Analysis of climate risks in the Arctic zone

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Abstract. The article examines the problematic aspects and risks of sustainable development of the Arctic zone of Russia in the context of ongoing climate change. It has been revealed that climate change is one of the reasons for the acceleration of erosion processes, which can lead to risks of destruction of infrastructure facilities, as well as restrain the development of the region's economy as a whole. The ongoing changes also threaten the biodiversity of the region and impede access to the economic resources of the region. Mitigating climate risks in the Arctic and ensuring its economic development are complex and complex tasks that can be solved through the implementation of public policy and cooperation between the public and the scientific community. Risk mitigation can be ensured through the implementation of ESG principles in Arctic industrial enterprises. A promising tool for environmental risk management is to take advantage of international cooperation. Also, the implementation of the state policy in the field of environmental management will help mitigate the negative impact of climate change.

1 Introduction

The Arctic zone is the polar region of the Earth, including the edges of the continents of Eurasia and North America, almost the entire Arctic Ocean with islands, with the exception of the coastal islands of Norway, as well as adjacent parts of the Atlantic and Pacific oceans. The area of the Arctic is 27 million square kilometers and five states extend their borders to the Arctic: Russia, Canada, the USA, Norway and Denmark. The Arctic is a region with high economic potential and has many resources necessary for economic development. According to modern expert estimates, up to 22% of the world's oil and gas reserves may be located under Arctic waters [5].

However, the Arctic region is the most vulnerable to ongoing global changes, since the climate in the Arctic region is changing faster than in other parts of the world. Climate change in the Arctic is leading to increased air temperatures, melting ice and snow, and thawing permafrost, while decreasing ice cover and thawing permafrost can lead to increased greenhouse gas emissions and increased global climate change [9].

Since Russia has the longest borders in the Arctic (22.6 thousand km), monitoring climate risks is an urgent research task. Over the past two decades, Russia has been consistently working to comply with key national interests in the Arctic: the development of hydrocarbons and control over sea routes [9]. Due to the strategic importance and high

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potential of the Arctic in the context of ensuring the security and economic development of the country, Russia considers maintaining its control over shipping along its Arctic territories, including the Northern Sea Route, as a matter of national security [2].

However, ongoing climate changes can cause significant damage to both the national interests of Russia and the existing infrastructure of the region, including the critical infrastructure of the Russian oil and gas industry, which is especially vulnerable to the conditions of thawing permafrost [1]. Thus, the purpose of the study is to analyze the climate risks of the Arctic zone and propose measures necessary to mitigate the negative consequences of climate change.

2 Materials and methods

The research materials are scientific articles by domestic authors, as well as data from reports of the Organization for Economic Co-operation and Development (OECD). In the process of achieving this goal, the author uses theoretical research methods, among which are analysis and synthesis, comparison and generalization, juxtaposition and abstraction, as well as deductive and inductive methods of scientific knowledge.

3 Results

The Arctic zone of the Russian Federation is facing a number of problems related to climate change. Firstly, this is the melting of ice and glaciers. Climate change is causing Arctic ice to melt, accelerating coastal erosion and threatening infrastructure such as oil and gas platforms and ports. [68–69].

Secondly, rising sea levels in the Arctic can lead to flooding of coastal areas and deterioration of living conditions for local residents. In addition, sea level rise may have a negative impact on the development of the oil and gas industry and other sectors of the economy [2].

Thirdly, an obstacle to economic development is the lack of infrastructure and conditions for economic development. In some areas of the Arctic there are no conditions for economic development, since infrastructure is needed for transporting goods and access to resources [2]. Climate change in this context complicates the development of infrastructure and the economy of the region as a whole.

Fourthly, climate change leads to deterioration of living conditions for rare species of animals and plants in the Arctic, which causes a reduction in biodiversity and threatens the ecosystem of the region as a whole, and also reduces opportunities for tourism [4].

Fifthly, climate change can affect the conditions of agricultural activity, which creates risks in the context of ensuring food security in the region [6].

However, it should be noted that climate change in the Arctic zone has a dual nature from environmental and economic points of view. On the one hand, the warming of the Arctic climate is a kind of payment in the form of a “carbon tax”; on the other hand, it rationalizes the conditions for business development: it opens access to new shelf resources and expands the possibilities of year-round international shipping. Based on the analysis of the problems associated with ongoing climate change, we can conclude that ensuring the economic development of the Arctic zone and leveling the consequences of climate change are two interrelated tasks that require an integrated approach.
4 Discussion

One of the key directions of state policy in ensuring the economic development of the region can be the sustainable use of Arctic resources, such as oil, gas, fisheries and other natural resources, taking into account their conservation and respect for the environment. To do this, it is necessary to conduct a comprehensive environmental impact assessment and develop technologies that will allow the use of resources while minimizing their negative impact on nature. Sustainable use of resources is achieved through the use of latest technologies and techniques such as green technology and more efficient use of resources, etc.

The implementation of a strategy for the sustainable use of resources in the Arctic zone can be solved by involving partner countries in Arctic integration projects on a mutually beneficial basis. For example, public-private partnerships, as well as the use of offset contracts (contracts in which the purchasing government of the importing country obliges the supplier from the exporting country to reinvest some part of the contract amount in the importing country) [8] will make it possible to attract the necessary investments for the development of the Arctic zone and manage the risks of climate change.

The next tool to mitigate climate change in the Arctic is to take action to reduce emissions of greenhouse gases such as carbon dioxide and methane. This can be achieved by increasing the share of renewable energy sources, such as solar energy, wind energy, as well as by increasing energy efficiency in the most energy-intensive sectors of the Russian economy. It is also necessary to carry out work to adapt to climate change, such as building protective structures and changing business practices.

One of the factors stimulating the implementation of ESG practices (environmental and social responsibility of enterprises) in Arctic industrial enterprises is government support, which includes preferences for social and environmental projects, support and preferential financing of projects involving the creation of closed production cycles, as well as expansion of areas application of public-private partnership [3].

An important aspect is also the creation and development of infrastructure in the Arctic zone, including roads, ports, airports, telecommunications, etc., in order to ensure the safety and efficiency of transport and communication flows, as well as the rational use of natural resources. Finally, it is advisable to continue research and monitoring of climate change in the Arctic in order to correctly assess risks and take effective measures to adapt to climate change. This can be achieved through strengthening scientific research in various fields such as hydrology, geology, biology and meteorology [7]. The identified problems, as well as proposed solutions, are summarized in Table 1.

In general, we can conclude that ensuring the economic development of the Arctic zone and leveling the negative consequences of climate change are two complex but interrelated tasks. It is important to note that if the development of the region is possible through the implementation of targeted economic policies, then mitigating the effects of climate change requires targeted efforts on the part of states, scientific communities and the public as a whole.

The result of the activity may be the creation of special funds and support programs for the development of the Arctic economy, the establishment of international agreements and standards for the protection of nature and ecological systems, as well as active work to attract investments and technologies to achieve these goals [10]. The Russian Federation is interested in attracting partner countries to implement joint large-scale projects for the industrial development of the Arctic territories.
Table 1. Climatic risks of the Russian Arctic zone and ways to solve them.

<table>
<thead>
<tr>
<th>Climate risks</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melting ice and glaciers accelerate coastal erosion and threaten infrastructure</td>
<td>Taking measures to reduce greenhouse gas emissions, including through increasing the share of renewable energy sources.</td>
</tr>
<tr>
<td>Melting permafrost leads to the destruction of production and city-forming infrastructure</td>
<td>The use in construction of technologies that are resistant to dynamic changes in soils, improving the thermal insulation of building foundations. Application of ESG principles in Arctic industrial enterprises.</td>
</tr>
<tr>
<td>Rising sea levels have a negative impact on the region's economic development</td>
<td>Construction of protective structures and changes in management methods taking into account the threat of flooding of coastal areas.</td>
</tr>
<tr>
<td>Climate change in this context complicates the development of infrastructure and the economy of the region as a whole.</td>
<td>Creation and development of Arctic infrastructure, including transport communications, ports, airports, telecommunications, etc. Implementation of integrated risk management strategies for investment projects. Application of international cooperation mechanisms.</td>
</tr>
<tr>
<td>Climate change is reducing biodiversity and threatening the region's ecosystem</td>
<td>Sustainable use of resources, taking into account their conservation and respect for the environment. For example, organic farming, the use of crops to improve the soil and the ecological condition of the land (agroforestry).</td>
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</table>

Source: compiled by the author

In addition, it is necessary to take into account the views and interests of indigenous peoples who live in the Arctic and depend on its environmental sustainability. The Russian Arctic is home to 82.5 thousand representatives of indigenous peoples (Nenets, Chukchi, Khanty, Evens, Evenks, Selkups, Sami, Eskimos, Dolgans, Chuvans, Kets, Nganasans, Yukagirs, Enets, Mansi, Vepsians, Koryaks, Itelmens, Keraks). Some of them lead a nomadic or semi-nomadic lifestyle associated with traditional types of environmental management, primarily reindeer herding, fishing, marine hunting, and hunting. Including Indigenous peoples in decision-making can help create fairer and more effective solutions for everyone involved. Finally, mitigating climate change in the Arctic also requires global efforts to combat climate change more generally.

5 Conclusion

Mitigating the negative impacts of climate change in the Arctic and ensuring its economic development are complex and complex tasks that can be achieved through the implementation of public policies and cooperation between the public and the scientific community. Realization of the economic potential of the Arctic zone is possible only if policies aimed at managing climate risks are implemented. Thus, leveling out the negative manifestations of climate change in the Arctic can be ensured by taking measures to reduce greenhouse gas emissions, including by increasing the share of renewable energy sources, using technologies in construction that are resistant to dynamic changes in soils, improving the thermal insulation of building foundations, and introducing ESG principles at Arctic industrial enterprises.

Another promising tool for managing environmental risks is to take advantage of international cooperation. For example, the development of mechanisms for the use of offset contracts can be successfully implemented in the Arctic regions of the Russian Federation to achieve the goals of socio-economic development of the territory, which is
especially important in the current conditions, when problems in the Arctic region cannot be solved only with the support of the state. Developing the terms of offset contracts beneficial for both parties to the transaction will make it possible to implement nationally significant projects in such areas as tourism, transport, shipbuilding, industrial production, logistics and real estate. The implementation of state policy in the field of environmental management will mitigate the negative impact of climate change. For example, organic farming and agroforestry, that is, the use of agricultural crops to improve the soil and ecological condition of the land, will help manage climate risks, on the one hand, and ensure food security in the region, on the other.

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