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Is There Any Tradeoff Between Energy Security and Climate Stability for the Arctic Region? An exploration of the Potential Levers and Obstacles to the Required Energy Transition

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Abstract: The Paris Agreement agenda urges to get rid of fossil fuels as soon as possible while responding to the constant increase in energy demand at the world scale. In a Special Report on the global impacts of global warming of 1,5°C above pre-industrial levels, the IPCC traces the different required roadmaps for the future GHG emissions. These adjusted carbon emissions pathways impose very challenging energy transitions for all countries. Moreover, the speed and scale of the required changes can lead to conflicts and other trade-offs between climate goals and development goals. In this context, the Arctic region appears to be a region richly endowed with natural resources, even though the conditions for their exploitation remain difficult. It is also a region particularly exposed to climate change. This communication aims at exploring the potential levers and obstacles to the energy transition for the Arctic Region. The approach used for the research is an analytical framework which does integrate the different dimensions of the so-called environmental security. Among the potential levers, the green hydrogen appears to be an interesting option.

Keywords: Global warming, energy, environmental security, tradeoff, hydrogen, development

The analytical framework

In the context of the current energy transition, the Arctic faces diverse critical issues with respect to environmental security. The so-called « environmental security » which traditionally refers to the natural resources and the associated energy supply security, (mastering the access of energy sources through the territorial control, property rights and access rights), is now extended to environmental concerns with respect to environmental impacts and damages caused by the energy supply system. Energy is a strategic commodity, which means that countries attach to energy an importance they do not attach to other goods. Energy also appears as an essential good according to the United Nations, access to which allows economic development and poverty reduction. The low price of energy then appears to be an important condition. In this respect, the energy supply security can be defined as "a regular energy flow that allows the demand to be satisfied at an acceptable price while respecting sustainable development" (Chevalier, 2010). The energy supply has an important economic dimension that can be measured by the degree of energy dependence. There is an important link between the energy supply security and the so-called economic security. The notion of energy dependence can be interpreted in two ways, depending on the adopted point of view. For energy-producing/exporting countries, this notion is defined as the part of the national economic activity due to energy. The energy producers wish to maximize their income under the fear of *overproduction* which would lead to a fall in the price. For energy-consuming countries, the level of dependence is measured by the ratio between energy imports and energy consumption. The energy consumers do consumers want energy price stability for fear of *underproduction* which would lead to a price increase. In the current energy transition context, energy governance regime at the world scale notably changes, shifting from property rights to access rights and emphasizing the *ricardian* scarcity rather than the *matlhusian* one (Petit & Schembri, 2009).

However, global warming reveals to the world another security concern, which aims at the preservation or stability of the climate, treated here as a common good on a global scale. This global environmental security is no longer concerned by vital interest of a certain country, but should also include the interest of the country's rivals. It would require a higher price of energy, which should internalize, through carbon pricing, all the negative externalities that undermine the maintenance of the common good and the cost of its restoration. The climate stability should be reached by avoiding any form of *over-consumption* of certain energy resources like the fossil fuels which are abundantly used in the world today. While energy security would rather concern the local or national scale and refer to the short term, climate stability refers to security issues that are global and long-term-oriented (Schembri & Remita, 2021). The potential conflict between these security targets raises fundamental questions about future economic development models that might be compatible with the climate agenda. In this regard, the dynamics of the fossil fuel market will have a significant impact on the effectiveness of climate policies. Fossil fuel owners and investors in fossil fuel infrastructure are sensitive to climate policies that threaten their natural resources and productive capacities, which will affect their behavior in the short term. Sudden implementation of these policies could have significant impacts on fossil fuel markets and beyond, via expectation effects such as the green paradox and the divestment effect. According to the climate agenda, more than a third of oil reserves, half of gas reserves and over 80 per cent of current coal reserves should remain unused from 2010 to 2050 in order to meet the Paris Agreement target (McGlade & Ekins, 2014 ; Bang & Lahn, 2020). These reserves that will not be extracted are *stranded assets*. An important issue is emerging on the extent to which the stock market valuation of fossil fuels-producing firms takes into account their stranded assets

The potential levers and obstacles for the Arctic region

For the Arctic region, these conflicts question the way in which natural assets, like energy resources, can be valued (Johnston, 2012). How can the Arctic region, which is richly endowed with fossil fuels, can value these assets that should be left in the ground? According to Loïzzo & Tiano (2019), the question of the planning and exploitation of the polar regions arises in a specific way in the Arctic for at least four reasons: strong natural constraints; a fairly recent integration into globalization; accelerated global warming with significant economic consequences; significant development gaps between territories, regions and countries. Most of the Arctic territories are still peripheral to their own country, while being partly integrated into the world economy. Two dynamics can be observed: First, the shift from traditional and local lifestyles to lifestyles integrated into the global economy. Then, that of moving from a position of marginal spaces in the economy and global geopolitics to a position of highly attractive spaces. Several factors can explain this growing interest in these attractive spaces for the exploitation of new resources in the context of the current energy transition. These resources attract the attention of different actors whose interest may be technological, economic or geopolitical with regard to diverse local contexts which are also constantly evolving. Moreover, the access conditions to resources have steadily improved over the past decades. At the regional level, air and sea services have been strengthened, facilitating trade. Added to this is the rapid development of means of communication contributing to an increased openness of the Arctic region. Moreover, global warming makes it possible to promote certain activities and the development of certain resources in the Arctic region. In addition, the adaptations induced by this phenomenon, in particular the northward migration of the biological limits, can also favor certain activities. We think of fishing activities and the emergence of pioneer agricultural fronts. However, the melting of the permafrost somewhat relativizes such prospects by producing swamps and other peat bogs in which the vegetation does not grow.

Among the attractive natural resources, we think in particular of certain considerable mining and energy resources, among which mineral resources. These are varied and scattered sites over the particularly numerous Arctic areas, which are dedicated to the extraction of minerals that are very useful for the current energy transition: copper, nickel, rare earths, uranium, etc. Moreover, the interest for the Arctic as a potential source for fossil energy resources has been growing over the recent years. According to an assessment conducted by the U.S. Geological Survey, it is estimated that this region contains more than 13% of the world's undiscovered oil and 30% of undiscovered gas (USGS, 2008). Furthermore, another important energy source present in the Arctic are gas hydrates, which are comprised of methane and water, which are frozen into a solid beneath the seafloor or under permafrost. Estimates suggest that there are between 6–600 times the amounts of gas hydrates versus conventional gas deposits in the world (CAGE, 2017). Until now, the extraction of these resources has not been of economic interest due to the extremely high costs of extraction. However, with the decreasing amount and duration of the ice cover in the Arctic, the extraction of these resources is becoming increasingly commercially viable. In this respect, the Arctic states derive a significant part of their revenues from hydrocarbons. For Alaska, this represents nearly 90% of its budget and across the Arctic region, the oil sector contributes to up to 23% of GDP. This is an exploitation that has been in operation for over 50 years. Fossil fuels activities are also a matter of exploration to discover new reserves. They refer to land and sea areas that have been the subject of exploration concession sales to large transnational gas and oil firms. These projects are particularly expensive requiring several tens of billions of euros. In addition, the data relating to these reserves are highly variable, generating strong uncertainties about the progress of exploration and extraction projects. Eventually, the low profitability of the deposits has contributed to slowing down exploration activity over the past decade. Indeed, despite global warming, operating constraints are still high, (weather conditions, the isolation of sites, the dangers associated with polar environments and the environmental risk associated with these activities).

What can be the role of the Arctic region in promoting the current energy transition? The Arctic appears to be a region capable of supplying large quantities of renewable energy which could be exported worldwide via green hydrogen (Mered, 2019). What are the sources of green electricity in the Arctic? What are the potential surpluses in terms of electricity production that could be exported? What would be the local consequences of deploying green hydrogen at a large scale (Schembri, 2021)? In this regard, it would be interesting to study the HYPER project proposed by Norway, which aims to build an international supply chain of green hydrogen by 2030. The electricity produced in Norway would be exported to Japan under the form of liquefied hydrogen, ammonia or compressed air. Iceland is another interesting country for its high potential in geothermal energy. This country aims to export part of its electricity to Europe. Despite the scarcity of liquid water in some territories, the Arctic reveals significant potential for hydroelectric power. Large hydropower projects had been developed in subarctic regions as early as the 1970s. Hydropower represents an over capacity of 80 GW for the Arctic region and constitutes the largest share in most of the region's energy mixes. The Arctic also has great prospects for wind, geothermal and even solar power. Iceland has the largest geothermal plant in the world and also uses hot water for tourism or agricultural purposes (heated greenhouses for vegetable production). Nuclear power also appears to be a source of electrical energy in the Arctic, particularly for extreme areas, too far from places of electricity production. In this respect, the Kola power station near Murmansk and the Bilibino power station in Tchoukotka, the most northerly in the world, are interesting examples. However, melting permafrost makes these infrastructures unstable, increasing the risk of accidents[1].

More fundamentally, the question of green hydrogen in the Arctic is the economic valuation of endogenous assets which should benefit local populations. In this respect, renewable energy in the Arctic can be an answer to the problem of energy supply in remote areas, which are regions isolated from the centralized network. Providing energy to such areas is currently not only environmentally unfriendly but also very expensive. As the Arctic region is characterized precisely by this type of scarcely populated and geographically scattered cities/villages, the introduction of off-grid green renewable energy sources could provide the much-needed solution to this problem (Boute, 2016). However, energy storage remains a key issue in order to react efficiently to fluctuations in electricity production and ensure a balance between supply and demand. This problem becomes even more pronounced in isolated, off-grid communities with limited access to backup energy. As a result, replacing the fossil fuel-based systems with renewable technologies requires the development of new energy storage solutions (Nastasi & Basso, 2016). Systems combining wind energy and hydrogen storage are currently being tested on several small areas in the Arctic regions. These demonstration projects are expected to show whether it is economically and technically feasible to start implementing hydrogen storage systems in remote communities in the North.

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[1] In order to avoid this, Russia has built the Akademik Lomonosov, a floating nuclear power station with two reactors of 35 MW each, cooled by sea water. The power station is moored in the port of Pevek, in Chukotka. This plant will be able to supply the local population as well as the oil industry in this area where the country wants to develop hydrocarbon production.

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