cooperation with Russia in the Arctic, China also needs to actively maintain dialogue with the Arctic 7 and explore energy cooperation paths to better promote China's energy security and long-term interests.

Keywords: Arctic energy energy cooperation China Russia

(A) ARCTIC ENERGY RESOUCES: A NEW ENERGY FOCUS FOR COUNTRIES

The Arctic region is rich in energy resources. However, since the Cold War, the Arctic has been a remote and neglected region internationally. It was not until 2007, when Russia planted its flag on the seabed of the Arctic to declare its sovereignty, that the long-term peace in the Arctic region was broken and a new wave of strong competition for the Arctic was set off. After the Russian flag-planting incident, other Arctic countries have taken various measures to actively compete for the Arctic. The U.S. Coast Guard sent its medium-sized polar icebreaker "Healy" to Alaska to survey the nearby seafloor terrain. Canada's then Prime Minister Stephen Joseph Harper announced that the Canadian government would build a new military training base and a deep-water military dock in the Arctic to consolidate Canada's sovereignty in the Arctic territorial waters. The Danish government also announced that it will send a scientific research vessel to the Arctic to collect geological data, hoping to emphasize its sovereignty over the Arctic.

In May 2008, the U.S. Geological Survey (USGS) released an assessment report on oil and gas resources in the Arctic region, which aroused people's interest in Arctic energy resources and attracted the attention of many oil companies, politicians and media around the world. It was also at this time that countries around the world began to pay

* PhD Candidate, Peking University, China, chenchuan@stu.pku.edu.cn

attention to Arctic energy resources.[1] Undiscovered oil and gas resources in the Arctic are estimated to be as high as 20.5% and 27.6% of global resources respectively. If total proven and undiscovered reserves are taken into account, Arctic oil and natural gas resources account for approximately 13% and 25% of the world's reserves respectively.[2] The oil and gas resources that have been discovered in the Arctic are mainly concentrated in a few basins, of which the West Siberian Basin has the largest reserves, followed by Northern Alaska (North Slope).[3] In terms of the distribution of undiscovered oil resources in the Arctic, Northern Alaska has the largest amount of undiscovered oil, followed by the Amerasian Basin, and the East Greenland Basin ranks third. As for the distribution of undiscovered natural gas resources, the West Siberian Basin has the largest number of undiscovered natural gas resources.[4]

In addition to non-renewable energy sources such as oil and gas, the Arctic region is also rich in renewable energy sources such as rare earth elements, hydropower, wind power, and geothermal energy, and its development potential cannot be underestimated.[5] Regarding renewable energy, the U.S. Arctic Research Council established a group specifically responsible for promoting renewable energy research in the Arctic region, the Arctic Renewable Energy Working Group (ARWG). For Europeans, renewable energy is seen as an opportunity for the European Arctic.[6]

As global climate change intensifies, especially climate warming in the Arctic, and the melting of Arctic sea ice and the freezing and thawing of permafrost accelerate,[7] the accessibility and exploitability of energy in the Arctic have greatly improved. This has made competition for the development of Arctic energy resources increasingly fierce. Countries inside and outside the Arctic region have introduced or adjusted their own Arctic strategies and formulated oil and gas development strategies. For example, the Basic Principles of the State Policy of the Russian Federation in the Arctic Zone Until 2035 and the Energy Strategy to 2035 promulgated by Russia in 2020 once again emphasized that the Russian Arctic region will be used as a strategic resource base to promote the accelerated development of the national economy.[8] In recent years, Norway has also begun to intentionally shift the focus of oil and gas exploration to the Arctic.[9] Greenland is also continuing to relax restrictions on energy development and regards the energy economy as an important pillar in achieving economic and political independence.[10] The EU has also recently stated that it will deepen its role in the Arctic

1 A. Moe, D. Hamilton, & K. Spohr, 'Russia and the Development of Arctic Energy Resources in the Context of Domestic Policy and International Markets', *The Arctic and world order* (2020) 119-142.
2 Arctic Council Sustainable Development Working Group, 'SDWG Report on Arctic Energy', (2009), 1-36.
3 L.Jingmei, et al., 'Potential analysis of Arctic oil and gas resources', *Resources and industry*, (2010) 29-33.
4 X. Qing & H. Maixiu, 'Analysis of Spatial Distribution and Characteristics of Oil and Gas Resources in Arctic Region', *Ocean Development and Management*, (2022) 17-23.
5 G. Arruda, Renewable energy for the Arctic: new perspectives', (Routledge, London, 2018).
6 F. Doris, 'Renewable energy seen as an opportunity for the European Arctic', The New Humanitarian, published on 21 November 2016, accessed 28 July 2023
7 H. O. Pörtner, et al. 'IPCC special report on the ocean and cryosphere in a changing climate', *IPCC Intergovernmental Panel on Climate Change: Geneva, Switzerland* (2019) 1-755.
8 H. R. Liu, Report on Arctic Region Development 2017 (Social Sciences Academic Press, Beijing, 2018)
9 J. Henderson, & J. Loe, '*The prospects and challenges for Arctic oil development*', (The Oxford Institute for Energy Studies, Oxford, 2014).
10 B. Poppel, 'Arctic oil & gas development: the case of Arctic', *Arctic Yearbook 2018* (2018), 328.

region and ensure a stable supply of energy from Northern Europe.[11] In addition, South Korea[12], Japan[13], India,[14] and other countries have also put forward many ideas about energy development in their Arctic strategies. The importance of the Arctic in the global energy map has become increasingly prominent, and countries around the world are actively positioning themselves in relation to Arctic energy development.

(B) THE IMPORTANCE OF ARCTIC ENERGY TO CHINA

As an important stakeholder in Arctic affairs, China attaches great importance to the development of Arctic energy and has listed the development and utilization of Arctic energy resources as its main policy proposition for China's participation in Arctic affairs.[15] Paralleling China's rapid economic development, China's energy consumption is huge on a global scale. Recent economic slowdown notwithstanding, China's energy demand means that its energy security faces substantial challenges. China is thus looking for new opportunities for oil, gas, and other natural resources imports.[16] The Arctic is very rich in natural resources, especially traditional oil and natural gas resources. Oil and natural gas are the important guarantee of China's national economic development, and its security is always the core issue of national sustainable development. For China, the exploration and utilization of oil and gas resources in the Arctic will greatly alleviate its energy tensions.[17]

In 2016, China listed oil and gas as strategic minerals, as the key object of macro-control and supervision and management of energy resources.[18] Although China is not an oil and natural gas resource-poor region, due to China's vast population, the per capita recoverable resource reserves of oil and gas minerals are far below the world average, and the resource base is relatively weak. China is still in the mid-stage of industrialization; its energy consumption structure has been continuously improved and the total demand for oil and natural gas resources is in a rapid growth phase.[19] In 2017, oil consumption increased by 5.2%, and natural gas consumption increased by 14.8%. However, the newly discovered geological reserves of oil and natural gas fell to the

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11 European Commission, European Political Strategy Centre, '*Walking on thin ice: A balanced arctic strategy for the EU*', Publications office of the European Union, published on 2019, accessed 29 July 2023

12 R. Guo, & T. Y. Sun, 'The Arctic Strategy under ROK's "New Northern Policy": Process and constraints', *Journal of International Relations* (2020) 136-153.

13 X. Zou, 'An analysis of the new situation of Japan's Arctic strategy', *International Data Information* (2019) 15-20

14 V. Pronina, et al., 'The Arctic policy of India', IOP Conference Series: Earth and Environmental Science (2020) 012047.

15 The State Council Information Office of the People's Republic of China (2018). 'China's Arctic Policy', published on 26 January 2018, accessed 5 August 2023.

16 S. Kopra, "China's Arctic Interest', in Lassi Heininen (eds), *Arctic Yearbook 2013* (Northern Research Forum, Akureyri) 107-124.

17 Z. J. Yang, et al., "The impact of Arctic ecological security on China's national security and its response strategies', *Marine Environmental Science* (2013) 34-35.

18 Ministry of Land and Resources, 'Ministry of Land and Resources: China has identified 24 minerals as strategic minerals', published on 30 November 2016, accessed 5 August 2023.

19 Ministry of Natural Resources of the People's Republic of China, 'National mineral resources planning (2016-2020)', published on 15 November 2016, accessed 8 August 2023.

lowest levels in nearly 10 years, and the total registered area of oil and gas exploration rights in China also decreased from 3539.9 thousand km2 in 2016 to 3284.6 thousand km2, showing a decrease of 255.3 thousand km2 and 7.2% decrease year-on-year.[20]

China is alarmed at this prospect. For a long time, China's oil and gas heavily relied on imports, and the oil and gas resources imported from abroad play an increasingly vital role in the sustained and stable growth of its national economy. In 2019, China imported 505.72 million tons of oil, an increase of 9.5%, and its dependence on foreign oil reached 70.8%; imports of natural gas was 96.6 million tons, an increase of 6.9% year-on-year, and its dependence on foreign natural gas imports reached 43%.[21] This dependence on imported oil and natural gas is likely to continue to increase, and after 2030, more than 80% of crude oil and 50% of natural gas will need to be imported, and the supply situation increasingly tight. China's dependency on foreign oil will exceed 80% by 2030.[22]

The degree of its dependence on imported oil and natural gas determines the magnitude of the impact of any imported supply interruption and directly affects the safety of energy or even the economy. China's oil and natural gas imports are mainly dependent on the Middle East and Africa, and its oil and natural overseas investments are also concentrated in Middle East and Africa. Though these areas are extremely rich in resources, both the Middle East and Africa have long been in political instability, social turmoil as well as insecurity, and face the intervention of powerful countries led by the United States. In these regions, China does not have enough political and diplomatic capacity to ensure a long-term and stable energy supply, nor does it have enough military force to protect China's oil and gas supply at source.[23]

In addition, the transportation of oil from Middle East and Africa needs to pass through the Malacca Strait, a strait which is seen as an energy resource lifeline for China. At present, about 70% of China's oil imports need to pass through the Strait of Malacca.[24] Furthermore, China's natural gas imports from Qatar, Malaysia, Indonesia, Australia and other countries also need to be transported through the Malacca Strait. Apart from the risks of piracy, terrorism and transportation accidents, China also faces the potential risks of military blockade and oil embargo by major powers in the Malacca Strait. In terms of China's energy imports, both the import source and transportation, China is facing great risks, and its energy safety is in a perilous state and possibly on the brink of disaster.[25] After former China President Hu Jintao proposed the Malacca

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20 Ministry of Natural Resources of the People's Republic of China, China Mineral Resources (Geological Publishing House, Beijing, 2019).

21 China Petroleum Enterprises Association, 'China Oil and Gas Industry Development Analysis and Prospect Report Blue Book (2019-2020)', People.cn, published on 30 March 2022, accessed 9 August 2023.

22 Y. Y. Wang, et al., 'Analysis of domestic and international oil and gas resources situation in 2018', *China Mining Magazine* (2018) 1-6.

23 Z.R. Hu, & Z. Q. He, 'Looking at China's oil and gas security from the world and China's oil and gas supply and demand situation', *Journal of Changchun Normal University (Humanities and Social Sciences)* (2013) 8-12.

24 D. Peng, 'Research on the Security Problems and Countermeasures for China'S Oil', *Energy of China* (2023) 56-63.

25 R. P. Singh, & S. K. Singh, 'CHINESE BLUFF IN MALACCA The Future Security Architecture of the Region and China's Indian Ocean Strategy', *EPRA International Journal of Multidisciplinary Research (IJMR)* (2023) 135-139.

dilemma, from Building Maritime Power to One Belt One Road, China has been actively seeking to diversify oil and natural gas routes to reduce its energy risks.

Due to abundant oil and natural gas resources in the Arctic, China keeps an eye on Arctic resources development. As climate warming intensifies, China can potentially transport Arctic oil and natural gas by the Arctic shipping routes. When excluding the natural environmental risks, Arctic shipping routes are more in line with China's interests and are safer for its oil and natural gas imports from the perspective of energy security. Indeed, China has great expectations in the Arctic shipping routes and regards them as an alternative to the predicament of the Malacca Strait.[26] In that case, Arctic oil and natural gas would be an indispensable part for China's energy import. The development and utilization of Arctic energy is thus not only related to China's energy supply, but also related to China's ability to resist energy risks, promote the strategic adjustment of the national energy structure, and ensure national energy security and sustainable economic development.

(C) CHINA'S ARCTIC ENERGY COOPERATION

Since joining the Arctic Council, China has actively participated in the development of Arctic energy resources and has extensively cooperated with various countries. However, due to the unclear rules for international revenue sharing on the outer continental shelf and the limited international seabed area in the Arctic region, the main path for China to participate in Arctic energy development is through investment and project participation by Chinese energy companies.[27] Currently, Chinese energy companies have participated in several energy and mineral development projects in the Arctic region, as described below.

Greenland has a large amount of resources such as oil and gas, iron, zinc, rare earth elements, and even uranium. The Greenland government also hopes to develop its economy through energy resource development and achieve economic independence. For Greenland, China is a deep-locked investor,[28] and the Greenland government has visited China multiple times to seek energy investment and cooperation, believing that Chinese investment could provide a boost for Greenland's efforts towards political autonomy from Denmark.[29] In Greenland, Chinese company General Nice fully acquired the Isua Project of London Mining Company in 2014, becoming the first Arctic project entirely owned by a Chinese company.[30] However, General Nice's iron ore mining license was later revoked by the Greenlandic government. In 2016, Chinese rare earth giant

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26 C. W. Pang, 'China's Resolution to the Malacca Strait Predicament', *Journal of Xinjiang Normal University (Philosophy and Social Sciences)* (2018) 11.

27 S. J. Chen, 'Joint Development Cases and Chinese Participation in Energy Exploitation in Arctic,' *Resource Development & Market* (2018) 1099-1104.

28 C. Chen, 'China's engagement in Greenland: mutual economic benefits and political non-interference', *Polar Research* (2022) 41.

29 E. Wishnick, China's Interests and Goals in the Arctic: Implications for the United States, (CreateSpace, South Carolina,2017).

30 M. Volpe, '*The tortuous path of China's win-win strategy in Greenland*', The Arctic Institute, published on 24 March 2020, accessed 12 August 2023.

Shenghe Resources acquired 12.5% of the shares of Greenland Mineral Energy Co., Ltd., obtaining the development rights of the rare earth mine Kvanefjeld. In the future, Shenghe Resources can hold up to 60% of the shares. However, due to environmental and other factors, all projects of Chinese companies in Greenland have been stagnant in the initial stage without any progress.[31]

China also has interests in Alaska. Alaska has abundant oil and gas reserves, and the development of oil and gas resources is also Alaska's main industry. According to the study conducted by the McDowell Group, nearly one-quarter of all wage and salary jobs in Alaska in 2018 are supported by the oil and gas industry.[32] Taxes from the oil and gas industry also constitute a very important source of tax revenue for Alaska. Given the importance of the oil and gas resource industry, the Alaska government has been actively encouraging and supporting the development of oil and gas industry resources. The Alaska government has even developed an Exploration Licensing Program to encourage energy companies to explore undeveloped areas. In September 2017, the Alaska State Natural Gas Development Corporation expressed strong interest in the Chinese market. Taking this opportunity, Chinese energy companies are also actively seeking cooperation with the Alaska state government and Alaska Natural Gas Development Company.

In November 2017, the Alaska state government, Alaska Natural Gas Development Company (AGDC) signed a non-binding joint development agreement with Sinopec, China Investment Corporation, and Bank of China. At that time, China planned to invest US$43 billion to develop LNG in Alaska and purchase 75 % of the project's mining volume in exchange for equal shares and the provision of necessary financing. This was one of the big deals signed during Trump's visit to China that year. However, with the outbreak of the "trade war" between China and the United States, both countries included oil, natural gas, and chemical products in the second round of tax lists, and energy cooperation between China and Alaska has also been affected. In July 2019, the president of Alaska Natural Gas Development confirmed that the project was no longer proceeding.

In addition to the aforementioned regions, the presence of Chinese energy companies is also evident in other Arctic regions, such as via the purchase of geological data from the Barents Sea by CNOOC, and the exploration cooperation between CNOOC and Eykon Energy of Iceland in the waters near Jan Mayen Island.[32] However, so far, in terms of Arctic energy cooperation, China has not had a significant impact on regions outside the Russian Arctic region.[33] The energy cooperation projects that China has truly operated and produced results in the Arctic region are all energy cooperation projects with Russia, such as the Yamal liquefied natural gas project.

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31 S.J.V. Brunnersum, 'China failed its Arctic ambitions in Greenland', Politico, Published on 22 October 2022, accessed 16 August 2023.

32 Y. Rosen, 'Oil and gas companies have outsized economic impact on Alaska, says industry study', Alaska Beacon, Published on August 31, 2023, accessed September 17 2023.

32 G. Beth, 'Iceland Aims to Seine Opportunities in oil Exploration', The New York Times, published on 1 October 2013, accessed 20 August 2023.

33 S.J.V. Brunnersum, 'China failed its Arctic ambitions in Greenland', Politico, Published on 22 October 2022, accessed 16 August 2023.

As referred to above, Russia attaches great importance to the development of Arctic energy resources. After Russia invaded Crimea in 2014, the West imposed economic sanctions on Russia, and many Western international companies suspended cooperation with Russia on Arctic energy projects, resulting in a significant decrease in cash flow to Russia's Arctic energy projects.[34] At the same time, the enormous economic pressure brought about by Western sanctions has also made it difficult for Russian companies to cope alone with the huge funding gap required for Arctic energy projects.[35] In order to overcome this difficult situation, Russia has begun to turn more to China to seek Arctic energy cooperation, and the Yamal Liquefied Natural Gas (LNG) project between China and Russia is under this background of cooperation. After China National Petroleum Corporation (CNPC) acquired a 20% stake in Yamal LNG, China's Silk Road Fund (SRF) spent 1.087 billion euros to complete the acquisition of a 9.9% stake in Yamal LNG in 2016. In the end, China collectively held 29.9% of the equity shares of the Yamal LNG project, while Novatek and Total held 50.1% and 20% respectively.[36] A significant part of the project financing for Yamal LNG (44%) was provided by China, and the participation of Chinese companies in the fulfillment of orders for a contract project could reach US$140 billion.[37] Besides, China also provided loans, technology and other support. With China's help, the Yamal LNG project was able to overcome difficulties and advance smoothly.[38]

After Russia invaded Ukraine in 2022, Russia's Arctic energy development faced a much worse situation than during Russia's annexation of Crimea in 2014. Western countries have interrupted the supply of advanced technology and equipment for Russia's Arctic activities, divested energy projects, restricted Russian payment methods, closed the doors to Western markets, and even excluded Russia from Arctic cooperation by seven other Arctic countries (Arctic 7). The implementation difficulty of Russian Arctic oil and gas resource development projects has significantly increased. Considering the enormous external restrictions and pressures faced by Russia, Russia has decided to shift its positioning in the energy export supply market from the West to the East, and is more actively engaging in Arctic cooperation with countries and organizations outside the Arctic region, especially China.[39] Russia greatly welcomes the joint development of the Arctic and cooperation in various fields between China and Russia,[40] and publicly lauds China's participation in the implementation of the Arctic project. It expresses optimism about the prospects of cooperation in the Arctic region with China.[41] China

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34 A. Gabuev, 'Did Western Sanctions Affect Sino-Russian Economic Ties?', Carnegie, published on 20 February, 2013, accessed 17 August 2023.

35 C. T. N. Sørensen, & E. Klimenko, 'Emerging Chinese-Russian Cooperation in the Arctic: Possibilities and Constraints', *SIPRI Policy Paper* (2017) 1-43.

36 V. Spivak & A. Gabuev, 'The ice age: Russia and China's energy cooperation in the Arctic', Carnegie Endowment for International Peace, published on 31 December 2021, accessed 26 August 2023.

37 M. Kobzeva, & R. G. Bertelsen, 'European-Russian-Chinese arctic energy system', in L. Xing (Ed.). China-EU Relations in a New Era of Global Transformation (Routledge. London, 2021), 11, at 1-25.

38 CNPC. ' Special Report: Yamal LNG Project Completed and Put into Operation', CNPC, published 2018,accessed 28 August 2023.

39 L. Zhao, 'Russia's Energy Strategy Adjustment and the Update of the Sino-Russian Energy Cooperation Agenda under the Dual Impact', *Northeast Asia Forum* (2023) 86-97.

40 The Arctic, 'Think Arctic conference participants to discuss Russia-China cooperation in the Arctic', The Arctic published on 26 May 2022, accessed 21 August 2023.

41 The Arctic, 'Russian ambassador to China: Beijing attaches great significance to the Arctic', The Arctic, published on 10 February 2023, accessed 21 August 2023.

has also responded positively to the attitude of the Russian side, not only strengthening its energy cooperation with Russia, but also signing a series of agreements with Russia to deepen Arctic cooperation, opening up cooperation in various new fields, including the Arctic shipping routes.

(D) POTENTIAL RISKS ASSOCIATED WITH CHINA'S PARTICIPATION IN ARCTIC ENERGY DEVELOPMENT

(1) Geopolitical risks

With Russia's increasing emphasis on the Arctic, the United States has also significantly adjusted its Arctic strategy. In October 2022, the US government released a new version of the Arctic Strategy, namely, its *national strategy for the Arctic region*[42]. The report assesses the increasing strategic competition in the Arctic region and claims that the United States, as an Arctic state, bears responsibility for the management and protection of the region against the backdrop of intensified competition in the Arctic region by countries such as Russia. The United States will enhance its ability to defend Arctic interests, contain threats faced by its homeland and allies, and reduce the risk of accidental escalation. The report particularly emphasizes the security issues of the United States' interests in the Arctic, making security the first pillar of its four pillars. To ensure security, the United States will strengthen its military presence in the Arctic region and take security measures with allies and partners to protect common interests.[43]

Therefore, the Biden administration has engaged its allies and partners in regularly holding joint military exercises in the Arctic region, expanding NATO's influence in the region. The future confrontation between Russia and the United States in the Arctic will continue, and geopolitical risks will gradually increase. In addition, once Sweden successfully joins NATO, a new geopolitical alliance will emerge among the Arctic countries, with seven out of eight Arctic countries forming an alliance with NATO, forming a situation where the Arctic 7 of NATO confront Russia.[44] The internal rift between Arctic countries seems to be growing, and the NATO oriented Arctic countries will also cause Russia to be more vigilant and even resistant, thus posing greater uncertainty for the stability and peace of the Arctic region.

(2) Changes in Arctic cooperation

Currently, Western countries have interrupted almost all bilateral and multilateral cooperation with Russia in Arctic affairs. Not only has Russia been excluded from the Arctic Council, but the previously well-developed offshore oil exploration cooperation between Russia and Norway has also been forcibly suspended. Germany's Siemens,

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42 The White House, 'National Strategy for The Arctic Region', published on October 2022, accessed on 23 August 2023.

43 Ibid.

44 L. W. Brigham, 'Ten ways Russia's invasion of Ukraine impacts the Arctic and the world', The Hill, published on 15 November 2022, accessed 24 August 2023.

France's Total and Technip, as well as Japan's Mitsubishi Corporation, have also withdrawn from Russia's Arctic LNG 2 Project due to enormous pressure.[45] Russia has currently shifted its Arctic cooperation direction to China. Taking into account the strong willingness of both China and Russia to cooperate in energy, the future energy cooperation between China and Russia will continue to deepen.

At the same time, China's energy cooperation with other Arctic countries has not made breakthrough progress. Under such circumstances, China is likely to form a model of participation in Arctic energy resource development that focuses on cooperation with Russia in the future. However, this mode of participation that focuses on cooperation with Russia may continue as Russia's isolation situation continues, causing China to face the problem of being forced to bind Russia and lacking the participation of other international forces.[46] This will not only make China more dependent on Russia for energy, but will also make China's Arctic energy cooperation have to bear more risks.

(3) The high cost and difficulty of Arctic energy development

The development of Arctic energy depends significantly on its profitability. The harsh natural environment and extreme weather in the Arctic region often require special equipment to ensure the safety and sustainability of energy extraction in the Arctic. Taking oil and gas as an example, the Arctic still experiences very low temperatures despite the warming trend, making it difficult for ordinary oil and gas extraction equipment to operate normally. Oil and gas extraction equipment needs to be specially designed to withstand severe cold temperatures. The soil conditions in the Arctic region are harsh, and additional site preparation is also required to prevent equipment and structures from sinking.

Due to the complexity of technology and environment involved in development, there is also a high risk of project delays and cost overruns. In addition, the Arctic region is located in a remote and sparsely populated area, with relatively backward transportation infrastructure and high transportation costs for oil and gas. The use of ice breakers also increases transportation costs, making the transportation of oil and natural gas to the final market a major challenge. At the same time, the labor force in the Arctic region is scarce and limited by harsh environments, resulting in higher salary requirements for employees, which also increases the cost of energy development.

(4) Strict environmental requirements

The ecological environment in the Arctic has extremely weak self-repair and regulation capabilities. In order to reduce the impact of energy development on the environment, Arctic countries have formulated strict environmental laws and regulations. In the process of energy development, in the event of accidents such as oil and gas leaks, not

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45 M. Humpert, 'France's Technip To Complete Exit From Arctic LNG 2 Project in First Half of 2023', published on 25 October 2022, accessed 24 August 2023.

46 Y. A. Jing, 'China's participation in oil and gas cooperation in the Arctic: progress, challenges, and countermeasures', *International Petroleum Economics* (2022) 12-17.

only is the cost of cleaning very expensive, but it will also cause serious damage to the flora and fauna of the region, threatening the Arctic biodiversity, including tundra vegetation, reindeer, polar bears, seals, whales, and other Arctic marine organisms, causing a devastating blow and irreparable impact.

Secondly, the shipping industry in the Arctic also has an impact on the natural environment and ecosystems due to greenhouse gas emissions. Currently, Arctic countries such as Finland and Russia have developed large transport ships and ice breakers powered by natural gas or nuclear energy, with the aim of reducing their impact on the Arctic ecosystem. Even so, resource development in the Arctic region has been facing opposition from environmental organizations and indigenous peoples, with protests continuing. Affected by environmental protection, China's energy extraction will face greater pressure.

(E) THE FUTURE PATH OF CHINA'S PARTICIPATION IN ARCTIC ENERGY DEVELOPMENT

The geopolitical situation in the Arctic region is clearly warming up. Although China does not want to see the escalation of confrontation between the United States and Russia in the Arctic, the politicization of development in the Arctic region is inevitable, and maintaining a low level of conflict in the Arctic region will be a more realistic choice.[47] In promoting the resolution of the Arctic issue, China should have a clear stance: stand on the position that the global destiny is connected, actively coordinate with all parties in the Arctic to calmly resolve conflicts, unite with more countries to improve multilateral international governance in the Arctic, and promote the opposite direction of the Arctic issue towards dependable legal regimes and justice. Moreover, the current close cooperative relationship between China and Russia has raised concerns among other Arctic countries.[48] China needs to pay close attention to the dynamic changes in other Arctic countries' perception of China in the Arctic. While deepening energy cooperation with Russia, China needs to pay more attention to the dynamic changes in other Arctic regions' perception of China in the Arctic, and strengthen cooperation with Nordic countries and Europe in the Arctic region, striving to develop friendly and cooperative relations with more countries.

Secondly, the harsh natural environment in the Arctic region poses very strict technical requirements for energy extraction and transportation. In order to save costs and better develop Arctic energy resources, China needs to strengthen the promotion of scientific and technological development and cooperation. The Chinese government can increase funding for scientific, technological, and equipment research and development, introduce measures to encourage enterprises to participate in the research and development of Arctic energy science and technology, and actively strengthen scientific and technological cooperation with countries around the world, such as in the fields of technical equipment such as ice breakers, anti-ice tankers, and search and rescue

47 Y. Wei, & W. H. Chen, 'Research on energy issues in the arctic region', *Globalization* (2021) 97-109.

48 A. P. MacDonald, 'China-Russian cooperation in the Arctic: A cause for concern for the Western Arctic States?', *Canadian Foreign Policy Journal* (2021) 194-210.

equipment, and Finland, Norway, Russia, etc., to enhance technological capabilities. At the corporate level, Chinese energy companies can actively learn from international energy companies, learn from their rich technical experience, and learn from their advanced management models. On the other hand, China can also promote exchanges between scientific research institutions among countries, improve the talent training system, increase talent training, and provide more talents for energy development.

In addition, China needs to pay attention to the issue of energy equity. The Arctic has a strong focus on energy equity, which is giving indigenous peoples and local communities access to safe, affordable and sustainable energy while protecting the environment.[49] In terms of Arctic energy development, China not only needs to effectively protect the fragile natural environment of the Arctic and reduce environmental pollution, but also protect the historical and cultural traditions of local indigenous peoples and respect the rights of Arctic indigenous peoples. Before carrying out relevant economic development activities, China must investigate and understand these rights in detail. In the process of energy development, the Chinese government should provide standardized guidance and national review for corporate investment processes to reduce the adverse impact of economic development activities on indigenous peoples. At the same time, Chinese companies must always maintain communication and exchanges with Arctic indigenous communities, pay close attention to the interests and needs of local indigenous peoples, and actively fulfill corporate social responsibilities to help establish a good national image internationally.

(F) CONCLUSION

China is currently in a period of economic transformation and massive energy consumption, and its demand for energy is huge. For a long time, China has had to import large amounts of oil and natural gas from other countries. Taking into account factors such as energy transportation security, energy source security, and energy pattern security, China has been trying to enrich its imported oil and natural gas energy sources. As climate change makes it possible to exploit Arctic oil and gas resources, China has also set its sights on the Arctic. In recent years, China has been actively carrying out energy cooperation projects in the Arctic region. Unfortunately, most of China's energy cooperation projects in the Arctic have failed to achieve expected goals, and in particular, none of the energy projects in Greenland have achieved actual output. Currently, the most well-operated and productive project in the Arctic that China has is the Yamal LNG project in cooperation with Russia. After Russia was sanctioned and ostracized by the West for its invasion of Ukraine, Russia chose to further strengthen Arctic energy cooperation with non-Western countries, especially China. Faced with Russia's enthusiasm for cooperation, China has also chosen to further deepen energy cooperation with Russia.

However, this does not mean that China's Arctic energy development will be smooth sailing. In fact, the current development of Arctic energy resources is faced

[49] D. McCauley, et al, 'Energy justice in the Arctic: Implications for energy infrastructural development in the Arctic', *Energy Research & Social Science* (2016) 141-146.

with two major long-term problems. First, the special natural environment of the Arctic makes development very costly, difficult, and technically demanding. Second, due to the fragile ecological environment of the Arctic, the Arctic's Energy development faces great environmental pressure. In addition, coupled with the current low period of international cooperation in the Arctic and the increasingly complex geopolitics of the Arctic, these have greatly hindered Arctic energy cooperation between China and Russia. If China wants to better promote China-Russia Arctic energy development, it must increase investment in talent training and technology updates, resolve technical pressures, cost pressures, and environmental pressures, and coordinate relations with various stakeholders. Finally, considering China's long-term interests, while deepening energy cooperation with Russia, China can also actively seek to strengthen energy cooperation with Nordic countries in the Arctic region, strive to expand the scope of energy cooperation partners, and always adhere to the principle of economic efficiency and environmental justice in the process of energy cooperation.