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**FROM POLAR ICE TO POLICY: THE ROLE OF US AND OTHER
KEY ACTORS IN ARCTIC CLIMATE CHANGE, ENERGY
TRANSITION AND GEOPOLITICAL DYNAMICS**

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Θεοφάνης Καλαντζής

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SUMMARY

This Dissertation, analyzes the fight in which the strongest international actors, such as the USA, Canada and Russia, have engaged in the Arctic. In particular, the current situation of the Arctic and the increasing consequences of climate change and the significant effects of the reduction of Arctic ice on biodiversity, indigenous communities, and the global climate are first analyzed. Next, the enormous potential of its energy sector is analyzed, examining the importance of fossil fuels and the prospects for transitioning to clean forms of energy. At the same time, initiatives for the development of renewable energy sources and technological innovations that promote sustainable development are analyzed, as well as the challenges facing the region for a smooth energy transition. A significant part of the analysis is devoted to the geopolitical environment of the Arctic as it has been shaped and the role played by major powers such as the US, Russia and Canada in securing their strategic interests and gaining comparative strategic advantage. International rivalries are particularly emphasized, but also the alliances formed for the exploitation of the region with the aim of securing the sovereign rights of the states that have interests in the Arctic and access to the natural resources of the region. The need to develop international cooperation to ensure the governance of the Arctic in sustainable terms is also analyzed. In this context, the current institutional framework governing the Arctic is presented through a set of international agreements, such as the Paris Agreement, as well as diplomatic initiatives and policies for the protection of the Arctic environment. The future scenarios for the Arctic, through the analysis of climate forecasts, the possible energy changes as well as the fluid nature of the geopolitical perspectives of the region are critical parameters of the analysis as well as the examination of the role of the international community in the governance of the Arctic and the need for a multilateral, collaborative approach.

INTRODUCTION

The Arctic, the coldest region on Earth, with the largest mass of ice in the world, is not only an environmentally key area, but also a strategic, geopolitical and energy area of extremely pivotal importance. The Arctic is one of the most vulnerable regions on the planet, especially in terms of climate change, with its rate of warming more than double the global average (Sörlin, 2017). The Arctic Peninsula which is home to nearly four million people facing the impacts of climate change that will alter their lives and livelihoods, is one of the fastest warming regions on Earth, with temperatures rising by nearly 3°C over the past 50 years (IPCC, 2021). For a long time, scientists' models had predicted, moreover, that the most significant effects of anthropogenic climate change would be located in the polar regions, and the case of the Arctic is a very typical example (Henderson et al., 2021).

The Arctic ice sheet, the largest on the planet, is a system of interconnected glaciers formed by snowfall that remains stable throughout the year. However, due to increasing temperatures, the ice in the polar regions ice has been steadily decreasing over the past few decades. Since 1979, the Arctic region has lost about 3.58 million square kilometers of sea ice, which is equivalent to about five times the size of Texas (National Snow and Ice Data Center, 2024), while West Antarctica is losing nearly eighty billion tons of ice each year (Copernicus Marine Service, 2023). The widespread melting of polar ice is expected to contribute to global sea level rise, with consequences for coastal communities around the world. In addition, melting ice can affect the ecosystems and marine life that depend on these frozen environments. Rapid climate change in polar regions may also affect weather conditions in other parts of the world, amplifying the challenges facing the people and communities that depend on these regions' natural resources (Nani et al., 2024).

In March 2023, satellite data showed the fifth lowest end-of-winter extent of Arctic sea ice in nearly 50 years of record-keeping (NASA, 2023). The relevant data show an incredibly significant loss of 9,5% per decade of ice compared to the 1981-2010 average or a loss of about 79,500 square kilometers per year (National Snow and Ice Data Center, 2024). The effects of melting ice not only affect the local environment

and indigenous communities, but also have wider geopolitical, economic and energy implications (Rantanen et al., 2022).

Until today, the geopolitical interest of the great powers has been focused mainly on the wider Middle East and on regions such as Eastern Europe and Southeast Asia, which traditionally constitute fields of strategic interests and competition, which determine the policies and decisions of the great powers. However, the changing factor of climate change shows that it has affected the balance of competition between the major powers. Thus, the competition now extends to the Arctic, which is emerging as a new region of particular geopolitical interest, as rich hydrocarbon resources are expected to cause future tensions in the region, making it the new arena of conflict between the great powers, which may lead to tensions and new geopolitical challenges (Young, 2011).

In this dissertation, the changing geopolitical conditions in the Arctic will be examined as part of a broader discussion of strategic competition in the Arctic. It is an area where climate change, energy transition and geopolitics interact to form the framework for political and strategic decision-making by the world's major powers. It will be examined how climate change and the melting of ice fundamentally affect international relations and policies for the exploitation of energy resources, while the diplomatic and strategic actions taken for the exploitation of the region by the major world powers that they are leaders on the international stage.

In particular, it will be examined, the context of the complex interactions between climate change, the energy transition, and geopolitical dynamics in the Arctic, focusing on the role of the United States and other key actors such as Russia and Canada through a multidimensional analysis that combines environmental, energy and geopolitical parameters. The Arctic is a fact, that it had remained for a very long time, an internationally neutral area, of no particular interest and therefore, far from geopolitical tensions. However, the emerging climate crisis, especially in recent years, which is causing ice to melt and new sea lanes to appear, has caused increased activity in this remote polar region. As sea levels rise, competing strategic interests begin to emerge (Ford et al., 2019).

Analyzing these new data at an environmental, energy and geopolitical level will allow us to better understand the challenges and opportunities arising from changes in the Arctic, which affect not only the region but also international relations and global

politics as a whole. In particular, the strategies followed by state entities - superpowers in the international environment, in order to adapt to the new challenging conditions created by climate change and the discovery and exploitation of new resources, will be thoroughly analyzed.

The dissertation aims to approach the Arctic region, as a place where climate change, energy transition and geopolitics interact and compose the political and strategic decisions of the great powers. In this context, it will be attempted to analyze the ways in which major powers and international organizations are responding to changes in the Arctic, how they are redrawing maps and how they are arguing for more extensive sovereign rights over what lies beneath the ocean: a vast strip of seabed of the Arctic, extending across the North Pole. At the same time, the importance of the Arctic's energy resources, and the challenges and opportunities arising from the energy transition towards more sustainable solutions are another factor in the emergence of geopolitical conflicts for dominance in the region.

The methodology followed in this dissertation is based on an analysis of secondary data from scientific studies in the relevant field, official documents and international treaties. Through the comparative analysis of different approaches and policies, the main strategic choices of the states involved, the broader geopolitical interests that dictate and mobilize their attitude, as well as the role of the international community for these new issues that are emerging with a focus on the Arctic, will be explored.

The dissertation is organized into five main chapters, each focusing on one of the key aspects of the subject. The first chapter offers an overall overview of the severe climate crisis taking place in the Arctic and the severe environmental impacts of melting ice. Scientific studies demonstrating how melting Arctic ice is affecting the global climate, marine ecosystems and local communities will be presented. Particular attention will be paid to how these changes affect geopolitical and economic interests in the region.

The second chapter focuses on the changing reality of the Arctic Circle and especially on very important, so far unexploited, energy resources of the Arctic, the exploitation of which is an important area of interest for global state actors, combined with the global trends and strategies of transition towards renewable energy sources. The existence of extensive reserves of fossil fuels in the Arctic has led to intensive

exploration and mining activities, mainly by the United States, Russia, Canada, China and European Union, so that Arctic has developed into a field of strategic confrontation by countries that aspire to play a leading role in the area. It will be analyzed how the region's energy resources influence the international political agenda and how the shift to renewable energy sources can shape the strategy of these countries.

In the third chapter, the geopolitical confrontations and the strategic tactics of the main players in the Arctic will be analyzed, since mainly the USA, Russia, Canada, China, and European Union, have important interests in the region. Geopolitical confrontations and diplomatic deliberations, such as the Arctic border dispute, exploitation of natural resources, military interests, will be examined, while attempts at multilateral cooperation will also be examined.

The fourth chapter examines international agreements and partnerships for the management of the Arctic region. In particular, international agreements will be analyzed, such as the Paris Agreement as well as international cooperation efforts mainly through the Arctic Council. Particular attention will be paid to how these policies attempt to balance environmental protection and geopolitical interests in the context of a new power politics.

The fifth chapter predicts future scenarios for the Arctic based on current trends in climate change, the energy transition as well as existing geopolitical dynamics as they have shaped and continue to shape. Through this analysis an attempt will be made to predict the trends, as well as predict how the region will develop in the future but also how the main actors, such as the USA, are expected to possibly adjust their policies to respond to the changes and also to the need to serve their wider interests in the Arctic.

In the final part of the dissertation, the findings of the study will be summarized, as well as future trends for the formation of Arctic strategies of the main international actors. At the same time, conclusions will be drawn about the complex interaction of climate, energy and geopolitics in the Arctic, attempting to present a comprehensive analysis of the factors shaping the future of the region. Finally, the critical role of international cooperation and international organizations will be emphasized, with the Arctic Council in particular, which is an intergovernmental forum for the promotion of cooperation, coordination and interaction between the Arctic states regarding common issues, in order to achieve sustainable solutions in the region.

CHAPTER 1: THE ARCTIC CLIMATE CRISIS: A COMPREHENSIVE OVERVIEW

1.1 Arctic region

The Arctic Circle, the most northerly of the Earth's five great parallel circles, begins at latitude 66.5 degrees north of the equator. The Arctic Circle passes through North America, Greenland, Northern Asia, the Scandinavian Peninsula and the Arctic Ocean. Eight countries have territories within the Arctic Circle, namely Norway, Sweden, Finland, Russia, United States (Alaska), Canada, Denmark (Greenland) and Iceland. The only country that is completely in the Arctic, is Iceland, while all the other seven countries only have some areas there (Coote, 2023).

The name "Arctic" comes from Ancient Greek and was given by analogy to the constellations of Ursa Major and Ursa Minor, which are located near the pole star. The area has been inhabited for thousands of years by indigenous populations, such as the Inuit and Sámi peoples. Pytheas, a citizen of the Greek colony of Marseilles, a skilled navigator, astronomer and sailor, was the first European explorer, who reached the Arctic in 325 BC (Reeploeg, 2023). In his treatise, entitled "About the Ocean", Pytheas records a sea voyage to Britain, the North Sea and the coastline of north-eastern Europe, the mysterious northern lands that were sources of supply of tin, timber and gold for the Mediterranean. This book contains interesting clues that Pytheas may have reached as far as Iceland and the Arctic Ocean. According to Strabo, the ancient Greek geographer, philosopher and historian, Pytheas sailed for six days before reaching a land he named Thule, which some scholars identify with Iceland. Whether Pytheas actually landed in Iceland is hotly contested, and the possibility has divided scholars for decades. Some scholars accept that Thule is indeed Iceland, while others consider it to be Norway (Reeploeg, 2023).

The area of the Arctic is about 45 million square kilometers, of which one-third consists of the Arctic Ocean and the surrounding seas (Kristoffersen and Langhelle, 2017). Today, the population of the Arctic is estimated at around 4 million, making it the most sparsely populated region of the world. The Arctic is rich in natural resources such as fish, furs, oil, natural gas, timber and rare minerals. Also, melting ice makes it

easier to navigate through formerly frozen sea lanes, affecting international shipping (Ritchie et al., 2021).

1.2 The impact of climate change on arctic ice

The Arctic is one of the most rapidly changing regions on the entire planet, with its current state reflecting the most severe effects of emerging climate change. The Arctic region combines a unique marine and terrestrial ecosystem, in which Arctic ice plays a key role in maintaining the balance of these systems and their sustainability. However, based on the available data, the Arctic is now warming at a rate twice as fast as the global average in recent decades, a phenomenon known as "Arctic amplification" (Lu, 2023).

Probable causes for the extreme warming trend in the Arctic include changes in cloudiness (cloud cover), increases in atmospheric water vapor, transport of more atmospheric heat from lower latitudes, and shrinking sea ice. In particular, with regard to the reduction of sea ice, the acceleration of the increase in temperature results from the increased absorption of solar radiation by the sea, as the reflection of light from the ice is reduced due to its gradual melting (Steiner et al., 2021).

As in recent years, the Arctic has experienced extremely high temperatures, this fact has led to a dramatic melting of sea ice, glaciers as well as permanent frost (permafrost) which plays an important role in shaping the geomorphology, hydrology and ecosystems of regions with a cold climate such as the Arctic. It is notable that since the late 1970s, the Arctic has lost approximately 75% of its sea ice volume. These significant changes have drastically transformed the Arctic landscape, resulting in the period in which the ice remains compact to steadily decrease (Corell, 2016).

1.3 Environmental impact of Arctic ice melt

The melting of Arctic ice has incredibly significant and wide-ranging environmental consequences, affecting not only the local ecosystem but also the global climate. These changes are driving climate change in the Arctic, which in turn is contributing to rising temperatures and the rapid melting of polar glaciers and sea ice. Melting ice has significant impacts on a number of areas including global ocean

circulation, sea level rise, biodiversity as well as indigenous peoples in local communities (Kumar et al., 2020).

One of the most important consequences of melting Arctic ice is a significant rise in sea level. As the ice melts, substantial amounts of water are released into the oceans. The warnings of scientists about the catastrophic consequences that the gradual rise of the sea level will bring to the coastal areas of the world, are continuous. In particular, flooding and coastal erosion are expected to affect the lives of millions of people who live in low-lying coastal zones. For example, cities such as Shanghai, Venice, and even New York are threatened with partial submergence due to rising sea levels, while small island nations such as the Maldives may be completely submerged within the 21st century (Meier et al., 2024).

Another important consequence of the melting of the polar arctic ice is expected, according to the experts, to concern the global circulation of the oceans. This is because the Arctic is a central element of the so-called thermohaline circulation, which is the circulation of deep and bottom ocean waters and which affects global climate and weather and starts in the Norwegian Sea, where warm water from the Gulf Stream warms the atmosphere in cold northern latitudes (Oldenburg et al., 2024). As melting Arctic ice releases massive amounts of fresh water into the oceans, this affects the natural salinity and temperature balance of ocean currents, which can lead to the disruption of ocean currents such as the Gulf Stream, a strong current in the Atlantic Ocean that originates in the Gulf of Mexico and flows into the Atlantic at the edge of Florida, accelerating along the eastern coasts of the United States and which keeps the climates of Northern Europe warm. Such a development could cause extreme climate changes, such as severe winters mainly in Western Europe (Rantanen et al., 2022).

The large-scale decline of Arctic sea ice has also, serious consequences for the global climate balance and sea level. This is because the Arctic acts as a "cooler" for the Earth, affecting the currents of gases and oceans. The reason lies in the fact that sea ice acts as a shield for the Earth, reflecting much of the solar radiation back into space. So as the Arctic ice melts, the dark ocean waters absorb more heat, which creates a feedback system that accelerates warming, a process known as the albedo effect, which is a measure of a surface's reflectivity. This results in worsening global warming, which contributes to more extreme weather events, significant sea level rise as well as serious disruptions to marine ecosystems worldwide (Perovich et al., 2021).

Also the melting of the permafrost in the Arctic area, releases large amounts of methane, which is known to be an extremely powerful greenhouse gas, formed by a combination of biological and geological processes and naturally trapped underground and under the sea bottom. The permafrost, which consists of layers of soil and ice that remain frozen for thousands of years, has trapped huge amounts of organic matter. As the ground thaws due to warming, the organic matter in the permafrost begins to decompose, releasing methane and carbon dioxide into the atmosphere (Collins et al., 2013). This process is particularly damaging to climate change as methane is much more powerful than carbon dioxide at trapping heat in the atmosphere. According to the researchers, the release of methane and carbon dioxide into the atmosphere from the permafrost may seriously accelerate the global climate crisis (Asbjørnsen et al., 2020).

Finally, rapid climatic changes, the continuous rise in temperature as a natural consequence of climate change and the melting of sea ice in the Arctic region, as well as increased anthropogenic activity, have yet another consequence. This is the ever-increasing interest in the Arctic, as the shorter distances created by the melting ice and the rich soils create opportunities for entrepreneurial development and attract investment capital both public and private. In particular, while in the past, crossing the Arctic seemed completely impossible, today, after the melting of the ice, it is now possible through the Arctic Passages, which are a complex formation between three continents, especially Europe, Asia and North America. The Arctic Crossing means that cargo from Western European ports goes to the Far East in half the time it takes today when ships travel through the Suez Canal. Today, three routes are now available for crossing the Arctic, the Northeast Passage, the Northwest Passage and the Arctic Ocean Passage, which has attracted the interest of various states with various competing interests in the Arctic region (Wu et al., 2024). Also, the discovery of hydrocarbon and mineral deposits, due to the melting of the ice, has fundamentally changed the geopolitical status quo, as it is a factor of attraction for countries such as the USA, Russia and China which, see the Arctic region, as a strategic center of energy sources, and thus, they strongly seek to take advantage of the new opportunities presented (Melia et al., 2017).

1.4 Impact on local biodiversity and indigenous populations

The climate crisis in the Arctic also has extremely critical consequences for both local biodiversity in the Arctic region and the indigenous populations, who live there and depend on the Arctic environment for their survival. The rapid changes in the climate and the continuous melting of the ice caps are disrupting local ecosystems and traditional ways of life, creating new challenges (Hirawake et al., 2021).

The Arctic has a hugely impressive and rich biodiversity, with species that have evolved and adapted to survive the extreme conditions and temperatures of the specific region. In the arctic marine ecosystem, dominated by sea ice, there is a wide variety of species, such as polar bears, seals and marine mammals, whose nutrition, reproduction and protection are directly dependent on the ice (Álvarez Fernández, 2021).

As is obvious, the rapidly increasing melting of the Arctic ice reduces and burdens the habitat of the specific species. For example, polar bears, which depend on hunting seals on the sea ice for their food, are now forced to travel longer distances to find food as they face shrinking sea ice. This has the effect of reducing the survival of their young, reducing their body weight and ultimately reducing their population. Seals are also affected in the same way as they are also faced with the melting of the ice on which they reproduce and find food for their young, while other marine species, such as whales, are affected by changes in sea temperatures and changing currents. In particular, these changes disrupt the food webs that support finding food for these marine mammals, as schools of fish and plankton, which are the main food for whales, decrease in number or move to other areas. In this way, marine mammals now find it difficult to find food, which contributes to the reduction of their reproductive capacity and also to the reduction of their population. Also, as whales may, in their search for food, move to colder sea currents, it increases the risk of them becoming entangled in fishing gear or even the risk of collision with ships (Barnes and Kaiser, 2017).

At the same time, the warming in the Arctic sea region has effects on land ecosystems as well. This is because the melting of the permafrost releases methane and carbon dioxide, which affects the plant and animal species that live in these environments. Thus, animals such as reindeer face more difficulties in finding food, as changes in rainfall make their access to plants on which their livelihood depends, difficult (Vincent et al., 2011).

The consequences of the climate crisis are also significant for the indigenous communities of the Arctic, such as the Inuit, the Sámi peoples and other indigenous populations who inhabit the region. The lives of these populations are linked to the

natural arctic environment, since they base their survival mainly on fishing, hunting and reindeer herding. As is evident, melting ice and severe climate changes in the Arctic region have disrupted these traditional ways of life, creating new problems of survival (Mardikian and Galani, 2023).

Hunting marine mammals such as seals and whales is becoming increasingly difficult as their populations decline and climate conditions make it impossible to use sea ice as a means of travel and hunting. At the same time, changes in terrestrial ecosystems have reduced the availability of animals traditionally hunted by indigenous communities, such as reindeer. These communities are particularly vulnerable to climate change as they depend on uninterrupted access to natural resources (Hanaček et al., 2022). Finally, the indigenous populations face significant problems as the rise in sea level due to the melting of the ice, as well as the increased erosion of the coasts put their settlements in immediate danger of extinction, as the foundations of the buildings collapse due to the destabilization of the soil forcing them to seek new areas to live (Brubacher et al., 2024).

1.5 The role of NOAA Arctic Program to research initiatives in monitoring Arctic Climate Change

The NOAA Arctic Program (US National Oceanic and Atmospheric Administration) a United States government agency created in 1970 as part of the United States Department of Commerce, has assumed a very critical role in monitoring climate change in the Arctic region, since as mentioned above, this is an area that is undergoing rapid changes in terms of temperature increase, a change that is clearly greater than the global average. The research carried out by this organization, and the data generated by the program, are critical not only for understanding the effects of climate change in the Arctic but also for the development of policy strategies that respond to the region's new challenges (Tabisola et al., 2023).

The main objectives of the NOAA Arctic Program are basically three: the monitoring of the climate in the Arctic, the understanding of the effects of climate change as well as the development of partnerships with international organizations for the exchange and joint use of research data and the development of strategic actions. In particular, the aim of the Program, is to understand and predict changes in climate, weather, oceans and coasts, to share this knowledge and information with others, and

to conserve and manage coastal and marine ecosystems and resources. The Arctic region is clearly at the forefront of climate change as current drastic conditions, such as melting ice and rising temperatures, make the region vital for studying global climate change. Through the monitoring and study of these parameters by NOAA facilitates the development of reliable forecasts as well as the development of policies to effectively address future challenges in the region (NOAA, 2020).

To monitor climate change in the Arctic, the NOAA Arctic Program uses a suite of modern technological tools as well as innovative research initiatives. For example through the collection of satellite images from a range of modern technological tools and research initiatives. Satellite images collected by the Suomi NPP and NOAA-20 program satellites used to collect data for monitoring the planet's environment and climate, including climate change in the Arctic, are essential for recording ice change, of temperatures and other climatic parameters in the area. The data provided by the satellites allow inferences to be made about the change in Arctic sea ice, surface temperature, sea level and other critical parameters affecting the Arctic climate and environment (Meining et al., 2019).

At the same time, NOAA's program uses measurements from marine platforms and research stations it has installed in the Arctic. The data obtained from these measurements help to understand the change in sea currents, temperatures and the effects on the local ecology and biodiversity. NOAA researchers conduct studies and surveys on a regular basis in the region in order to collect data that can contribute to developing reliable predictive models for the future climate state in the region, as well as improving the understanding of the rate of climate change taking place.

As it is clear that climate change issues in the Arctic require international cooperation, the NOAA Arctic Program works closely with international organizations and countries with interests in the region, such as the Arctic Council and the United Nations Framework Convention on Climate Change (UNFCCC), to sharing data and participating in joint research initiatives. These partnerships facilitate the development of joint strategies and policies to effectively address climate change in the Arctic (Scott, 2020).

The NOAA Arctic Program also participates in international conferences and forums where policy makers have the opportunity to discuss the latest developments on the impacts of climate change on the Arctic and thereby develop the best possible strategies for managing natural resources and environmental protection in the Arctic region. These partnerships ensure that NOAA research significantly influences

decisions made at the international level about the Arctic while contributing to the design and implementation of policies to protect the Arctic environment (Scott, 2020).

Main Research Areas and Priorities The NOAA Arctic Program is focused on a set of critical research areas. Among these are the study of sea temperatures, climate conditions, ocean currents as well as the predicted fluctuation of sea level in the area. The program is also constantly investing in new technologies in order to achieve the optimization of the monitoring methods it uses, such as the use of virtual models that have the ability to simulate the changes taking place in the Arctic ice and in the Arctic ecosystems in general. NOAA's findings have important application in the development of strategies for the management of natural resources and the protection of biodiversity, as they concern two cutting-edge sectors that have been very seriously affected especially in the last ten years, due to climate change in the Arctic. Finally, through the research carried out by the program, the understanding of the relationships and interactions that take place between the Arctic and other regions of the world is enhanced, which contributes to the development of even more reliable and accurate climate models (Meining et al., 2019).

CHAPTER 2: EVOLVING ENERGY LANDSCAPES: ARCTIC RESOURCES AND TRANSITION STRATEGIES

2.1 The strategic role of the exploitation of energy resources in the Arctic

The Arctic is a region that has very important energy resources, which mainly include fossil fuels such as oil, natural gas and hydrocarbons. It is obviously about energy resources, which given their value but also their relative scarcity, given that as time goes by they show a significant decrease, they have attracted a lot of international interest and huge financial investments, due to the significant reserves that are under the ice. The need to find new sources of energy in the global market makes energy resources in Antarctica a particularly important source of wealth. However, it should be noted that the exploitation of these resources in the Arctic is extremely complex as well as controversial, both from an environmental and geopolitical point of view (Romasheva & Dmitrieva, 2021).

The Arctic includes one of the largest areas in the world that have unexploited reserves of oil and natural gas. Based on estimates with U.S. estimates. Geological Survey (USGS), which is the Organization of Geological Survey of the United States which was founded in 1879 and operates under the Federal Service of the Interior (Department of the Interior) with the role of providing scientific data and knowledge for various fields, with the main objective of understanding of the natural processes affecting the planet and society, the Arctic region holds approximately 13% of the world's undiscovered and untapped oil reserves and 30% of the world's undiscovered and untapped natural gas reserves. The largest concentration of these very important energy resources is found in the North Arctic sea, near the coasts of Russia, Canada and Alaska (Morgunova, 2020).

Although these energy resources are vast and potentially extremely profitable, their extraction is a much more difficult undertaking as well as quite dangerous compared to other areas of the world. This is due on the one hand to the fact that the Arctic is a remote area and on the other hand due to the extreme climatic conditions prevailing there. In particular, their mining venture is difficult due to the risks associated with their extraction despite the fact that the continuous reduction of arctic ice and ever-

increasing temperatures have opened new routes for the exploration and exploitation of these energy resources. The countries that exploit or have expressed the desire and intention to exploit these energy resources in the Arctic are mainly Russia, the United States, Canada, Norway as well as other countries with access to the Arctic and other countries with access to the Arctic.

The USA, for example, has expressed a relative interest in exploiting these energy resources through Alaska, as Alaska, as part of the United States, has significant energy resources, mainly oil and natural gas. The Alaskan Arctic region, including the Arctic National Wildlife Refuge (ANWR), is very important for oil and gas development. Russia, too, has already developed policies to exploit Arctic energy resources as well as strategies to increase oil and gas production in the region, using advanced extraction and transportation technologies. This is due to the fact that Russia owns most of the Arctic which allows it to extensively exploit the region's energy resources, mainly oil and natural gas, through oil drilling and other energy projects in the Arctic region, such as in the North Sea (Carayannis et al., 2021).

As is obvious, the economic importance of the exploitation of energy resources in the Arctic is extremely great, as their exploitation can create enormous possibilities for the creation and development of existing and new energy markets. At the same time, the extraction of oil and natural gas in the Arctic could contribute to reducing the dependence for these energy resources on other regions, such as the Middle East or North Africa. At the same time, it is important to emphasize that the exploitation of energy resources in the Arctic is associated with a set of particularly serious environmental risks. As mentioned above, the Arctic is already particularly vulnerable to the effects of rapid climate change, with rapid melting of sea ice and a significant rise in temperatures. As is obvious, the potential hazards of accidents in the extraction of these energy resources, such as oil spills or other types of pollution, could have devastating consequences for the region's already highly fragile ecosystem. At the same time as extreme weather conditions prevail in the Arctic, this also makes it very difficult to prevent and also to deal with the consequences of possible such large-scale accidents (Urbański, 2016).

At the same time, it should be emphasized that the major concern for the extraction of fossil fuels in the Arctic is linked to the increase in CO₂ and other greenhouse gas emissions, which will logically further increase the already significant effects of climate change. Also, the exploitation of Arctic energy resources may be contrary to international statutory initiatives and treaty provisions to reduce greenhouse

emissions and protect the climate, such as, for example, the Paris Agreement. The great interest already expressed in the exploitation of energy resources in the Arctic is also expected to be linked to very important geopolitical dimensions. Competitions for the control of energy resources in the region are very likely to lead to political conflicts between states that have significant interests in the Arctic. For example, Russia has already developed huge programs related to economic as well as military strategies, to strengthen its presence in the Arctic at a time when the United States and other countries have expressed significant concerns about the possible onerous geopolitical effects of the Russian strategy (Morgunova, 2021).

At the same time, the international legal regime of the Arctic, such as the Convention on the High Seas (UNCLOS), provides a framework for the regulation of the relations between the interested international actors, the relations between them and the possibilities of exploiting the resources. This framework already determines who has exploration and exploitation rights in the area. It is therefore obvious that a possible violation of the relevant legal framework as well as the increased interest in resorting to procedures concerning possible conflicts between states on these issues, can intensify political tensions between states with extremely unfavorable and unpredictable consequences for the future. The role of energy resources in the Arctic remains in any case critical, both from a geopolitical and economic point of view, as they can play a central role in shaping the global energy strategy. However, their exploitation should take into account the serious environmental and geopolitical consequences, as the Arctic remains a region characterized by the interaction between a network consisting of environmental concerns, international relations of states and very large strategic economic interests (Johnston, 2012).

2.2 Renewable energy initiatives in the Arctic

2.2.1 Prospects and possibilities

The Arctic region, due to its vast natural resources, attracts a great deal of international interest in the creation and development of energy infrastructure for the utilization of these resources, while at the same time, efforts are being intensified to utilize renewable energy sources. Despite the challenges associated with the extreme climate conditions in the region, the initiatives and strategies for the exploitation of

renewable energy sources in the Arctic highlight the region's potential for sustainable development and strengthening of energy security, both locally and internationally.

The exploitation of renewable energy sources in the Arctic, i.e. energy produced from renewable, non-fossil, energy sources that are naturally replenished on the time scale of human life, focuses mainly on the exploitation of sources such as wind, solar and geothermal energy. These sources of renewable energy present many and important exploitation possibilities, given that the conditions prevailing in the Arctic region, despite adverse weather conditions, can support the production of energy from these sources (Arruda & Arruda, 2019).

Wind energy

The Arctic region is particularly favorable for the development of wind farms, as the prevailing winds in the region are of high intensity and continuous. Wind power has become one of the most important sources of renewable energy in the Arctic, particularly in the coastal regions of Russia, Norway, and Alaska, where strong winds make the area suitable for the development of wind farms. However, the development of these projects for the exploitation of wind energy in the Arctic is not limited to technological and economic feasibility, but is directly influenced by geopolitical interests.

Countries such as Russia and Norway have expressed strong interest in exploiting renewable energy sources in the Arctic, having invested in the construction of large wind farms along the Arctic coast. This is because these areas not only favor the exploitation of wind energy but also the development of other infrastructures linked to their energy strategy, but also the strengthening of the local and national economy, such as infrastructures for the extraction and processing of natural resources, the utilization of thermal energy from geothermal sources, port and shipping infrastructure as well as research centers and technological facilities (Ghani et al., 2019).

Northern Norway too, has already several wind farms in the Arctic, while Russia has expressed an interest in the exploitation of wind energy in the Arctic, as it recognizes the enormous potential for enhancing energy security in this way, both for itself as well as for the Arctic. Russia is already investing in renewable energy technologies in the Arctic, not only to achieve internal energy security conditions, but

also to ensure control of energy resources in the Arctic region, which includes large areas for the installation of wind farms. The potential for wind power generation is ideal for the Arctic due to its geographical uniqueness as it is a remote area where the local community is highly dependent on external energy sources (Kryltcov & Solovev, 2019).

This peculiar geopolitical dynamic for the exploitation of wind energy in the Arctic is intensifying as other countries, such as the US and China, strongly seek to strengthen their presence in the Arctic through strategic energy investments, which is causing tensions in the region. In particular, China's renewable energy strategy in the Arctic includes participation in international projects such as wind farms and infrastructure to enhance its energy security and support the "Silk Road" policy through the Arctic (Liu et al., 2023).

Solar energy

Solar energy is also a very important source of renewable energy with high prospects both for the countries concerned internationally and for the Arctic itself. However, exploiting this renewable energy source in the Arctic is a difficult undertaking due to the unique challenge of the polar night and given that these areas do not receive solar radiation for months. However, the significant technological development that has contributed to the development of modern photovoltaic systems, which are more efficient, solar energy can be harnessed in the Arctic to generate energy during the summer season, where there are long periods of sunshine. Given Russia's expansionist policy that owns a large percentage of the Arctic Circle, solar projects have already been developed by Russia to serve remote communities and facilities, proving the potential of renewable energy in this extreme environment (Osawa et al., 2024).

Geothermal energy

Geothermal energy is another important type of renewable energy source, which has attracted the interest of many countries, especially in areas with intense geothermal activity. Iceland, for example, has developed advanced geothermal power

generation and heating systems on the periphery even though it is not exactly in the Arctic, demonstrating that geothermal energy can be a central pillar of the energy transition. Some Arctic regions, such as Russia and Canada, have already identified very important geothermal fields in the Arctic and have already invested heavily in this technology, and are expected to invest more in this technology. The interest of international actors demonstrates in any case that the exploitation of geothermal energy in the Arctic can provide continued and reliable energy production, despite the adverse climatic conditions prevailing in the region (Kolker et al., 2022).

In conclusion the exploitation of geothermal energy in the Arctic has an extremely important geopolitical dimension, as Russia and other countries in the region seek to expand their influence through partnerships and investments in renewable energy projects. At the same time, the development of geothermal projects in the region is linked to the increase in energy security and the strengthening of the diplomacy of the Arctic countries.

2.2.2 Challenges and opportunities for renewable energy exploitation in the Arctic

Renewable energy sources in the Arctic, while offering significant opportunities for the region and the states concerned, are also associated with a set of significant challenges. These challenges mainly concern the extreme climatic conditions but also the peculiar situation of the region that require the development of specialized infrastructures that can withstand extreme temperatures and particularly challenging conditions. As in the Arctic there are winters with extreme temperatures, large glaciers, but also the particularly remote geography of these areas, make the installation and maintenance of such projects much more expensive ventures and much more complicated compared to the development of related projects in other regions internationally. In addition, the technology for harnessing renewable energy resources in the Arctic is not fully developed as it is still under development, and many of these infrastructures are currently at an experimental stage (Hansen & Tàbara, 2024).

The success of initiatives to exploit renewable energy sources in the Arctic depends to a significant extent on the cooperation of states and international organizations, such as the Arctic Council, which, as mentioned above, promotes cooperation in the field of environmental protection and sustainable development in the

region. Through the cooperation, countries operating in the Arctic have the opportunity to exchange know-how and jointly strengthen the renewable energy infrastructure in the region, aiming at the energy independence of local communities and the minimization of environmental impacts. However, if one considers that states have conflicting interests in the Arctic region, the project of cooperation becomes largely difficult and challenging. Nevertheless, achieving cooperation should be a priority for interested states as renewable energy sources in the Arctic offer a promising prospect both for the region itself and for state interests, with appropriate strategies and technologies enabling development of renewable energy sources, despite geographical, climatic and other challenges. In this way, the advanced and sustainable exploitation of these resources is expected to have positive consequences not only for the Arctic but also for the overall global energy transition (Romasheva & Dmitrieva, 2021).

The exploitation of available renewable energy sources in the Arctic is increasingly attracting large investments and efforts for strategic partnerships, but at the same time intensifying geopolitical rivalries. So countries with significant strategic interests in the Arctic, such as Russia, Norway, Canada, the US and China, are competing in a race to develop strategic plans to control the Arctic's natural resources and energy infrastructure. In any case, cooperation, but also competing interests and confrontations, are expected to affect the course of development of the exploitation of renewable energy sources and the development of related projects for the exploitation of renewable energy sources, as the energy interests of the states are directly linked to the their political, economic and strategic position in the region.

In the near future, it is expected that cooperation at the international level and strategic agreements for the development of renewable energy sources in the Arctic, at least to the extent that it is expected to be done as the specific projects are particularly expensive and require cooperation, will be decisive in the direction of energy transition in the region. However, on the other hand, we should not ignore the fact that geopolitical rivalries and the desire for political and economic dominance of the states concerned will continue to shape the dynamics of the region, making the Arctic a decisive factor in the evolution of the global energy strategy (Murgunova et al., 2020).

2.3 Geopolitical ambitions focusing on the exploitation of energy resources in the Arctic.

As mentioned above, geopolitical tensions in the Arctic have increased, as many countries recognize the strategic and economic importance of the region and seek to establish their presence through significant investments in infrastructure and other strategic actions to exploit the significant energy resources in the Arctic.

Russia

Russia is one of the most active countries in the Arctic as it owns the longest Arctic coastline, extending its land into vast areas of the Arctic Circle. In particular, Russia extends to areas such as the Kola Peninsula, Siberia and the Arctic Archipelago region, while extending to the Sakhalin Islands and the regions around the Arctic Circle. This is a vast area which gives Russia a comparative advantage as it has strategic control over the Northern Sea and the Northern Sea Route, which makes the country dominant in the Arctic geopolitical chessboard (Stephen & Blank, 2011).

Obviously the geopolitical importance of the Arctic for Russia is enormous, as the country seeks to secure strategic control over sea lanes and exploit the Arctic's rich energy resources. For this reason Russia has invested and continues to invest huge sums in the development of infrastructure critical to the exploitation of these resources, such as the development of ports and shipping facilities including the port of Murmansk, the port of Piorent and the port of Vladivostok. The development of ports in the Russian Arctic boosts commercial activities and access to the Northern Sea Route, which has emerged as vital for international shipping due to shrinking sea ice due to climate change. Russia is also investing in the purchase of icebreakers, mainly the Arktika type, which are the most powerful in the world, while planning the development of the "Lider", which is expected to be the most powerful nuclear icebreaker in the world. Russia is constantly strengthening its available fleet of icebreakers by creating new, more sophisticated models as its goal is to secure control of the Northern Sea Route while its main concern is also to expand shipping connections through the region (Shapovalova et al., 2020).

USA

The United States of America, although it does not hold the same extensive area in the Arctic compared to Russia or Canada, nevertheless plays a very critical role in the region due to the existence of energy interests. Alaska, as an American territory in the Arctic Circle, is of strategic importance for the exploitation of energy sources. It is typical that most of the oil and natural gas production of the USA comes from the areas of Alaska, such as Prudhoe Bay, the largest oil field in the United States which is located along the northern coast of Alaska, near the Barents Sea and about 900 kilometers north of Anchorage (Thangaraj & Chowdhury, 2022).

The discovery and exploitation of energy resources in the Arctic has led to the increasing political and strategic importance of the Arctic region for the US. As the sea rim of the Arctic Ocean has very rich reserves of oil and natural gas, the USA has invested in very large mining projects in this area. The US in particular, through companies such as ExxonMobil and ConocoPhillips, have invested huge funds in mining projects in the region. The company ExxonMobil, for example, an American multinational oil and gas company based in Dallas, Texas, one of the largest oil companies in the world, with operations in many countries, cooperates with the Russian Rosneft, the largest oil company in Russia and one of the largest in the world, for the development of energy projects in the Arctic Ocean, mainly for the extraction of natural gas and oil.

At the same time, Alaska is a strategic hub for the transportation and processing of energy resources, through the Trans-Alaska Pipeline System (TAPS) oil pipeline, which stretches from Prudhoe Bay in northern Alaska, near the Arctic Ocean, to Valdez, which located on the southeast coast of Alaska, in the Pacific Ocean with a length of 1,500 kilometers transporting oil from Prudhoe Bay to the southern regions of the USA. Although meeting US energy needs continues to depend on traditional energy sources in the region, namely fossil fuels such as oil, natural gas and coal, the country has developed policies to exploit renewable energy sources in the Arctic. The development of wind and solar projects in Alaska is part of a broader strategy to reduce CO₂ emissions and strengthen the energy independence of remote communities. For example, the creation of the wind farm on Kodiak Island in Alaska, which was created by the United States through the Kodiak Electric Association, which is a cooperative energy company of the Kodiak region in Alaska, is one of the most typical examples of the creation of a wind farm for covering the region's energy needs (Thangaraj & Chowdhury, 2022).

The growing importance of energy resources in the Arctic is a fact that has now made the United States a key player in the region's geopolitical chessboard and energy map. US involvement in major strategic partnerships with countries such as Russia, Norway, and China reinforces the dynamic surrounding the exploitation of these resources. A relevant example of US cooperation in this context is the support of the American company ExxonMobil in the project of the Russian Sakhalin 1 field, where the company participated in oil and gas production projects. Through these partnerships, the main concern and pursuit of the USA is to ensure energy security, as well as the significant strengthening of the country's geopolitical position, as well as the vision to secure vital energy resources for the future.

The geostrategic importance of US policy in this area, as well as the importance of the partnerships it has developed with other countries, highlights the competition between states on the global chessboard for dominance in the Arctic. Of course, it should be emphasized that in this context, tensions and disagreements between states are expected to be inevitable in the near future, as the competition for the richest areas gradually intensifies, obviously increasing the tension. The strengthening of the infrastructure and the development of new technologies for the exploitation of energy resources will play a central role in shaping the future of the region, and geopolitical interests, as the main pursuit of the states that have interests in the region is to consolidate their control over exploitable sources Arctic natural gas and oil (Burke & Matisek, 2021).

China

China, although it is not an Arctic country, nevertheless recognizes the importance of the region for the "Polar Silk Road", within the framework of the Belt and Road Initiative (BRI), and thus has developed relevant action. In particular, the country has been investing especially in the last five years in very large and costly infrastructures, such as ports and shipping facilities, while promoting its commercial activity along the Northern Sea Route by investing in large ports and strengthening its fleet of icebreakers, in order to ensure the navigation in the region and to facilitate the export of energy resources. Russia currently has the world's largest fleet of icebreakers, which are essential to keeping the Northern Sea Route open. At the same time, Chinese companies have also undertaken the creation of large energy projects in

the Arctic, such as the Yamal LNG natural gas project in Siberia, in which China is investing significantly through state-owned companies as well as cooperation with Russian companies in the extraction of natural gas (Puranen & Kopra, 2023).

For example, China is currently cooperating with the Russian company Novatek, which is the largest independent natural gas producer in Russia and one of the largest in the country after Gazprom, in the development of the Arctic LNG 2 project, which is one of the largest mining investments and liquefied natural gas production in the Arctic. The Arctic LNG 2 project aims to produce and export natural gas from northern Russia to very large markets across Europe and Asia. The project has been developed on the Gydan Peninsula of Siberia, and involves the construction of three huge LNG processing facilities, allowing the production of a total of approximately 25 million tons of LNG per year (Wu, 2022).

The development of Arctic LNG 2 also includes the development of a series of floating platforms that are specially designed for its smooth operation in the harsh climatic conditions of the Arctic. The development of this project is aimed at strengthening the Russian position in the global LNG market and at the same time opening new trade routes through the Northern Sea Route. Apart from Novatek, very large international investors such as Chinese state-owned companies as well as companies from other countries such as Japan and France are participating in this huge project. The specific international collaboration initiated by China is indicative of the enormous strategic importance the Arctic has acquired for the energy potential of the region and the geopolitical interests of the countries involved as they have great interests in the Arctic (Alexeeva & Lasserre, 2022).

Canada

Canada is one of the largest Arctic countries and has extensive areas in the Arctic Circle such as the Northern Territories and Nunavut Land. These areas include the Arctic Archipelago, which includes islands such as Ellesmere Island and Baffin Island. These areas are of strategic geopolitical importance not only for navigation and maintaining control of Canada's maritime borders in the Arctic Circle but also for the exploitation of natural resources such as oil and natural gas. As can be seen, the strategic management of this area by Canada is of critical importance, as it includes important marine ecosystems and huge amounts of natural resources, especially

hydrocarbons and minerals. For this reason, the government of the country has focused mainly on strengthening its infrastructure in the region, as well as on the exploitation of energy reserves. Some of these investments include the development of an advanced fleet of icebreakers to ensure navigation through Arctic waters as well as investments in maritime security infrastructure to ensure Canadian sovereignty in the region. At the same time, the Canadian government invests significant funds in the development of military facilities to protect the interests of the state. In particular, the relevant militaries include the creation and maintenance of military bases in the Arctic, such as CFS Alert, which is the northernmost military base in the world, and serves as a monitoring and research base and is vital to ensuring Canada's sovereignty in the Arctic Circle. At the same time, the development of these military infrastructures and equipment is critical, given the increasing geopolitical tensions and the strategic importance of the Arctic (Morgunova, 2020).

For the exploitation of Arctic energy resources, Canada's policy is the desire to exploit in close proximity the significant natural gas and oil reserves located in the Canadian Arctic regions. For this reason the Canadian government has developed cooperation with companies to create exploration and mining projects. Typical examples are the collaboration of the Canadian government with the company Teck Resources, based in Vancouver, in northern British Columbia, Canada, which participates in mining projects for metals and other raw materials, as well as the collaboration with Suncor Energy, one of the largest oil production companies in Canada, headquartered in Calgary, Alberta province that is primarily engaged in the extraction of oil sands, a form of petroleum found embedded in sandy or shale formations land, as well as with oil and gas refining and production and which company is actively involved in oil and gas extraction projects in the Arctic Circle.

At the same time, Canada is developing infrastructure that will allow it to claim marine areas rich in energy resources, such as the construction and upgrading of icebreakers and other naval facilities while trying to take advantage of new shipping routes that are opening due to the reduction of sea ice such as the North Sea Route which runs along the Russian coast of the Arctic Ocean, from the North Pole to the Kirov Archipelago, providing a shorter route for shipping between Europe and Asia as well as the Northern Passage route, which runs from North America and Russia to Europe, bypassing the need for long detours via Suez or Panama. It should also be emphasized that Canada's interest in maintaining control of its Arctic regions is related

to commercial shipping, as sea routes through the Northern Passage can offer significant economic opportunities (Smyth & McIntosh, 2022).

Norway

Norway is a strategic factor in the Arctic, since it has quite large territories in that area. In particular, Norway extends to the Arctic Circle, the Norwegian Sea and the Barents Sea are two sea areas that are rich in energy resources, such as oil and natural gas, forming a central point of Norway's energy exploitation strategy. At the same time, Norway has the autonomous region of Svalbard (Svalbard), which is an archipelago of Norway, located in the Arctic Ocean, north of Norway and Iceland very close to the Arctic Circle, and is an area very rich in natural resources such as minerals and oil. Another important island is the volcanic island of Jan Mayen, which belongs to Norway and is located in the Arctic Ocean, north of Iceland and east of Greenland and also near the Arctic Circle.

Norway has had a strategic presence in the region, mainly since the mid-1970s, when significant oil and gas deposits were discovered in the Barents Sea, and today it exploits its natural resources, develops modern technologies for their exploitation, while maintaining a strong military and a political presence in the Arctic mainly in the areas near the North Sea and the Barents Sea with military bases and installations, such as the strategically important airport in Bodø in northern Norway, which is located just north of the Arctic Circle and is known for its strategic location, as it is close to the Barents Sea as well as the naval base in Tromsø, near the Arctic Circle which is home to a particularly important Norwegian Navy naval base, which is critical to Norway's monitoring and defense in the Arctic (Østhagen, 2021).

Norway implements a policy which is oriented both towards the exploitation of traditional energy resources as it is known for the exploitation of oil and natural gas deposits in the Barents Sea, as well as the promotion of renewable energy sources in the region. In this way, Norway continues to strengthen its position as a leading natural gas exporter in Europe while at the same time developing modern and innovative technologies for the exploitation of hydrocarbons in the Arctic. A prime example is the technology of subsea mining facilities as the country is a world leader in the development and use of subsea technologies for oil and gas extraction, such as the subsea fields in the Barents Sea (Caymaz et al., 2022).

Norway's strategy for renewable energy in the Arctic is also significantly developed with a particular focus on the development of wind and hydropower projects in the Arctic. A relevant example is the wind farm on Kvaløya Island which was created in 2017 by Statkraft, the largest renewable energy company in Norway and takes advantage of the region's strong wind conditions to generate electricity. At the same time, Norway is investing in sustainable technologies to exploit the Arctic's renewable resources to reduce CO2 emissions and strengthen its energy independence. A typical example is the HydroFlex Project which was completed only in 2020 by Statkraft, the largest hydropower company in Europe and one of the leaders in the field of renewable energy in the world, and aims to develop hydropower technologies using flexible systems that allow energy storage and real-time management of energy production.

Finally, Norway's strategy is investing in naval bases and strategic facilities in the Arctic, seeking to strengthen its competitive position in a geopolitically contested space. An example is the development of the modern naval base at Tromsø in northern Norway, on the island of Tromsøya, near the northern tip of the country, within the Arctic Circle. This particular base is used for strategic purposes and is of vital importance for Norway as it strengthens the country's surveillance and immediate reaction capacity in the region. At the same time, it plays a critical role in monitoring the marine areas of the Arctic Ocean, being a strategic hub for defense, in an area with a particularly intense load of geopolitical tension due to competing interests for the exploitation of natural resources and sea routes (Jensen, 2020).

CHAPTER 3: GEOPOLITICAL CHESSBOARD: POWER PLAY IN THE ARCTIC REGION

In this chapter it will be analyzed the geopolitical dynamics that have developed around the various interests of states in the Arctic, focusing on the key international players who move the threads of politics and diplomacy, as well as the strategic rivalries that shape the geopolitical chessboard. In particular, importance will be given to the role of the United States in the Arctic, with particular emphasis on its strategic presence and economic pursuits, as well as efforts to form international alliances and agreements that will strengthen its strategic interests. Also the role of Russia and Canada will be analyzed, with a focus on their geopolitical interests in the Arctic, the challenges, and the cooperations framework with other countries as well their strategies for obtaining a geopolitical advantage in Arctic region.

3.1 The role of the USA in shaping the geopolitical framework of the Arctic

As explained in detail, the Arctic is today one of the most strategically important regions of the planet, given that the significant climate change as well as the geopolitical pressure exerted by the policy followed by the major international players in the region, shape new trends, dynamics and opportunities for the Arctic. With the significant retreat of the ice due to the increase in temperature and the emerging access to new sea routes and the exploitation of huge amounts of natural resources that have remained unexploited until today, the Arctic is a field of international confrontations and attempts at cooperation. The Arctic's geostrategic position and the economic interests associated with it make the US one of the most important players in the region, and the US Arctic strategy central to US influence in international relations more generally (Bouffard & Rodman, 2021).

3.1.1 US strategic presence in the Arctic and military infrastructure

The strategic presence of the US in the Arctic is enhanced by its military infrastructure in the region, mainly through its naval and air strategic facilities both in Alaska which is the main focus of US military activities in the Arctic and in other regions of the North Pole . In particular, the US Air Force maintains strategic air bases in Alaska, to manage and support military operations in the region and to secure US interests. In particular, Eielson Air Force Base in Alaska is a strategically important air base for American forces in the Arctic.

This is because this base provides air support as well as proper training for the US Air Force. Its strategic value is very great, due to its proximity to the Arctic Circle area. Similarly, the strategic Clear Air Force Station in Alaska serves the radar and surveillance function to detect possible missile attacks and other threats as well as to monitor the activities of other major powers, such as Russia. In addition, the US maintains naval bases and infrastructure that enhance its strategic influence in the region. In particular, Naval Base Kitsap in South Alaska is used to support US naval forces in the Arctic, focusing primarily on offshore operations, and at the same time, due to its highly strategic location, the naval base allows the support of US naval missions in the region as well as exercising control over the North Sea region (Wegge, 2020).

At the same time, the US has a critical strategic presence in the Arctic Ocean as the US Coast Guard and naval forces frequently conduct exercises in the region to establish their presence as well as train in cold environments. At the same time, US nuclear submarines, which are based at Naval Submarine Base Bangor in Alaska, operationally support US naval missions in the Arctic and in this sense have a significant strategic importance. Also, US military infrastructure in the Arctic, both air and naval, is vital to protect US interests and ensure freedom of navigation, which is particularly important in addition to security and global trade (Bouffard & Rodman, 2021).

3.1.2 Strategic alliances and USA participation in international agreements concerning the Arctic

The presence of the USA in the Arctic is also strengthened by the multidimensional strategic cooperation with other countries that have strategic interests in the region, such as Norway and Canada for reasons related to geopolitics, security,

and economy. The Arctic is a region of strategic importance for international security, as melting ice opens up new sea routes and increases competitiveness for the exploitation of natural resources. The US seeks to strengthen security in the Arctic by cooperating with NATO countries and other strategic partners through joint military exercises, deployment of joint forces, information sharing, etc., which prevent potential conflicts in the region, as Antarctica is an area where strategic rivalries remain active and land claims are constantly evolving, mainly due to the potential existence of rich energy resources, thus ensuring maintaining US power in the region. For example, the US cooperates with countries such as Denmark and Norway with which they develop strategic alliances, as they aim to weaken the Russian presence in the region and strengthen their role against the competition (Dauylbayev et al., 2024).

These partnerships, with countries that have common interests in the Arctic, act as a deterrent to the manifestation of any unilateral action that could affect the balance in the region. For example, in 2018, the US announced the development of cooperation with Denmark in the region of Greenland, which is part of the kingdom of Denmark through the creation of a new military base at Thule Air Base which is considered of strategic importance for monitoring the Arctic and the development of anti-missile systems. It is an infrastructure that serves the US to identify and deal with geopolitical threats in the region. Also in the same way, the US has developed cooperation with Norway, which is a member of NATO and maintains a military presence in the Arctic, as in particular it maintains an air base in Bodø for the maintenance and training of the Norwegian military forces and plays a role in monitoring the Arctic as well as naval based in Tromsø.

The US has been cooperating with Norway since 2016 through joint participation in military exercises and missions, such as the "Cold Response" exercise held in Norway on an annual basis. Finally, the US participates in international agreements concerning cooperation in the Arctic, and the exploitation of the region's natural resources, such as the United Nations Convention on the Law of the Sea (UNCLOS), although it has not ratified it, which defines the rights of states and the rules for the exploitation of the natural resources of the sea, including oil, natural gas and other marine resources in the Arctic (Bird et al., 2018).

3.2 The Russian presence in the Arctic and its strategic geopolitical interests

Russia holds a key strategic role in the Arctic, because, as mentioned above most of its territory extends above the Arctic Circle. Russia plays a central role in the geopolitical dynamics of the region, being one of the most powerful players and an awe-inspiring rival of the US. The country's strategic interests include energy exploitation as analyzed in the previous chapter and of course its military presence in the region and its influence on the international scene. Russia's Arctic regions are of strategic geopolitical relevance as they enhance its energy resources and are also important for the country's security in a region characterized by heightened international tensions and acute strategic rivalries. The Arctic is for Russia a region of particularly critical importance as it is linked to its geopolitical power and national sovereignty (Lagutina, 2021).

The Russian strategy in the Arctic is primarily focused on the exploitation of the region's natural resources, especially oil, natural gas, which are important for the country's economy, while at the same time it is also interested in the development of infrastructure for the exploitation of renewable energy sources such as wind power. At the same time, Russia is seeking to strengthen its military presence and maintain control of sea lanes, such as the Northern Sea Route, which are becoming increasingly critical due to climate change and shrinking Arctic sea ice. Russia's strategy is also based on the creation of modern over-equipped infrastructure such as ports, modern icebreakers and shipping facilities, which allow it to maintain maritime and commercial supremacy in the Arctic region (Staun, 2023).

3.2.1 Russia's strategic military presence in the Arctic

At the same time, Russia has invested significantly in strengthening its military presence in the Arctic, and in the creation of modern military bases such as the Alexander Nevsky base in the Novagorda archipelago, near the Arctic region of Murmansk, the Novosibirsk Archipelago base, a base of strategic importance due to its geographical position near the Northern Sea Route as well as the Kizilyar base on the Kola Peninsula, which has been deployed to protect Russia's interests in the northern regions and Southern Siberia. Russia has significantly strengthened its presence in the Arctic region by upgrading strategic infrastructure, emphasizing air and naval readiness, as well as training and re-equipment of its forces. It is obvious that Russia's investments to protect its energy interests in the region and mainly to control the rich energy deposits, which include oil, natural gas and metals, are huge and

basically aimed at securing its dominance in the region, which is particularly critical for the country's geopolitical interests today and in the near future (Grajewski, 2017).

3.2.2 Russia's participation in international relations and alliances to maintain its influence in the Arctic

One way Russia seeks to maintain its dominance and influence in the Arctic is through international alliances and agreements. Russia in particular cooperates with other countries in the region, such as Norway, as it wants to strengthen its position and secure its interests as much as possible since it closely links the security of the region with serving its own energy and strategic interests. For example, in 2010 the two countries signed the agreement "The Barents Sea: Treaty between Norway and the Russian Federation concerning Maritime Delimitation and Cooperation in the Barents Sea and the Arctic Ocean" which regulates maritime borders and maritime areas in the disputed territories of the Sea of Barents. This agreement opened the way for mutual cooperation between Russia and Norway in the Arctic region and now the two countries are cooperating for the exploitation of hydrocarbons as they defined the areas where the oil reserves can be jointly exploited, with respect to international regulations and the protection of the environment (Staun, 2023).

At the same time, Russia has participation in multilateral alliances and organizations for the management of natural resources and security in the Arctic, such as the Arctic Council, the most important multilateral organization for the management of Arctic issues. Russia is among the leading countries in the Arctic Council, and actively participates in all negotiations concerning the management and protection of Arctic natural resources. Russia cooperates with the other member states of the Arctic Council to create policies that ensure the sustainable exploitation of Arctic resources with respect for the environment and local populations. In fact, under the auspices of the Arctic Council, Russia has signed a set of critical agreements concerning issues such as the management of natural resources in the Arctic, the management of natural resources, etc. An example is the Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic, a very important agreement in which Russia along with other countries with interests in the region participated in order to promote cooperation in dealing with climate change and environmental destruction in the region. Finally, Russia actively participates in the negotiations that take place from time to time within the framework of the Convention on the Law of the Sea, but also in the

agreements on the management of marine resources, which makes the country a central player in the region. In fact, Russia's main pursuit is the expansion of its maritime zone in order to consolidate its presence in the Arctic and to have control over natural resources and strategic maritime corridors. (Grinyaev et al., 2023).

3.3 Canada's strategic interests in the Arctic region

3.3.1 Canadian geopolitical location

Canada's strategic role in the Arctic area is important because of its geographical location, but also because of the strategic interests associated with the Arctic region. The Canadian territory includes extensive parts of the Arctic circle, mainly through its northern territories, such as Nunavut, Canada's federal territory, that is, a region under the direct control of the Canadian Federal Government, which covers most of the Arctic circle, and northern Canadian Arctic, Northern Ontario, New Scotland, and Quebec as well as through the areas around the Arctic Archipelago islands such as the Baffin, Ellesmere, Victoria and Banks (Perrin et al., 2021).

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Arctic's strategic position for navigation as well as its rich natural resources make it a critical area for the national security and economic development of Canada. As early as the late 18th century, the Arctic was a region of strategic importance for Canada, where during the colonial period, the Canadian Arctic area was considered vital to the exploitation of the natural resources it provided, such as fur, minerals, and hydrocarbons. Gradually, as the importance of the Arctic has increased due to climate change, the enhancement of navigation and the exploitation of natural resources, the role of Canada in the region, due to its geopolitical interests, has been greatly enhanced. Today, Canada's geographical location in the Arctic allows the country to

have immediate access to the basic marine roads such as the northern sea route, which upgrades its strategic position in relation to other countries claiming rights in the region. For this reason, and as Canada's geographical location is privileged for its interests in the region, it faces competition from other countries, such as Russia, and the United States (Russell, 2023).

3.3.2 Strategic interests and policy

Three basic parameters are decisive for Canada's strategic position in the Arctic, and in particular, the management of natural resources, the security and the defense of national sovereignty, as well as the protection of the environment. As for the management of natural resources, after climate change, and as Arctic resources become more and more accessible, Canada is intended to exasperate its interests for exploiting them. In particular, Canada has been investigating significant investments for the exploitation of rich Arctic sources such as oil and gas in Canadian Arctic, which are of strategic importance for the country's energy security. For example, the Canadian Government has made major investments for exploiting energy resources such as the project "Hibernia Oil Project" one of the largest energy -related energy projects as it contributes to the exploitation of rich oil deposits in the Arctic Ocean in Canada (Perrin et al., 2021).

At the same time, Canada has developed a wide network of partnerships with countries such as Norway and Russia, to manage these resources mainly through multilateral organizations and international alliances, such as the Arctic Council where countries are working closely on issues of sustainable management of energy resources, Renewable energy sources and environmental protection in the Arctic region. While these partnerships are important, Canada, at the same time, seeks to maintain its position in favor of its sovereignty in the region as well as to defend its rights in the privileged exploitation of resources in the North Pole (Huebert, 2022).

For Canada, security in the Arctic region is a matter of vital importance, as it considers that strategic navigation routes and areas where natural resources are located are particularly critical to securing its national sovereignty. For this reason, Canada is invested significantly to enhance his military presence in the Arctic. In particular it has created modern military bases that ensure Canada's presence in the region and enhance the country's ability to manage challenges from other Countries

claiming the Arctic, such as the Canadian Forces Station Alert (CFS Alert) at the northern end of Ellesmere Island, Canadian High Arctic Research Station (Chars) on the island which supports the Canadian armed forces missions to the Arctic. At the same time, Canada participates in various multilateral organizations with the Arctic Council to resolve disputes and securing peaceful coexistence in the region. At the same time, it participates in various agreements concluded within the Arctic Council and which govern navigation and environmental protection in the Arctic. Finally, Canada, through the United Nations Organization and the Treaty on Sea Law, is trying to ensure its position and influence on the Arctic by constantly expanding its continental shelf in the Arctic Ocean area for easier exploitation of energy resources (Exner-Pirot, 2021).

As climate change has a serious impact on the Arctic by significantly affecting the ecosystem, Canada has taken initiatives to raise awareness of Arctic issues as well as environmental protection. For this reason it has also joined international agreements to protect the Arctic by supporting the rational and responsible for the exploitation of the natural resources of the Arctic. For this reason, Canada has invested significantly in large environmental projects but also in the evaluation of the impact programs of climate change on the Arctic, and also participates in actions to reduce environmental pollutants and the sustainable development of the area. Also, due to Canada's strategic position in the Arctic, the Canadian government has adopted the policy of close cooperation with other countries and international organizations.

Canada, for example, has joined a set of strategic alliances with countries such as the US, Russia, Denmark and Norway, to settle any differences in the Arctic region by ensuring a smooth framework for achieving peaceful cooperation for shared use. Marine areas, exploitation of resources as well as developing environmental protection partnerships. This political partnerships that Canada has developed is crucial to strengthen the Canadian position in the Arctic region. Finally, Canada's participation in military alliances such as NATO and military cooperation with the US contribute to consolidating its presence in the region and to enhance the energy and trade agreements that are concluded and relating to the Arctic region (Perrin et al., 2021).

CHAPTER 4: POLICY RESPONSES AND INTERNATIONAL COOPERATION: NAVIGATING ARCTIC GOVERNANCE

4.1 Governance and the legal framework in the Arctic Ocean

Due to the special weather conditions and the intense ice cover that prevail in the Arctic Ocean, the Arctic region had, as mentioned above, remained unaffected by man-made activities for a long time. For this reason, moreover, the Arctic has not been treated in the same way in terms of legal regulation, as other seas have been treated, although it is not a complete terra nullius. In particular, there are already a set of international agreements and treaties concerning the Arctic region. The relevant initiatives began to be undertaken after the end of the Cold War where, in the public debate, analyzes were formulated for the legal regulation of the Arctic Ocean region, especially since the establishment of the Arctic Council, which assumed a more active role in individual issues concerning the region, while at the same time the international community's interest in the Arctic increased as it began to express concerns about the lack of legal regulations in the region and requests for the need to create additional mechanisms governance in the Arctic, primarily to protect the region from the reckless use of natural resources and to seek solutions to current and future issues. Thus, today there is an important set of international legislative frameworks that concerns the maritime area as well as the coastal areas of the arctic (Koivurova, 2013).

One of the key legislative frameworks is the United Nations Convention on the Law of the Sea, which provides a legal framework for activities in the world's oceans and seas. In particular, the Treaty regulates the obligations of states regarding issues such as maritime zones and their delimitation as well as the exercise of state sovereignty. The Convention on the Law of the Sea also regulates the tools for the resolution of international disputes through organizations established by the Convention, such as the International Tribunal for the Law of the Sea, the International Seabed Authority and the Commission on Continental Limits. Ice shelf (Koivurova, 2008).

However, the question that strongly concerns the relevant dialogue is whether, after climate change, which has dramatically increased accessibility in the region due

to the melting of the ice and the relative interest of the states that have interests in the region, there is a need for additional regulations or whether the existing arrangements are adequate to protect the Arctic. In particular, concern has been expressed about whether there is a need or desire for the creation and signing of a special "Treaty of the Arctic" as well as whether the participation of indigenous peoples in decision-making is sufficient or not. Some analysts argue that the Arctic legal system is complex and based on four main pillars: International "hard" law, "soft" law, "state domestic law", and "transboundary private law" (Berkman & Vylegzhanin, 2013).

The First Pillar, or Hard Law, consists of legally binding instruments for states, such as the United Nations Convention on the Law of the Sea, which covers most of the Arctic region. Hard Law is mandatory for all states to implement and is confirmed through international agreements, ensuring the equality and sovereignty of states. The Second Pillar concerns Arctic Soft Law and includes arrangements and international partnerships, which are not legally binding on states. One such example is the Ottawa Declaration of 1996, which established the Arctic Council with the aim of strengthening the cooperation and coordination of the Arctic states to address key challenges that were considered common to all states and which concerned mainly the protection of environment and sustainable development. The Arctic Council, among other things, provides guidelines for the future of the region, while Soft Law in general is a process that facilitates future commitments by states, so that the guiding principles gain increasing weight (Koivurova & Byers, 2014).

The Third Pillar of international law is the domestic law in the Arctic and includes the national, domestic law of each Arctic state, which forms the framework of legislation for the Arctic. In particular, the internal law of each country is decisive as it shapes the legal approach of each state towards the challenges of the region, creating a connecting link of legislation with social, economic and political parameters. Finally, the Fourth Pillar concerns Transboundary Law in the Arctic and includes private international law regulations that regulate cross-border commercial relations between the Arctic states. The aim of the Fourth Pillar is to resolve potential conflicts between individuals and companies, especially in cases where more countries are involved due to increasing business activities in the Arctic, especially in areas such as natural resource extraction (Rafaly, 2022).

4.2 International agreements and cooperation

4.2.1 Bilateral intergovernmental agreements

The first inaugural treaty that established the framework for cooperation in the Arctic Ocean was the Treaty of Spitsbergen in 1920. Through this treaty, a first legal framework was formulated to guarantee the peaceful development of the region, while at the same time it explicitly prohibited any military activity in the Arctic. Although this treaty demonstrated at that time the strong interest and at the same time the concern of the international community for the prevention of conflicts in the Arctic and was initially signed by most of the Arctic states, however key players were slow to join. It is characteristic that Russia joined much later in 1935, while Iceland only joined in 1994. At the same time, a set of other treaties in the Arctic region deal with individual environmental issues and promote cooperation between states, either through bilateral agreements or through international conventions. Such examples are the 1911 Convention for the Protection of Seals, the Spitsbergen Treaty on the Status of the Svalbard Archipelago in 1920, the 1973 Agreement for the Protection of the Polar Bear, and the establishment of the Eskimo Council in 1977 (Maksimova & Armashova, 2021).

Other important treaty agreements also include the 1988 Arctic Cooperation Agreement, the US-USSR Maritime Boundary Agreement, the 1991 Arctic Environmental Protection Agreement, the 1992 Canada-Russia Arctic Agreement, and the establishment of the North Atlantic Marine Mammal Protection Commission in 1992. In addition, in 1993 the Euro-Arctic region was established in the Barents Sea, while in 2002 the International Maritime Organization (IMO) issued the first guidelines for navigation in ice and the Arctic Ocean. A set of also important transnational agreements followed, such as the 2010 Norway-Russia Agreement on the Barents Sea Boundary, the 2011 Agreement on Arctic Search and Rescue, which was signed by the eight Arctic states: the United States, Canada, Russia, Norway, Denmark (on behalf of Greenland), Iceland, Sweden and Finland as well as the 2013 Agreement on Marine Pollution Preparedness, also signed by the eight Arctic states, focuses on preventing and responding to marine pollution risks, particularly from oil spills (Maksimova & Armashova, 2021).

4.2.2 International and regional Organizations

The legal framework concerning the Arctic is also significantly influenced by international and regional organizations, as well as by the governance organizations of the indigenous peoples living in the region. The most important regional cooperation organization is the Arctic Council which was established through a long course of cooperation in the Arctic between governments and other bodies. In particular, in 1987, Russia proposed the creation of a "zone of peace" in the Arctic, paving the way for international cooperation. After the end of the Cold War, regional cooperation with indigenous peoples, such as the Inuit, was greatly strengthened as these peoples joined the Inuit Circumpolar Council (ICC). Also established were the Northern Forum, an international organization made up of regional governments of the Arctic states, as well as other countries with an interest in the region, such as China, Japan and South Korea, as well as the International Arctic Science Committee (IASC) a non-governmental, international organization established in 1990 to promote and coordinate scientific research in the Arctic. In 1991, the first Arctic Environmental Protection Strategy (AEPS) was signed by the eight Arctic states, with the aim of reducing pollution and protecting the marine environment (Shulyatyev, 2022).

In 1952, the Nordic Council was created to strengthen the cooperation of the five Nordic countries, while in 1971 the Nordic Council of Ministers was created, an intergovernmental body that functions in addition to the Arctic Council. In 1993, the Barents Euro-Arctic Council was established to promote cooperation in the Arctic between Russia, Denmark, Finland, Iceland, Norway, Sweden and the European Commission while in 2010, the Pacific Northwest region was established as an alliance between Alaska and Canada Economic Region Arctic Cause (PNNER) which extends from the northwestern states of the USA to the western provinces of Canada. In 1991, the Northern Forum was founded, an international non-governmental organization for the cooperation of regional governments of the Arctic states, with the aim of sustainable development, as well as addressing common environmental and socio-economic challenges. The Northern Forum also cooperates with countries such as China, Japan and South Korea, with the aim of improving the quality of life of the northern peoples, sustainable development and socio-economic cooperation (Vylegzhanin, 2011).

As is obvious, the idea for the creation of these organizations is based on the need for better cooperation and coordination of the states that have territories in the Arctic region. However, intergovernmental cooperation has also developed outside the

Arctic as regional organizations such as the EU are also involved. and NATO, which show an interest in the region while the cooperation also extends to international organizations, such as the United Nations and Organizations such as the International Maritime Organization (IMO) and the Food and Agriculture Organization of the United Nations (FAO). (Mokhorov et al., 2020).

4.2.3 The Paris Agreement and the commitments of the states regarding the Arctic

The Paris Agreement, which was adopted in 2015, during the 21st Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC), in Paris, is an international treaty aimed at mitigating climate change and reducing global greenhouse gas emissions. In particular, the Paris Agreement set the limitation of global temperature increase to levels below 2°C compared to pre-industrial levels, with the goal of a limit of 1.5°C. This is an Agreement that is particularly important for the Arctic because, as discussed above, the Arctic is warming approximately two to three times faster than the global average, with the result that climate change has disproportionately affected the region, with very serious consequences for the Arctic ecosystems but also the indigenous populations living in the region as well as for the climate, at a global level (Ranva, 2016).

In particular, the Paris Agreement offers a framework for the development of international action and cooperation between states with the aim of addressing the climate crisis as it sets targets for limiting warming and the need to reduce carbon emissions. As is obvious, the implementation and successful implementation of the goals that the Paris Agreement has set is of vital importance for the Arctic, as the region is extremely sensitive to temperature increases. The rapid melting rates of the Arctic ice, due to the disproportionate increase in temperature is related not only to the loss of local species but also to the rise in sea level, which affects coastal areas and populations both in the Arctic and around the world. At the same time, the Arctic functions as a very important regulator of the global climate, through the maintenance of low temperatures and the reflection of part of the solar temperature. However, the melting of the Arctic ice inevitably leads to an increased absorption of heat, which acts even more burdensome for climate change (Duffey et al., 2023).

4.2.4 States' commitments to reduce carbon emissions and challenges for the Arctic

A particularly important aspect in the operational context of the Paris Agreement is the obligation of countries to submit their commitments, known as Nationally Determined Contributions (NDCs), to reduce carbon emissions. Arctic states, such as the United States, Canada, Norway, Russia, and the Nordic states, have indeed committed to significant reductions in carbon emissions as well as to taking appropriate measures to address the consequences of global warming. Arctic as well as the protection of its natural ecosystems (Quillérou et al.,2020).

Of course, while the states' commitments for the Arctic should be particularly ambitious, as the effects of climate change in this region are very significant compared to other regions, however, states often stand in the way or do not formulate ambitious and active commitments. For example, Russia, despite its national commitments to reduce carbon emissions, as mentioned above claims a primary strategic role in the Arctic due to its interest in the exploitation of energy resources such as oil and natural gas, which are discovered under its ice Arctic but also the exploitation of renewable energy sources which are also abundant in the region. With the melting of the Arctic ice, interest and investment in the exploitation of these resources and the facilitation of access to these resources has accelerated, however, as is obvious, their exploitation and burning will increase global emissions, further burdening the Arctic. It is a double dilemma for Russia, between protecting the environment and economically exploiting the available resources in the Arctic, which is a serious issue for the governance of the region (Syed Abdul Kadir et al., 2013).

In the same way, the USA but also Canada and the USA have developed political and national commitments to protect local populations and strengthen the resilience of the infrastructure of these populations. But even in this case, the USA and Canada are faced with the dilemma that these infrastructures are often affected by the increase in temperature and the melting of the ice as the retreat of the ice causes subsidence of the ground, destabilization of the foundations and finally, destruction of the infrastructures of the indigenous peoples of the Arctic region.

However, through the national commitments of the states participating in the Paris Treaty, the areas of indigenous peoples, who depend on the Arctic ice for travel, fishing and hunting, are supported through national improvement programs mainly in road and marine infrastructure, but also programs for educating local populations to

practice safe hunting practices. Also, the states are committed to the creation of common funds and financial programs for the indigenous peoples of the Arctic to protect traditional fishing and hunting activities, with the main objective of ensuring their sustainability, but also programs to strengthen the resilience of these communities in climate change. effects such as the education of local populations, to learn adaptation strategies to climate changes, but also the upgrading of local livestock and agriculture systems that have a direct dependence on the environment in the Arctic region (Syed Abdul Kadir et al., 2013).

CHAPTER 5: FUTURE SCENARIOS: IMPLICATIONS FOR CLIMATE, ENERGY, AND GEOPOLITICS

5.1 Arctic sea ice reduction scenarios and Arctic climate predictions

The Arctic is one of the fastest changing and most vulnerable regions on the planet due to the very serious effects of climate change and especially the increase in warming rates in the region compared to the global average. These new data have very critical consequences for the reduction of arctic sea ice and arctic glaciers, which are fundamental characteristics of the specific region and consequently have very serious consequences for local ecosystems and the local environment as well as for global climate conditions, such as also for the chessboard of existing geopolitical relations. The following analysis examines the main scenarios for Arctic sea ice decline and climate projections for the region, focusing on the potential impacts and challenges that Arctic countries and the international community will face (Middleton et al., 2021).

5.1.1 Future scenarios for ice reduction

One of the most visible consequences of climate change in the Arctic region is certainly the reduction of sea ice, which is related to the increasing temperature in the region, the reduction of the reflection of sunlight, as the Arctic ice during the melting process is replaced by more dark surfaces such as ocean water. A set of future scenarios can be formulated for the reduction of arctic ice. The first scenario is based on the assumption that if current greenhouse gas emissions continue without drastic measures to combat climate change, the Arctic is expected to lose most of its sea ice by 2050. Indeed, the scenarios are particularly ominous as predict that by the end of the 21st century it is possible that the Arctic will lose its ice completely. This is obviously a dramatic scenario for the reduction of the Arctic Ocean ice, which will have very negative consequences, both for the Arctic ecosystems, the way of life of the indigenous communities as well as for the global sea routes. In this scenario, the consequences for Arctic ecology will be catastrophic, as ice-dependent ecosystems

such as polar bears, seals, and seabirds such as the polar gull, moose, and sea goose, they will face a serious threat (Brigham, 2020).

Another scenario refers to limiting the rise in temperature to 2°C, based on the Paris Agreement. Also in this case the Arctic will continue to experience a significant decrease in its ocean ice and in fact the loss of ice in this case is expected to rise up to the level of 70%. This scenario is associated with very significant changes in the ecology of the region, but does not include the complete disappearance of the Arctic ice. In any case, however, the loss of ice in the Arctic based on this scenario is very significant and will cause serious consequences for local ecosystems, and the viability of indigenous populations due to the disappearance of their traditional activities related to fishing and hunting (Keys & Meyer, 2022).

Finally, a last scenario relates to the achievement of the Paris Agreement's goal of limiting the increase in temperature to 1.5 °C relative to pre-industrial levels. Based on this scenario, the reduction of ice in the Arctic could be limited, but the region will end up being under a status of very high risk. In the context of this last scenario, although the reduction of the Arctic ice will be smaller compared to the previous two scenarios, the region will continue to face serious challenges due to changes in the ecosystem, such as the change in the distribution of marine organisms in the Arctic Ocean, while indigenous communities will continue to be significantly affected by climate change, threatening their sustainability (Keys & Meyer, 2022).

5.1.2 Effects of Arctic ice reduction on global climate balance

It is a fact that the reduction of ice in the Arctic is not only linked to local consequences as the Arctic is a very critical factor contributing to the global climate balance. This means that the loss of ice will result in an increase in global temperature as due to the loss of ice, the Arctic will absorb more sunlight due to reduced reflection, which will increase the temperature of the Arctic Ocean and atmosphere. This phenomenon is expected to lead to further intensification of global climate change and the triggering of extreme weather phenomena in other regions of the planet. At the same time, the loss of Arctic ice is expected to contribute to sea level rise, due to the release of large volumes of water into the ocean. This fact is threatening to coastal areas not only in the Arctic but worldwide, as a result of which floods and increased risk to coastal infrastructures are expected (Duffey et al., 2023).

Finally, the reduction of Arctic sea ice affects atmospheric circulation in the region through changes in the variation of atmospheric currents as well as by affecting wind patterns in the region, which can have an impact on weather conditions around the world. Some of the scenarios predict that the change in Arctic temperature may in the near future lead to weather instability in North America, Europe and Asia, as well as increase the likelihood of intense storms and other extreme weather events (Duffey et al., 2023).

5.2 Possible changes in the energy sector

As the Arctic is considered one of the most privileged regions with the greatest development potential in the energy sector, due to its rich natural resources and strategic location, significant climate change as well as the gradual reduction of sea ice are expected to bring significant changes in the energy and resource exploitation sectors in the region. This will not only have significant consequences for the Arctic countries, but also for the global energy market, as well as for the international geopolitical landscape as a whole (Akperov et al., 2023).

5.2.1 Hydrocarbon exploitation

The Arctic today has vast, untapped hydrocarbon resources, mainly oil and natural gas. It is known that the areas around the North Sea, the Arctic Ocean and Siberia have very large reserves of hydrocarbons, which can cover the world's energy needs for many years. Based on relevant estimates by the US Geological Survey (USGS), approximately 15% of the world's untapped oil reserves and 35% of untapped natural gas reserves are located in the Arctic. In particular, estimates show that the Arctic has over 100 billion barrels of oil untapped as well as 1,750 trillion cubic feet of natural gas with 70% of the oil reserves and 40% of the natural gas reserves lying beneath the sea ice in the North Sea and in areas around Russia (Morgunova, 2020).

As the arctic sea ice gradually decreases, this facilitates access to the exploitation of these reserves, opening up new possibilities for the extraction of these energy sources mainly oil and natural gas. For this reason, multinational companies that are active in the field of extracting these energy resources, have invested large

sums in recent years in the extraction of hydrocarbons in the Arctic. In particular, they are developing modern mining infrastructure, such as new oil extraction platforms, natural gas pipelines as well as subsea facilities. In particular, Russia has developed innovative strategies for the extraction of oil and natural gas in the Arctic, orienting its relative interest in the regions of the Arctic Ocean and Siberia.

However, despite the fact that there is great potential, the extraction of hydrocarbons in the Arctic is associated with very large challenges such as technical, geopolitical and environmental challenges. As the weather conditions prevailing in the content are extreme combined with the fact that the sea is frozen and also that these areas are particularly remote, this makes the process of extracting and transporting the resources an extremely difficult and expensive undertaking. At the same time, the possibility of marine pollution through the creation of oil spills exponentially increases the concerns for the arctic ecosystem which is already vulnerable to the enormous consequences of climate change (Morgunova, 2020).

5.2.2 Exploitation of renewable energy sources

At the same time, the Arctic has the potential to develop as a profitable region for the exploitation of renewable energy sources, mainly in sectors such as hydroelectric power and wind power. This possibility is favored, due to the high frequency of winds that blow in the area as well as due to the existence of large rivers, such as the Kolyma and Mackenzie rivers, i.e. conditions that offer significant possibilities for the exploitation of these energy sources. For example, in 2015, Sweden presented plans to exploit wind potential in the Arctic. As the technology is developing rapidly while the operating costs of both wind and hydropower, this makes these renewable energy sources more accessible and attractive for investment. The already existing offshore wind farms in the Arctic region, especially around the northern coasts of Canada, Norway and Sweden, are expected to provide very large prospects for clean energy production as well as for strengthening energy security in the region and globally (Romasheva & Dmitrieva, 2021).

Of course, it should be emphasized that the development of the energy sector in the Arctic requires the creation of extensive infrastructure such as pipelines, power plants, roads and ports. However, the interest of both the Arctic countries and international investors is very high, so they have already begun to invest large funds in

the development of infrastructure to facilitate the extraction of hydrocarbons as well as the development of renewable energy sources. In fact, as early as 2015, Iceland and Norway have built infrastructure for the development of wind energy projects, while Russia has also done the same at the same time, announcing the creation of new seaports in the Arctic Ocean to support hydrocarbon extraction and development of renewable energy sources (Morgunova, 2020).

5.2.3 Geopolitical confrontation in the Arctic: future trends

As analyzed above, the exploitation of energy resources in the Arctic has already caused intense geopolitical confrontations by countries that have indulged in a race to gain a strategic comparative advantage. In particular, the areas around the North Sea and the Arctic Ocean are considered of the highest strategic importance for the major powers, such as Russia, the United States, Canada, but also China and the European Union. The differences that arise regarding the limits of the Arctic waters that each country has, as well as the activation and exploitation of new potential mining areas, remain open and often intensify, with the result that they significantly affect the diplomatic relations between the states (Østhagen, 2022).

The development strategy that Russia has developed for the exploitation of resources in the Arctic is primarily shaped in the context of the country's energy security, i.e. the country's ability to cover its domestic energy needs from the exploitation of these resources and at the same time to strengthen its position as a dominant energy provider in international markets. On the other hand, the United States and Canada are seeking access to Arctic resources, albeit for different reasons while their goals differ in their priorities and strategic approaches. In particular, as far as the USA is concerned, the Arctic is a region of the highest geostrategic interest, with access to the region's resources being considered critical for strengthening the country's energy independence and expanding its influence in the region. The US aims to exploit oil and natural gas fields as this could potentially reduce the country's dependence on suppliers while enhancing its energy security and protecting its strategic interests especially with Russia, which is seeking significant influence in the Arctic (de Buitrago, 2019).

Accordingly, Canada focuses mainly on environmental management investments in the Arctic and on the protection of the rights of indigenous communities,

whose livelihoods directly depend on the natural Arctic environment. Although Canada is the last to consider the creation of infrastructure for the exploitation of the region's energy resources, however, the weight it gives is more to the balanced distribution of its actions between development and environmental protection. In any case and regardless of the type of policy pursued by the countries concerned, the reduction of the Arctic ice and the continuous possibility of access to new sources of exploitation create a geopolitical scenario in which lurks the risk of a future increase in tensions in the region due to the confrontations of the states for resource management (Østhagen, 2022).

For this reason, today more than ever, needs arise for the development of new international agreements that will more effectively regulate the issue of resource exploitation in the Arctic. Certainly, the current international framework as well as existing agreements, such as the United Nations Convention on the Law of the Sea (UNCLOS), provide the tools and prospects for the settlement of any emerging state disputes today and in the future, but the challenges remain active . For example, there remain open a set of issues besides the exploitation of energy resources in the Arctic, which require intergovernmental cooperation such as for example the management of marine life, the protection of the environment and the equitable distribution of resources. (De Buitrago, 2019).

CONCLUSIONS

The analysis of issues related to policy agendas around the Geopolitical Arctic, concerning globalization, reveal a multidimensional challenge that combines environmental, geopolitical and energy parameters and in particular economic interests and rivalries, regional instabilities, climate change and a wide range of strategies developed by state and non-state actors. Climate change and the increasing melting of ice are bringing to the surface new economic and geostrategic opportunities for the exploitation of natural resources and new sea lanes, but also challenges for global powers. causing the interest of world powers. In the geostrategic chessboard of the Arctic, all interested countries for which energy security is closely linked to political and economic stability are currently taking action, while at the same time they seek access to the resources of the Arctic for reasons of energy sufficiency, but also strategic presence.

The the exploitation of Arctic energy resources raises significant environmental concerns, since their extraction, exploitation and transport raises serious concerns on the one hand about possible irreversible effects on local ecosystems and the creation of geopolitical background tensions. Undoubtedly the financial opportunities that offers the Arctic through energy resources, and new sea corridors due to climate change are very large. However, the challenges associated with the development of geopolitical strategies by the main actors are also great.

The governance of the Arctic an international neutral zone that has long been kept out of geopolitics, is today one of the most demanding and multifaceted issues of the modern global political scene, as the region remained for centuries far from the interest of the states in its exploitation. Today's increased interest, however, is connected not only to environmental concerns but also to concerns regarding the lack of a fully binding legal regime. The role of the Arctic Council, the most important intergovernmental forum for Arctic issues, has a significant contribution, however, it also presents a deficiency precisely because the legal framework it has introduced is non-binding. The Arctic countries currently cooperate mainly through the specific non-binding forum that tries to direct the development of sustainable policies and the promotion of international cooperation in the region, but the lack of binding may potentially be a source of problems in the future as the states intensify their competition

in the region, there will be a risk of igniting tensions, which the Arctic Council will possibly be unable to resolve effectively as the lack of legislative binding limits its effectiveness. Certainly its role is critical, as it helps promote cooperation in areas such as climate change, environmental protection and maritime safety.

At the same time, while the Paris Agreement imposes binding responsibilities on member states, for the reduction of greenhouse gas emissions, however, forecasts especially for the Arctic show that even if the global climate goals set by the Agreement are achieved, the region will continue to face serious climate challenges. Essential in this context is, in addition to the protection of the environment, the protection of the indigenous peoples and the activities that they have traditionally developed in the region in order to preserve the cultural wealth of the Arctic and at the same time to ensure social balance as these communities are directly dependent on the natural environment for their survival while the significant climate changes in the region affect them disproportionately. It should also be emphasized that the national programs which, as analyzed, are developed by international actors in the region, and aim to protect the environment and indigenous communities are important, but the development of strong international cooperation is also required.

The Arctic region is undoubtedly at the center of multiple and conflicting interests which are developed at many levels and concern the environment, energy and geopolitical strategy. The priority will have to be from now on, the adaptation of the governance of the Arctic, to the modern challenges for the effective management of resources and the protection of its rich ecosystems. In order for these goals to be realized, the international community should work together despite any individual differences to develop a coherent, holistic framework that will combine policies for the protection of the Arctic environment and sustainable and sustainable development as well as social justice, setting appropriate restrictions on the reckless exploitation of the region's energy resources.

In any case, the successful outcome of this endeavor depends on the willingness of states, Arctic and non-Arctic, to work together not just for national benefit, but for the long-term common interest. If the challenges associated with the Arctic and the effective management of its rich resources are not addressed today and in the future through a combined action of state and non-state actors, the challenges may become more pressing with unforeseen consequences for the Arctic region as well as for the actors involved. While the scientific community as well as environmental organizations raise concerns about the melting of the Arctic ice and rapid climate

change, a game of dominance is underway in the region with the prize of untapped natural resources and new trade routes and commercial transit opportunities being created in context of the new conditions.

While the scientific community as well as environmental organizations raise concerns about the melting of the Arctic ice and rapid climate change, a game of dominance is underway in the region with the prize of untapped natural resources and new trade routes and trade transit opportunities being created in context of the new conditions. What will happen in the future cannot be predicted at a time when leading defense and security analysts around the world are warning of the possibility of a "warm episode" in the Arctic as competition increases, so does the risk, so it could occur every at any time the conflict. Currently tensions and conflicts have been avoided. But no one can guarantee that the status quo will not change, as climate change continues to erode the ice, and reshape global geographic and geopolitical scenarios, making interests in the prospect of Arctic exploitation increasingly their presence felt. What is certain is that the melting of the ice is reshaping and reshaping the geography of the region, while the concern of many remains that the appetites of the geopolitical giants could lead to a management of the Arctic question that would be explosive.

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