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Valentina Ignatyeva, Sébastien Gadal

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Renewable Energy in the Russian Arctic: Energy Transition and Opportunities in the Context of Post-pandemic Realities

Valentina Ignatyeva 

Email : valentina.ignatyeva@etu.univ-amu.fr

Affiliationids : Aff1, Correspondingaffiliationid : Aff1

Sébastien Gadal

Email : sebastien.gadal@univ-amu.fr

Email : szh.gadal@s-vfu.ru

Affiliationids : Aff1 Aff2

[Aff1](#) Aix-Marseille University, Aix-en-Provence, France

[Aff2](#) North-Eastern Federal University, Yakutsk, Russia

Abstract

The abstract is published online only. If you did not include a short abstract for the online version when you submitted the manuscript, the first paragraph or the first 10 lines of the chapter will be displayed here. If possible, please provide us with an informative abstract.

The COVID-19 pandemic has caused unprecedented changes to the global economy and has thoroughly shaken the energy industry. The awakening regarding global warming and climate change is leading to an accelerated adoption of energy transition mechanisms across various regions around the world alongside the beginning of the shift away from fossil fuels. Considering the overwhelming role that fossil fuels and fossil fuel-driven industries play in Russia's economy—particularly their prevalence in the Russian Arctic region—these global decarbonization trends should come as a wake-up call for the country to reconsider its energy strategy and the role that decarbonization and renewable energies need to play in it. The long-term sustainability of the economic development of the Arctic regions will be influenced by global environmental and climate regulation, as well as the ongoing transformation of energy markets. A robust incorporation of renewable energy systems (RES) would not only provide a more sustainable route for the economic development of the Arctic regions but could also create additional economic opportunities for the country, while significantly reducing the hazardous effects on the health of the local population and local environments.

Keywords

Green energy
Energy transition
Arctic
Sustainability
Russia
Energy security

21.1. Introduction

The COVID-19 pandemic has not only caused unprecedented changes to society and the economy around the world, but also has inadvertently demonstrated the Earth's incredible resilience and its ability to clean up and recover after years of accumulated emissions. The pandemic has provided us with a peek into what a low-carbon future could hold in store if we act now and go full speed down the decarbonization path.

As this has been happening, the recent collapse of oil prices in 2020 has also shown the fragility of the fossil fuel sector in these volatile and changing times and has underlined the importance of economic and fuel diversification. Considering the overwhelming role that fossil fuels and fossil fuel-driven industries play in Russia's economy—and particularly their prevalence in the Russian Arctic region—this should provide a wake-up call for the country: it needs to reconsider its energy strategy, and understand the role that decarbonization and renewable energies need to play in it.

The long-term sustainability of economic development in the Arctic regions will be influenced by global environmental and climate regulation, as well as, of course, the ongoing transformation of energy markets. As renewable energy sources are already completely intertwined with the concept of sustainable development and decarbonization, they can play a significant role in ensuring the sustainable development of the Russian Arctic. A more robust incorporation of renewable energy systems (RES) would not only provide a sustainable route for the economic development of the region, but would also see health benefits for local populations and regional environments.

Moreover, more and more of Russia's economic partners are going down the path of carbon neutrality and increasing their goals to reduce emissions and switch over to greener energies; therefore, for Russia to stay relevant and competitive in the long-term, it should consider embracing some of these global trends and begin incorporating appropriate policy changes. Now is the perfect time to adopt the necessary incentives and prioritize resilient investments to begin changing the country's economic structure in order to help drive Russia toward overcoming future economic and climate challenges and turn some of these potential challenges into growth opportunities.

The outbreak and exponential spread of the COVID-19 coronavirus (SARS-CoV-2) thoroughly shook the foundation of every society across the globe, claiming over five million lives (as of 15/11/21). After nearly two years of intermittent quarantines, border shutdowns, travel restrictions, civil unrests, economic downturns, and continued volatility, the pandemic is still far from over.

This global health crisis has provided a jarring realization of how unprepared we are as a society for shocks of this magnitude, and forced many of us to reevaluate our priorities and how we operate. Countries were required to implement emergency measure that redefined how societies function for months on end, with some countries enforcing country-wide lockdowns, prompting people to adapt to new realities of working from home, thus reshaping the energy demand curve.

These draconian measures, however, also led to an unprecedented decrease in global emissions not seen in years. One study published in the journal *Nature Climate Change* showed that at the peak of quarantine (April/May 2020) there was a 17 percent decline globally, taking emissions down to around the level of 2006 (*Nature Climate Change*, 2020). For weeks, the media showed the impact of confinement on nature and how cities permanently encapsulated in smoke were seeing clear blue skies for the first time in years; stars spread across the night sky in big cities as both air and light pollution cleared away; the canals of Venice saw fish and swans for the first time in decades; and wild animals ventured and roamed into nearby cities and communities across the globe. People were fascinated how quickly the silence from human activity had led to positive reverberation across global environments.

While the quarantines have had a short-term effect on pollution levels, the overall concentrations of greenhouse gases continue to grow in the atmosphere, showing just how vital it is to act now to avoid an irreversible environmental catastrophe in the future. Of course, as the initial lockdowns began to ease and people ventured out and resumed economic activity, the levels of pollutions quickly shot back up, negating all the positive effects that were incurred during the initial quarantines. Nonetheless, energy related CO₂ emissions fell by 7 percent in 2020 (IEA, 2020).

While the pandemic is still far from over and the far-reaching effects of it will continue to shape how we operate, countries are adopting recovery packages to salvage their economies in the months and years to come. Many are therefore looking—and indeed pushing—to use this opportunity to not just restore the economies to the way they were, but to do it better by incorporating green solutions and decarbonization measures. Even some international oil giants understand that green recovery is key to long-term survivability not just of their companies but more importantly of the planet.

21.3. Ringing the Arctic “Warming” Bell

At the same time, while economies and societies are still trying to find their way through the mess of the pandemic and market fluctuations, there are even more worrying things happening with the climate.

For years, there has been a rise in climatic anomalies, which have been getting more intense in the recent years. Over the past 25 years, the number of dangerous meteorological events has more than doubled. Intense heat waves, violent storms, tornadoes, floods, and wildfires have dominated the news across the globe. The Russian Arctic has been making headlines in recent years as the effects of global warming are undeniably and forcefully resonating through the area.

While temperatures are steadily increasing across the globe, in the Russian Arctic they have been increasing on average 2.5 times faster than in other parts of the world. In June 2020, the city of Verkhoyansk (in Russia), typically known as the coldest city on Earth, hit an unprecedented 38 degrees Celsius—the highest temperature ever recorded above the Arctic Circle. In recent years, the Russian Arctic was on average 4 degrees warmer, both on land in the water, than previous years. In 2020, the average temperatures in north-central Siberia were about 8 degrees Celsius above average (Litvinova & Borenstein, 2020). According to the United States' National Oceanic and Atmospheric Administration (NOAA) and NASA, 2020 nearly tied with 2016 as the hottest year on record; now, 2021 is also well on its way to crown this grim pedestal, with July of this year being the world's hottest month ever recorded (NOAA, 2021).

These persistent high temperatures have also been the cause of devastating wildfires that have been ravaging the Siberian and Arctic landscapes more and more frequently over recent years. 2021 squeezed out 2012 as the top recorded year in the twenty-first century for forest fires in Russia, reaching a total of 18.16 million hectares, with over 4 million hectares in Yakutia alone (Bonch-Osmolovskaya, 2021).

According to meteorologists, this continuous warming will continue to narrow the difference in temperature and pressure between the Arctic and lower latitudes, therefore slowing the Arctic jet stream, leading to weather systems that bring extreme heat or rain getting stuck over places for much longer periods (Litvinova & Borenstein, 2020). Considering the white nights of the North in the summer, where the sun never fully sets at night, the prolonged exposure to its rays paired with the rising temperatures means that the ground will not have sufficient time to cool off. This will perpetuate even more wildfires in the future.

In addition, it will also give rise to another major problem, whose ramifications would be detrimental not only for the Arctic but also for the entire global community. The high temperatures and increasingly severe and prolonged wildfires are leading to the thawing of permafrost. This can have a destructive effect on local infrastructure, as most of the building and pipeline foundation is built on permafrost. According to the Russian Minister of Natural Resources, this thawing is the underlying reason for 23 percent of all technical system failure in the region, and up to 29 percent of oil and gas production facilities can no longer be operated (TASS, 2021). A recent study showed that the cost of overall infrastructure and structural damages caused by climate change and the melting permafrost could easily surpass \$100 billion (Streletskiy et al., 2019). This cost, however, does not consider the potentially irreparable damages to the environment that could ensue from this structural undermining. This was the case in 2020, where subsidence of the foundation piles (due to permafrost thawing) at the Norilsk-Taimyr energy plant led to largest oil spill on record for the Russian Arctic.

Moreover, the thawing of permafrost has also been calculated to lead to methane release, which is a strong greenhouse gas estimated to contain more than twice the amount of carbon as already exists in the atmosphere (Tamsin, 2020). There are fears that the melting permafrost might also have some other hidden surprises in store as it thaws out, potentially releasing unknown or dormant viruses back into the air, in which case the current pandemic world order might become a dangerous new normal.

21.4. Adapting to New Realities

Seeing how the current pandemic destabilized society globally, there has been a growing understanding that the shocks from a changing climate will be more intense, prolonged, and—if we wait too long—irreversible. Therefore, as countries are adopting pandemic recovery packages, many have taken this opportunity to accelerate the energy transition by incorporating more aggressive decarbonization strategies to ensure a more sustainable future.

Energy transition is being defined by decarbonization, energy efficiency, and the robust integration of non-fossil energy sources. Renewable energy sources have become practically synonymous with this trend and have been growing at exponential rates. According to Bloomberg NEF, the world committed a record \$501.3 billion to decarbonization in 2020, beating the previous year by 9 percent; global renewable energy capacity additions beat all previous records despite the economic disruption caused by the COVID-19 pandemic (Saul & Mathis, 2021) **▲01**. The International Renewable Energy Agency (IRENA) estimates that more than 260 GW of renewable energy capacity were added last year, exceeding the growth in 2019 by almost 50 percent (IRENA, 2021).

As one of the largest oil and gas producers in the world, and whose primary exports are fossil fuels (accounting for over 50 percent of export commodity trade), Russia's economy is particularly exposed to these changing global energy trends.

Russia's two major export markets—the EU and China—have actively emphasized their goals to become carbon neutral by 2050 and 2060 respectively, and both regions are looking increasingly toward renewable energies as the solution to reach this goal, as well as to increase their energy security and reduce import dependence.

The EU has pledged to allocate €550 billion to green projects over the next seven years, which is the largest single climate pledge ever made (Abnett, 2020). Furthermore, under the new Green Deal, the EU is planning on restricting funding for natural gas projects under the revised green finance rules because of the risk they pose to the collective climate goals, with the addition of the proposed Carbon Border Adjustment Mechanism (CBAM), which would impose additional taxes on imports to prevent carbon leakage. Under the pandemic recovery program, the European Commission is considering fast-tracking the adoption of this mechanism and passing the necessary legislation in 2021 in order to introduce it in 2023.

Global institutions are also cutting their financing for fossil fuel projects. In 2019, the European Investment Bank (EIB) declared that it would end financing fossil fuel energy projects from the end of 2021 (Cohen, 2021) AO2. In 2020, other private investment banks (including Deutsche Bank, Morgan Stanley, Citibank) followed suit, announcing their strategies to reduce exposure to the fossil fuel sector (Cohen, 2020).

As the world steps more solidly on the decarbonization path and toward a more sustainable energy structure, Russia's overreliance on fossil fuel production and revenue can expose its economy, which is why diversification and sustainability should be the key drivers in shaping the country's strategy in the years to come.

21.5. RES in Russia—A Path to Sustainability and New Opportunities

With significant hydrocarbon reserves, renewable energy generation has not been a top priority for the Russian government. Nonetheless, some effort is being made to keep up with the global trends and to allocate some importance to renewables in future energy strategies, mostly with aims to improve technological knowhow in this rapidly evolving sector and to reduce the carbon footprint.

While currently renewables (excluding large hydro and nuclear) make up less than 2 percent of Russia's total energy mix (Tikhonov, 2020), new generation capacity has been growing every year, with an end goal to reach 12.5 percent by 2050 (Maksimov, 2021). This share of renewable energy refers to predominantly wind, solar, biomass, and small hydro, as large hydro has been widely present in Russia's energy mix for decades, accounting for roughly 20 percent of total generation in 2020 (Russian Power System Operator, 2021). At the same time, natural gas, which currently accounts for more than 50 percent of the energy mix, is set to remain as the primary energy source in the years to come (Finmarket, 2021).

The Russian Government published several decrees to develop mechanisms to promote renewable energy generation for integration into the grid, as well as for generation in isolated regions and territories, aiming to resolve various environmental and social issues at the same time. Among these, they have introduced an incentive for long-term power supply contracts for RES, where the state guarantees a return of investments with a yield of about 12 percent on the invested capital over 15 years (Decree №499). Furthermore, they have local content requirements, meaning that these installations must use materials that are either partly produced or assembled in Russia (Order №3788). This measure was introduced to stimulate economic activity and create jobs in the renewables sector.

At the same time, a lot of freedom is given to the regional governments to establish their own mechanisms (like the Nenets Autonomous Region's program for cogeneration plants [mostly wind and diesel]), which is why active collaboration with local administrations is crucial to successfully promote regional RES development in the Russian Arctic.

When it comes to strategies, the Arctic regions have emerged as a central focus point for Russia. In October 2020, the Government adopted the official Strategy for the Development of the Russian Arctic Regions to 2035, as well as numerous supporting legislations aimed at providing tax and financial incentives for socio-economic development in the regions. Still, this goal of aggressive development comes at a time of heightened environmental fragility of the Arctic and growing global trends toward decarbonization and curbing climate change. It is thus paramount that this development does not come at an unacceptable cost.

The long-term sustainability of the economic development of the Arctic regions will be influenced by the global environmental and climate regulation, as well as the ongoing transformation of energy markets. As more and more of Russia's economic partners are working toward carbon neutrality and increasing their goals to reduce emissions through improved energy efficiency measures and integration of green energy sources, it is important that Russia considers embracing these global trends beyond setting carbon neutrality targets by predominantly relying on the carbon offsetting provided by the rich forest coverage it is endowed with, especially as in the context of global warming, millions of hectares of these forests are being decimated by fires, from which it will take years to recover and to return to the previous level of carbon absorption. Moreover, these fires are further exacerbating the situation by contributing to overall carbon emission levels: in 2021 the amount of CO₂ released from the forest fires in the Arctic reached almost 400 megatons, double what was released the year prior (Tanayev, 2021).

It is here that RES could play an integral role for Russia, not only in curbing the environmental costs of economic development, but in achieving the outlined goals of improved energy security, living conditions, connectivity, and infrastructural integration.

A lack of energy security and isolation has been the fundamental roadblocks to regional development and growth, and one of the main contributors to poor living conditions in the region. The isolation of many communities and economic hubs presents major logistical issues, as the lack of proper infrastructure significantly complicates the delivery and increases the cost of goods, in particular energy. Since the majority of the Russian Arctic is not connected to the main electricity grid, there is an overreliance on imported coal and diesel to run regional generators. Limited supplies of fuels have led to intermittent power and heat availability for local populations, with some areas only having access to a few hours of electricity a day. This "Northern Delivery" which can often only be carried out in the summer months due to accessibility issues, can see up to 8 million liters of diesel fuel and 20–25 million tons of coal (IRENA, 2017) being brought into these Arctic regions. Moreover, the federal and regional budgets allocate hundreds of millions of rubles each year to cover the cost of these deliveries, and the share of the transport component in these costs can account for over 70 percent (Berdin et al., 2017: 3). This high cost of the "Northern Delivery" has led to extremely high tariffs for electricity in some Arctic regions, which can be 4–5 times higher than the average electricity price in the country. Curbing high energy costs could provide additional impetus to justifying the profitability of RES in addition to providing energy security.

One of the major advantages of renewable energy systems is that, by decreasing the overall cost of their energy, they would not only be able to provide these isolated regions with secure and continuous power supply, but would also significantly reduce the financial burden both on federal and regional budgets, as well as on the individual consumers. Moreover, these RES solutions would also help in reducing the anthropogenic effect on the local environment, improving living conditions for the local population, and significantly reducing exposure to health risks.

In addition to isolation, many issues have led to a lower-than-average life expectancy in the region, as compared to other parts of the country: the harsh weather conditions of the Arctic, a lack of economic opportunities, intermittent energy/heat supply, and low access to proper health care. This situation is worsened by the fact that most regional power and heat generation is derived from either diesel generators or fossil fuel-based (mostly coal) plants which strongly contribute to high levels of air pollution in these communities. This is further exacerbated by the fact that these are predominantly used throughout the nearly endless cold weather months, where the slow-moving and dense cold air ends up trapping these particles in place, causing them to accumulate and

Numerous studies have shown that sustained exposure to high levels of particulate matter (PM) can have significant adverse effects on respiratory and cardiovascular systems, strongly contributing to higher mortality rates in affected areas. Some studies have also shown that this exposure can create underlying conditions that “exacerbate the severity of COVID-19 symptoms and worsen the prognosis of this disease” (Wu et al., 2020). As global warming thaws permafrost layers, as weather patterns and environments change, and as the global population continues to be increasingly mobile, the spread for new diseases, revival of dormant ones, and the overall likelihood of future health crises become more probable. It is thus paramount that everything is done to improve living conditions for communities across the globe to ensure that environmental conditions are not a factor in mortality rates.

To this extent, renewable energy systems could help address multiple elements of these underlying problems, by helping alleviate (if not altogether removing) the problem of air pollution in these communities.

When it comes to isolation in these regions, it is not only present in terms of road and energy infrastructure but in terms of telecom networks as well. The lack of sustained and secure energy systems has not created the necessary foundation to allow for the establishment of proper digital connectivity throughout large parts of these regions. While on one hand, this could present a potential barrier for successful integration of renewable energy systems, especially considering how those systems are reliant on digital platforms for remote operations and grid management, on the other hand, they could actually serve as the necessary impetus to help drive the development of better regional connectivity.

As the world is increasingly becoming more reliant on digital solutions across various economic sectors, including energy management, it is impossible to consider sustainable development of the Russian Arctic Zones without touching on the digitalization of energy systems and the need for more robust development of network coverage in the area.

The onset of the pandemic has completely rewritten the working culture across industries. Over the course of the last two years, hundreds of thousands of companies across the globe were forced—either by government-implemented restrictions or by own choice—to go remote, requiring their teams to reorganize and reenvision how to operate in this new context. Since then, most have adapted to living and working under these new conditions, to the point that most companies have now accepted either a hybrid or even maintaining a fully remote operation going forward. This drastic change to the work culture has increased reliance on technology, internet, telecom services, and of course electricity.

This transition to remote and “online” operation has not been limited to just the professional sectors. Many schools and universities have had to go online for parts of the years, communication with friends and family has become increasingly virtual, and various entertainment platforms which have provided respite have also expanded in the virtual space. As this digital reality provides the basis for more basic needs, the demand for electricity will continue to soar, as will the need for data centers, which constitute a “backbone of internet infrastructure” (Middleton & Rønning, 2020).

This growing electricity and processing demand could turn RES and the Arctic regions into perfect partners going forward, as renewable energy installation can not only help meet the local demand for basic power and heat in a sustainable and reliable way, but could also ensure a more rapid transition of these regions into the progressive communities envisaged by the Arctic development strategies. Moreover, data centers require significant amounts of energy to not only operate but to cool their processors; therefore, there is also tremendous business potential in integrating more of these centers throughout the Russia Arctic. They can thus serve an integral role in developing new and reliable energy systems across these urban centers, while also meeting the growing demand of the digital economy.

Furthermore, with the aspirations to have robust development of the Arctic regions, renewable energy should be strongly considered not just as mechanisms for minimizing environmental impact and sustainable development, but also as strong drivers for job creation, as RES project can be “as much as three-times more demanding of capital and jobs compared to traditional energy developments” (Cohen, 2020). The growing need for data centers with increased volumes of digital traffic (as well as their maintenance) will create additional opportunities and requirements for human capital in the regions.

Finally, renewable energy systems also provide another market opportunity for the region. With the exponential growth of RES across the globe, as well as the ongoing digitalization of economies, there is a growing demand for rare earth minerals that are necessary for RES installation, battery storage, defense, and tech. Having the fourth largest reserves of rare earth minerals in the world at around 12 million tons, Russia is severely underdeveloped, accounting for only 2 percent of global production (MiningWorld Russia, 2020). While the Russian Government has adopted new legislation to help increase Russia's share of global rare earths output to 10 percent by 2030, there is still ample room for growth and development in this sector, as well as a need to reduce its own import dependence for these elements. Moreover, as demand for these elements is on the rise and as other importing countries (such as the US and EU) are actively trying to ramp up their RES capacity and decrease their import reliance for these elements from China, Russia could become an integral player in diversifying this trade dynamic.

21.6. Conclusions

In conclusion, as a new reality begins, where attention on climate change is heightened and economic recovery strategies are aimed at preventing new irreparable global shocks, Russia, as it focuses on revamping its northern territories, has a perfect opportunity to develop with this future in mind. Renewable energy systems have an important role to play in this energy transition and in helping develop these isolated areas into growing and modern urban centers. Renewable energies could also provide new economic opportunities for Russia that could facilitate and accelerate the desired development of its Arctic regions. However, global trends of decarbonization and digitalization will require a powerful and symbiotic relationship between green energy, sustainability, and economic development, and it is important that the right structure is set in place to ensure that this relationship is at the core of Russia's Arctic development.

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