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Preparing for Uncertain Futures:

Co-created scenarios for the Russian Arctic

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Summary

People living or working in the Arctic are faced with uncertainty regarding future social, political, economic, and environmental change. This uncertainty is due not least to the ongoing transformations caused by climate change. This paper presents results from a project entitled “Yamal 2040: Scenarios for the Russian Arctic”, which employed ‘Strategic Foresight’, a specific co-design and engagement methodology, to support stakeholders of one particular region in the Arctic, the Yamal-Nenets Autonomous Okrug (Yamal region) in Western Siberia, Russia. It was the project’s objective to respond to this situation of general uncertainty, to develop forward-looking scenarios to better understand the risks and opportunities associated with future transformations in the Arctic. The findings presented here may be of interest for stakeholders in other parts of the Arctic and Russia that depend on the exploitation of fossil fuels and/or are facing complex and uncertain situations.

Three future scenarios were developed together with stakeholders at a series of workshops. The scenarios take into account climate projections as well as possible environmental, social and cultural concerns, economic opportunities, and political and legal developments. Representatives of different stakeholder groups (Indigenous Peoples Organizations, and environmental NGOs, local communities, Yamal industry, the media etc.) were involved from the beginning of the project and acted as co-authors of the elaborate scenarios.

The scenarios envision different futures for the region. In one of them, Yamal’s petroleum business is shrinking as a result of the global energy transition. In another scenario, Yamal’s gas industry is booming because gas is viewed worldwide as a “transition fuel”. In two scenarios, Yamal experiences severe consequences of climate change, such as rain-on-snow events, or anthrax outbreaks and mercury releases out of thawing permafrost, which create life-threatening challenges for Indigenous communities. In contrast, the third scenario projects cooling instead of warming in Yamal and Europe resulting from the interaction of a number of unexpected climate factors.

Participation in the construction of scenarios provided stakeholders with an opportunity to deepen their knowledge about the impacts of climate change and their interaction with other factors that influence the future of Yamal, as well as to reflect on own ways how they think about the future. In a second phase of the project, strategic options were developed together with stakeholders, to enable proactive preparation for possible future developments.

Acknowledgements

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The website of the project is: blue-action.eu

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1. Introduction

The oil- and gas-rich Yamal-Nenets Autonomous Okrug/ Yamal region in Arctic Russia is a highly relevant case to explore current and future interactions of global, regional, and local change processes, especially in the context of resource extraction. The Yamal region is situated on the northern part of the West Siberian plain and borders the Kara Sea in the north. It is one of the largest federation subjects of Russia and covers an area of 770.000 km². As of 2015, about 534.000 people live in the Yamal region, of whom 8% are Indigenous. Indigenous groups include titular Nenets, Khanty, and Selkup, who still practice nomadic reindeer herding, hunting, fishing, and gathering. While these subsistence activities are crucial for the economies, cultures, and health of Yamal Indigenous communities, they are now threatened by a mix of factors – in particular climate change and ongoing oil and gas development in the region.



Figure 1. Map of Russia, the Yamal-Nenets Autonomous Okrug is marked in red.

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The Yamal region produces more than 80% of Russia's natural gas (Nalimov and Rudenko 2015). Oil and gas condensate are also extracted in Yamal, albeit in less substantial volumes. The region hosts a number of ambitious and complex petroleum investment projects with worldwide export plans (Stephen and Valeeva 2018). Most important of them are the Yamal LNG and Arctic LNG-2 projects as well as the Bovanenkovo gas field and the Novoportovskoye oil and gas condensate field projects (ibid).

The oil and gas industry plays a crucial role in the economy of the Yamal region and has transformed it into one of the richest regions in Russia (Larsen and Fondahl 2014). However, the situation may look very different in the future: many of the currently active oil and gas

fields in West Siberia are maturing. Thus, the Russian government is eager to explore untapped resources in its Arctic regions. This includes prospects onshore but also increasingly offshore, i.e. tapping the vast continental shelf off the Russian coast with its immense commercial opportunities and environmental risks.

The Arctic is experiencing dramatic environmental changes due to the impact of climate change and industrial activities, and Yamal is no exception. Sea ice decline, permafrost thaw, coastal erosion, and air and water pollution are already threatening Yamal communities and infrastructures as well as the region's flora and fauna. To give an example of the impact of climate change in the Yamal region, mass reindeer deaths have occurred in recent decades due to sudden changes in temperatures. The resulting rain-on-snow events and arrival of thick ice prevented the reindeer from foraging for food. Such events seriously threaten the subsistence activities of the Indigenous peoples in the region. Scientists point to the link between climate change and the higher frequency and intensity of rain-on-snow events (Forbes et al. 2016).

Climate change is a very important but not the only driver influencing the developments in the Yamal region. The future of this region is a complex issue afflicted with many uncertainties. Examples of such uncertainties are:

- global supply and demand trends for energy resources (including oil and gas price trends)
- progress in energy efficiency and market share of renewable energy sources
- the macroeconomic situation in Russia and specifically the future of the Russian energy policy
- the geopolitical situation in the Arctic and in other regions
- development of climate policies to tackle global warming and its consequences (such as the implementation of the Paris Agreement),
- and regional and national regulations for resource development, transportation, and environmental protection.

To support stakeholders in the Yamal region and elsewhere to deal with multiple uncertainties regarding the future of the region, IASS (Potsdam, Germany) together with Foresight Intelligence (Berlin, Germany) and the Primakov Institute of World Economy and International Relations (IMEMO, Moscow, Russia) initiated a scenario-building exercise entitled "Yamal 2040: Scenarios for the Russian Arctic", which formed part of the international research project Blue-Action. Within this case study, a series of workshops were held in Moscow and in Potsdam in 2017 and 2018. At these workshops, Yamal stakeholders and scientists created a set of scenarios, envisioning the region in 2040. The purpose of the scenario exercise was not only to produce scientific knowledge but also to improve the capacity of stakeholders to adapt (in face of uncertain developments), and to strengthen the science-policy link in Arctic inter- and transdisciplinary research efforts. The findings presented in this paper have been published already in the form of project deliverables¹.

¹ See Stephen, K., & Valeeva, V.: Arctic Stakeholder Map: Stakeholder groups involved in Yamal oil and gas development. Blue Action Case Study Nr. 5. Potsdam, Institute for Advanced Sustainability Studies (2018). URL: https://publications.iass-potsdam.de/rest/items/item_3742916_3/component/file_3742918/content; Stephen, K., Valeeva, V., Gabriel, J., Nikitina, E., Kuznetsov, A., Aksenov, Y., & Semenov, V.(2019). Environment scanning workshop and report 2. Potsdam: Institute for Advanced Sustainability Studies (IASS). URL: <https://zenodo.org/record/3341291>; Stephen, K., Valeeva, V., & Gabriel, J.:CS5 Quantitative and qualitative analysis of the engagement of stakeholders. Potsdam: Institute for Advanced Sustainability Studies (2019). URL: <https://zenodo.org/record/3346855>

1.1 Participants

As part of the Yamal scenario case study, the Blue-Action team produced a stakeholder map (see Stephen and Valeeva 2018) showing the large number and diversity of those actors who are engaged in or influenced by Yamal oil and gas projects². The Yamal stakeholder map included stakeholder groups from within the region itself, Russia generally, as well as from outside the country. They belong to various spatial scales: federal and local authorities, international organizations and regional institutions, as well as Arctic and non-Arctic players. Stakeholder groups also have different legal status, spanning for example state and non-state actors.

The map provided the basis for creating the list of workshop participants. Among them, there were representatives of:

- Yamal local community,
- Indigenous peoples NGOs,
- Environmental NGOs,
- Oil and gas business,
- Consulting companies focusing on the development of the Russian Arctic,
- Media,
- Scientists

1.2 Methodology

In the case study “Yamal 2040” we employed the Strategic Foresight methodology, which is used worldwide by decision-makers to anticipate uncertain futures. This method allows us to broaden the perception of possible future developments and expand the awareness of emerging risks and opportunities (Habbeger 2010). Strategic Foresight supports decision-making by developing a set of scenarios of how the future could unfold. The scenarios are created in a structured communication process with the participation of various stakeholders who bring different perspectives on the investigated issue. Skillful facilitation within the Foresight process enables dialogue between different and often opposite ideas, and encourages participants of the process to constructively deal with their own cognitive biases and to think “outside the box” when making decisions about the future. This method is especially helpful in exploring complex and uncertain situations and can be perceived as a capacity building exercise for stakeholders to help them to better adapt and be prepared for alternative futures. During the whole “Yamal 2040” process, we kept reflecting on Strategic Foresight, its strengths and limitations as a method to engage stakeholders in a scientific process. Our reflections are summarized in the respective deliverable (Stephen et al. 2019).

² The initial focus of our case study was on the future of oil and gas projects in the Yamal region. That is why we produced the stakeholder map covering this topic. However, at the first workshop participants jointly decided that it would be more interesting and relevant for them to talk about the future of the whole region and not only about petroleum development. We adjusted our research plans accordingly and created scenarios for the whole Yamal region. However, since the oil and gas industry plays a crucial role in Yamal today, the produced stakeholder map was still helpful and relevant for the scenario process.

The methodology setup for the “Yamal 2040” Strategic Foresight project consisted of two phases: the first phase was about exploring alternative developments (Foresight), the second phase centered around the question of how to act in face of uncertain developments and various opportunities and threats (Strategic Foresight). The approach to create scenarios and to draw practical implications that we used in the Yamal case study was developed by Johannes Gabriel and comprises seven steps (see illustration) that were done during the three workshops (Gabriel 2014).

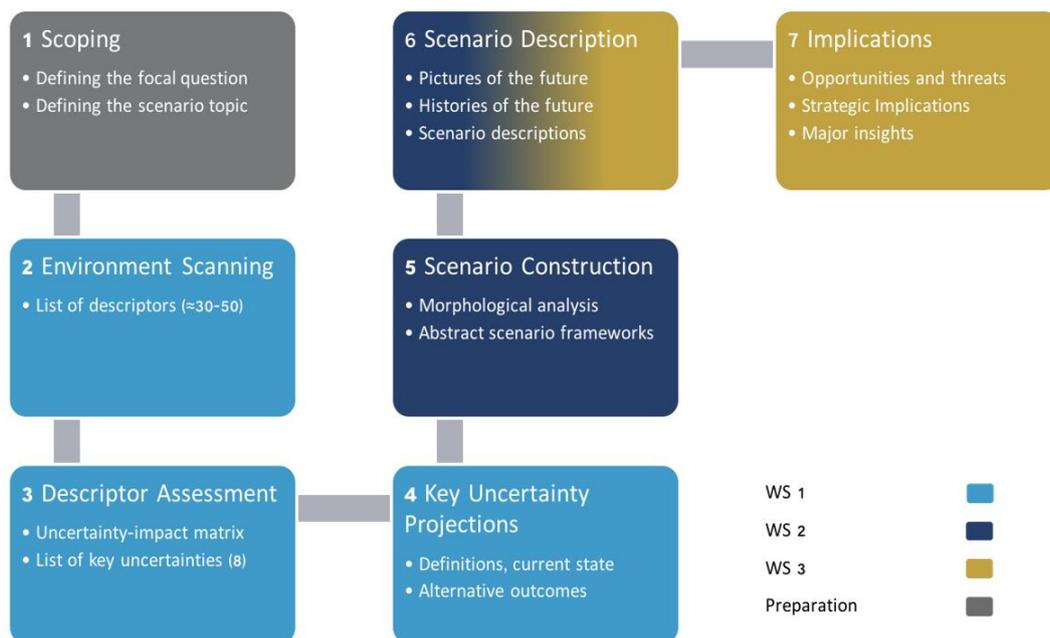


Figure 2. Methodology.
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During the first workshop, participants, first defined the time horizon, and formulated a question that outlined the research interest (1). After that, they engaged in environment scanning (2). During this step, participants jointly created a comprehensive list of factors that influence the future of the Yamal region. Subsequently, the participants assessed all factors’ impact on the topic and their uncertainty (high or low) in order to identify the factors that would be used to construct raw scenarios (3). During the “Yamal 2040” exercise, this assessment was a two-step process: First, the participants assessed all factors in small breakout groups. Second, all participants discussed the breakout groups’ assessment and agreed on seven highly uncertain and impacting factors, so-called “key uncertainties”, and marked ‘trends’, the most impactful, however certain factors. In the next working step, participants projected each key uncertainty into the future by developing alternative assumptions about the respective key uncertainty’s future state in 2040 (4). All key uncertainties and their respective projections form, when put in a table, a morphological field. The morphological field is used to create raw scenarios using a morphological analysis (Ritchey 2018). In our project, we utilized a “reduced” morphological analysis: instead of using a computer to calculate cross-impacts, participants created consistent raw scenarios step-by-step in a group discussion. As this construction technique is prone to groupthink, it was facilitated by an experienced moderator. This was done during the second workshop (5).

Key Uncertainties	Scenario 1	Scenario 2	Scenario 3
Oil and Gas Prices	Correlated, low prices (20-70\$, 1.5–3\$)	Low price for oil (20-70\$), high price for gas (3-7,5\$)	Correlated, high prices (70-120\$, 3-7.5\$)
Russia’s Economic Development	O/G: high; other sectors: low GDP growth: 1-2%	O/G: high; other sectors: low GDP growth: 2-5%	O/G: high; other sectors: high GDP growth: >5%
Sanctions	persist	abandoned	persist
Inclusion of Indigenous peoples and civil society in decision-making	Joint decision-making	Government under pressure	Civil society and Indigenous peoples excluded
Climate change impacts on the Yamal region	High	Medium	More ice and less permafrost thawing
Global energy transition	Breakthrough	On the way	Stalled
Environmental damages from O&G industry	High production, low regulation	High production, high regulation	High production, high regulation
Investment climate	Not good	Good	Good

Figure 3. Raw scenarios as developed at the workshop

After the construction of raw scenarios, participants broke-off into scenario teams to further develop their respective scenario by mind-mapping the situation in 2040 before backcasting one plausible trajectory that could lead to the situation in 2040. After the participants concluded their process of ideas generation in the workshop, the project team translated the participants’ ideas into written scenario descriptions to fix the end results of the foresight process and to make the scenarios accessible to a broader audience (6). The written scenario descriptions were revised several times by the workshops’ participants afterwards.

At the third workshop, as part of the strategic foresight component of this project, participants first identified relevant stakeholder groups who would be affected by future developments of Yamal, before they identified potential opportunities and threats the scenarios would pose for these stakeholders. Participants then developed strategic options for each of these stakeholder groups to deal with the opportunities and threats of a specific scenario. After that, these options were stress-tested under the conditions of other scenarios to identify those options that would be effective under each scenario (7).

2. Scenario descriptions

Below are the final versions of the descriptions of the three scenarios and one additional scenario elaborated at the third workshop. The developed scenarios are not forecasts, they are rather thought experiments about future developments that provide better understanding of complex environments, making sense of uncertain futures, avoiding surprise.

Scenario 1. Yamal 2040: Reinventing Itself

In 2040, a big breakthrough in energy storage technology has changed the world. Grid-scale and back-up batteries have evolved dramatically through new discoveries in superconductor research. In addition, a new method to store and transport hydrogen at ambient pressure and temperature has evolved, making the practical application of hydrogen as energy carrier more safe and cost effective. Technological breakthroughs usually lead to changes in consumption behaviour and this one was no different. The demand for oil and gas sharply declined and Russia – in part due to trade wars and geopolitical tensions – has failed to implement policies that would lessen its oil and gas dependence.

But the impacts of climate change have taken their toll as Yamal is doubly affected. The region has traditionally been heavily involved in oil and gas production, and its geographical position and cultural history make it particularly vulnerable to the effects of climate change. By 2040, the mean temperature in Yamal is reaching a level of 4°C warmer in comparison to the pre-industrial level. In summer, temperatures are frequently higher than 30°C. There is increase in precipitation, however, the distribution is uneven throughout the year: most of the region gets an increased amount of precipitation in winters and autumns but sees less rain during summer resulting in frequent droughts in Yamal during the warm months of the year. The increased probability of rain falling on snow leads to more instances of ice covering the surface, which makes it nearly impossible for reindeer to survive as they cannot reach their food under the icy cover. By 2025 the amount of reindeer in the region has declined by 75%. Consequently, the Indigenous peoples of Yamal have to change their traditional way of reindeer herding by introducing supplementary feeding, new medication, and restricting animal migration.

Due to shrinking job opportunities, Yamal's population has steadily declined until the beginning of the 2030s. It remains about steady since then, which can at least in part be attributed to the inclusion of Indigenous people and civil society groups in political decision-making processes – a change that has been implemented to prevent further population decrease. Additionally, Indigenous peoples are becoming more motivated to fight for their rights after the Yamal reindeer population almost died out in the mid-2020s. Their efforts are fruitful, as extractive industries' influence is on the retreat. The ~200,000 people left in the region (YNAO counted 520,000 people in 2010) are faced with the general impacts of climate change. While the local population, including Indigenous people, is being forced to move away from the sea as coastal regions are swallowed by water, 80% of the general population lives in cities, which are increasingly struck by summer heat waves. The negative effects of

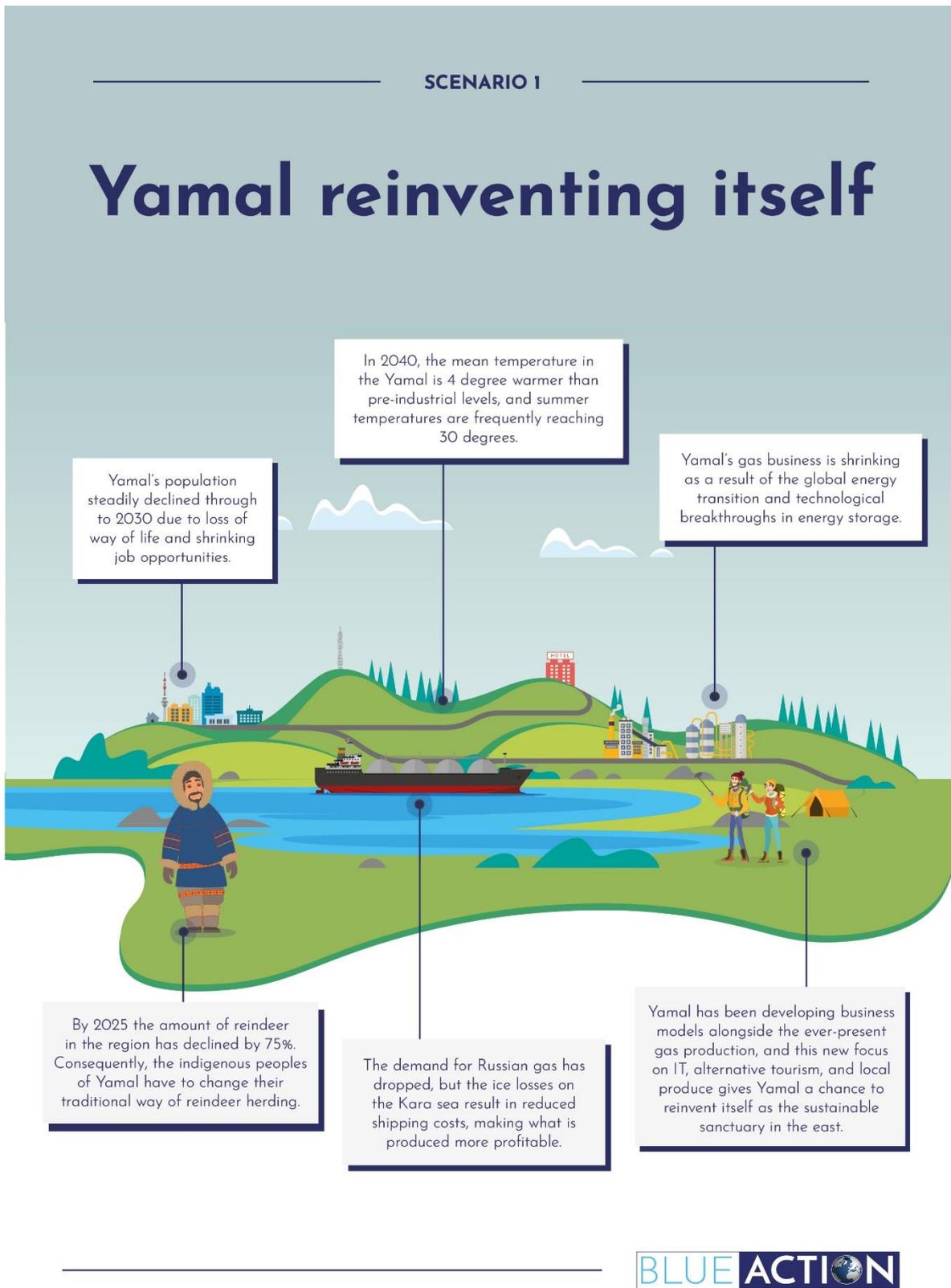
the still largely unrestricted production of oil and gas, such as oil spills and air pollution, also persist and reach their peak in the late 2020s.

After the technological breakthroughs in the energy storage systems, which also included grid development and energy transport, the demand for Russian gas – especially from Western Europe – declines as new technologies enable more energy savings, better energy efficiency and as well as facilitate the turn towards renewable energy. However, Yamal is not experiencing the dreaded sudden petroleum industry drop and corresponding losses in revenue. Rather, onshore gas production is fading out following the natural decline of gas fields. At the same time, the industry generates a larger profit from the Kara Sea, which is increasingly free of ice during spring, summer, and autumn, resulting in reduced shipping costs to bring Yamal gas to markets. Therefore, the decline in gas production is not unanticipated and rather incremental, while at the same time logistical costs are reduced, making what is produced more profitable.

In a situation that seems the perfect set-up for failure, Yamal begins to thrive. Unlike Russia as a whole, Yamal has been developing business models alongside the ever-present gas production. While these old business models are slowly starting to fail, Yamal's new focus on IT, alternative tourism, and local produce is strengthened. Technological advances and the melting sea ice on the Kara Sea facilitate the movement of goods and people to and from Yamal while at the same time making the region more inhabitable. Changes in western energy consumption and the general shift in western attitude regarding sustainability as a lifestyle, correspond with a shift in Yamal policy-making, which is focusing on conservation and, at the same time, turning away from Moscow towards stronger ties with the EU. Even the declining population turned out to be a blessing in disguise, as it led to the inclusion of Indigenous people and civil society in regional decision-making. Being a region with high participatory involvement is now feeding into EU citizens longing for authenticity, sustainable tourism, and thoughtful consumption, strengthening Yamal's position in the eyes of Europeans.

Driven by technological advancements and recognizing the devastating effects of climate change, Yamal needed a new outlook into the future. While technological innovations occurred, these took a few years to fully make it to market and implementation on the ground, thus providing a soft landing for Yamal's gas production in form of enough time to adapt to new technological standards. Also difficulties in energy transport could be alleviated, overall allowing for an incremental change of Yamal's gas production and transport system. New businesses, new policies, demographic changes, and the resulting changes in political decision-making perfectly aligned with cultural and technological developments in the west, giving Yamal the chance to reinvent itself as the sustainable sanctuary in the east.

Figure 4. Scenario 1
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Scenario 2. Yamal 2040: Gas Boom

It is 2040 and the effects of climate change on Yamal have not been as severe as many expected based on early 2020's climate model projections. However, the mean temperature still has increased by 3°C. Precipitation has increased slightly and coastal erosion is at a steady 1-2 meters per year. Yamal is still subjected to extreme weather events and uneven permafrost thawing. Heat waves still occur in the summer leading to droughts with temperatures over 30°C. The erratic distribution of permafrost thawing is a troubling development for reindeer herders, as the ground releases enormous amounts of mercury that makes its way into the food-chain. Additionally, air quality problems are prevalent, especially in urban areas. But overall, while Yamal is experiencing climate change problems, it seems to have been comparatively lucky.

In the early 2020s, several large-scale climate disasters shake the world. The US East Coast is hit again, as well as Mexico and several states in the Caribbean. The ensuing rescue and rebuilding efforts by the international community are highly resource intensive. Many of the regions depend on humanitarian aid for years to come. Governments and NGOs strengthen their focus on mitigation to (in the long-term) reduce the risk of climate disasters by tightening regulations and especially through higher funding for technological innovation. The newly elected US president vows to re-enter the Paris Agreement³.

Recognizing the devastating effects of climate change, global energy transition plans gain traction. There is a growing awareness regarding possibilities of linking climate change mitigation with the conditions of energy production. Consumption behaviour is starting to change on a large scale as consumers pay increasing attention to the origin of their energy supply. In the US, widespread use of nudging technologies is taking effect as these technologies are linked to Amazon Echo, Google Home, and the like by 2027. In using these technologies, users are on the one hand made aware of their consumption behaviour and on the other guided towards reducing their ecological footprint. China makes energy consumption central to the Social Credit System in order to monitor citizens and companies. Russia ratifies the Paris Agreement⁴ after long political struggles and – together with the US and China – pushes for gas as a transition fuel. Spikes in oil prices, because of turmoil in the Middle East and North Africa, in particular due to direct confrontations between Saudi Arabia and Iran, as well as domestic instability in Angola and Nigeria, push Liquefied Natural Gas (LNG) as an alternative.

The International Maritime Organization reaches its goal of tightening regulations in Emission Control Areas as their efforts (including, but not limited to, its Global Maritime Technology Cooperation Centres) receive additional funding by the European Union and the Chinese government, starting in 2029. These regulations further increase the usage of LNG as a shipping fuel. New ships are built, and old ships are retrofitted with dual fuel motors. While much of this work is still done in South Korea, Japan, and Finland, Russian efforts to develop domestic shipbuilding are slowly gaining ground. At the same time, many ports all over the world are developing LNG infrastructure and LNG demand rises dramatically.

³ The US re-entry to the Paris Agreement was just an assumption in 2018 when the scenarios were developed. However, this did happen in 2021.

⁴ Russia did ratify the Paris Agreement in 2019.

In a gradual process starting in 2030, something resembling a consensus on Crimea is reached. While western governments are not officially approving the annexation of Crimea, they are slowly building up closer ties with Russia and vice versa: the Crimea situation is accepted as a political reality and sanctions are lifted incrementally in exchange for concrete Russian efforts to normalize its relation with Ukraine, such as the withdrawal of Russian operatives and military equipment from Eastern Ukraine and shared control of the Russia-Ukraine border.

With resource extraction in Yamal on full capacity, negative external effects such as operational waste and water discharges proliferate. Various international NGOs carry out comparative environmental impact assessments, with dramatic results for Yamal. The effects on Indigenous Peoples, biodiversity, and water and air quality are catastrophic. Wildlife migration routes and habitats are destroyed. It is these kinds of impacts that trigger local and international mobilization. The Russian government is under pressure as especially European consumers are increasingly aware of the origins of the gas that heats their homes. By 2032 the EU has funded the development of technologies that allow real-time surveillance of energy consumption and providers are forced by law to make this information available. By 2035 these technologies are integrated into Netflix and Amazon Prime and both offer footage of the regions that a household's current energy is originating from. When consuming energy from Yamal, documentaries on the Nenets' struggle for survival are offered in the sidebar, while consumers of wind energy receive offers to watch material on the latest developments in North Sea offshore parks.

The demand for LNG is steadily on the rise until 2040. Yet another turmoil in the MENA region further drives demand and leads to high investment in infrastructure for LNG production and transport. In Yamal, Arctic LNG 2, the Altai Pipeline, and Yamal-EU II are fully operational by 2037. A positive investment climate coincides with the lifted sanctions and joint ventures start to develop rapidly. Gazprom teams up with German energy companies and creates facilities in Yamal that show a higher degree of corporate social responsibility than has previously been observed in the region. Yamal is for the first time experiencing highly regulated gas production, done by socially and environmentally responsible companies. Due to increased consumer awareness – especially in Europe – such practices not only conform to newly established Russian regulations, but also turn out to improve local business opportunities. After years of disregard for the environment and Yamal's population experiencing its devastating effects, the risks of oil spills are almost eliminated. Yamal is now happily producing gas.

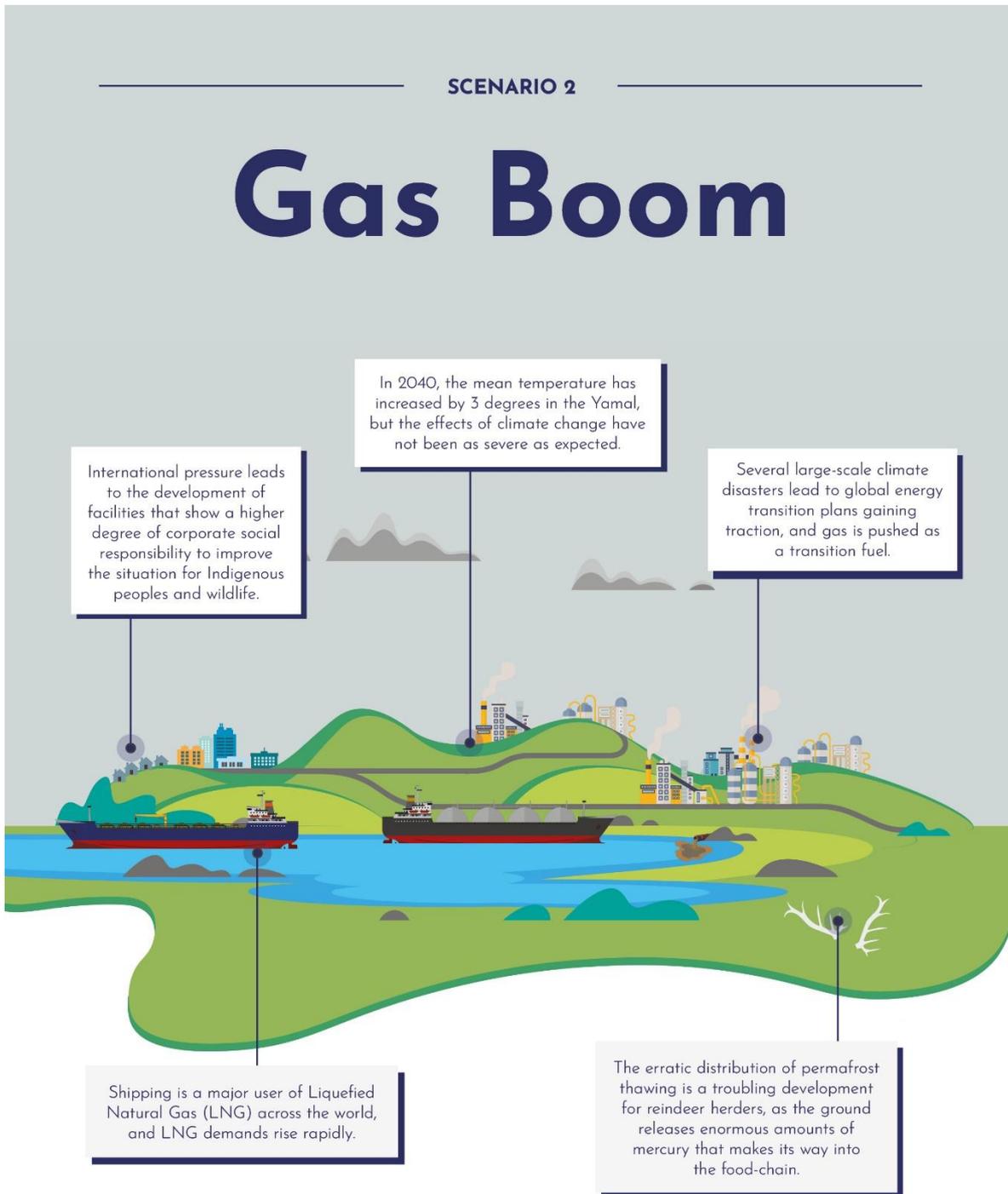


Figure 5. Scenario 2
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Scenario 3. Yamal 2040: Snow Queen

In 2040, prices for oil and gas are high due to a stalemate in the global energy transition and higher global consumption rates. Russia has enjoyed high growth rates not only originating from the energy resource sector but from the development of other sectors as well. Yamal is a key region for expanding gas production; however, also other sectors such as infrastructure and chemistry flourish. The continuing sanction regime imposed by Western states has promoted industrial diversification and home-grown innovation in Russia (and Yamal). Regional impacts of global climate change have been rather unexpected. Due to a combination of different factors including major volcanic eruptions, uncoordinated American and Chinese geoengineering experiments, the Gulf Stream slowing down, and increased concentration of cooling aerosols in the atmosphere as a result of further urbanization, Yamal and Europe experienced cooling instead of expected warming⁵. Permafrost is stable and the Kara Sea is covered with pack ice even in summer, impeding shipping activities and the LNG industry. LNG from Yamal LNG and Arctic LNG 2 are shipped out solely westwards to Europe. Decision-making in Yamal excludes Indigenous communities as the energy lobby is strong and Indigenous participation in ecological surveys and audits are considered to be sufficient.

Starting in 2020, a series of extremely cold winters in particular in Europe put demand for Yamal gas and its price tag on an upward trend. Already by 2023, there is a noticeable winter cooling over Northern Europe that scientists expect to be rather stable for the years to come. Although the EU seeks alternative ways, gas is used as a “transition” solution for heating. Despite no temperature changes in Asia, China increases gas consumption for plastics production. By 2022, all Yamal Gazprom projects supply Nord Stream 2, while less profitable projects are revised, leading to a more homogeneously successful business landscape. Within 2024, nuclear energy projects in Europe are revisited, new oil and gas projects are being developed, and a regional program to further the development of the gas chemistry industry is started in Yamal. The success of these efforts prompts the Russian government to revise alternative energy programs. Industry diversification is therefore promoted, yet the focus on nuclear, petroleum, and chemistry sectors reduce the investments in renewable energy as well as entirely new sectors, such as tourism, services, or education.

Yamal experiences home-grown efforts in diversification, the deliberate strengthening of the industry with Arctic LNG 2 approaching full capacity, the Altai Pipeline at full capacity, and Yamal-EU II about to be extended in 2024, but gas sector sanctions on Russia persist. In order to be able to supply the ever increasing demand from Europe and East Asia despite western sanctions, the Russian government fosters even more investments in research and development. Furthermore, new legislation on foreign direct investment in Russia’s energy sector, including the Arctic, is passed, leading to increased money inflow from Asia. By 2027, the Power of Siberia pipeline becomes insufficient to meet Chinese gas demands as China – for the first time – exceeds the US in GDP. Russian GDP growth rates around that time are over 4%.

By 2030, the Altai pipeline is redirected via Kazakhstan, and Yamal LNG and Arctic LNG 2 are extended. In the early 2030s, gas supply to China via the Altai pipeline commences. With the mid-2030s bringing GDP growth rates to over 5%, Russian companies can go beyond

⁵ This projection of climate change impact was considered by climate scientists who participated in the scenario exercise as very unlikely but still probable

surviving and can afford to take care of issues outside their core business. Large-scale protests across Russia provided additional motivation for the Russian government and business to invest more in people's well-being following the Norwegian example. In Yamal, ecological impact assessments and programs to preserve Indigenous peoples' traditional ways of life as well as to provide basic levels of participation in the resources sector are set up and running. Programs for the economic, social, and ecological improvement of oil and gas extraction are successful. The Russian energy sector becomes cleaner and more inclusive, focusing on where to extract, how to compensate, and what environmental standards are being adhered to. With stable international demand for oil and gas in combination with a diversified – yet energy resource based – portfolio, Yamal achieves a stable regional economy and development, transitioning smoothly from nomadic traditional ways of life to settled industrial lifestyles.



Figure 6. Scenario 3

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Wild Card: Breakdown of Gas Infrastructure

In addition to the three scenarios, the participants of the third workshop also considered the impact of a so called wild card, an accident that may happen any time and have a profound effect on the whole situation. As a wild card, workshop participants decided to choose the breakdown of gas infrastructure as a result of a huge gas eruption. The possibility of such an accident indeed exists in Yamal and is a subject of great concern for regional business and officials since 2014 when the first crater was discovered on the Yamal peninsula. The crater looked like a hole and was more than 50 meters deep and 20 meters in diameter (The Barents Observer 2018).

The discovery attracted attention of the world scientific community, however experts have not agreed on the nature of its origin so far. Some scientists argue that the crater appeared because of migration of deep gas as a result of permafrost thawing. Other blame explosive cryospheric processes or even consider a meteorite falling on earth (Buldovicz et al. 2018). Meanwhile, several more craters were discovered in Yamal. The biggest one was found only about four kilometres from a gas pipeline transporting gas from the Bovanenkovo gas field. It is more than 60 meters in diameter and about 200 meters deep. Also, several small hills were discovered in the Yamal region which, according to experts, could be “gas bubbles” ready to explode anytime (The Barents Observer 2018). So far, scientists cannot predict the location and time of formation of new bubbles and craters, which creates a huge uncertainty for Yamal infrastructure, locals, and the petroleum business.

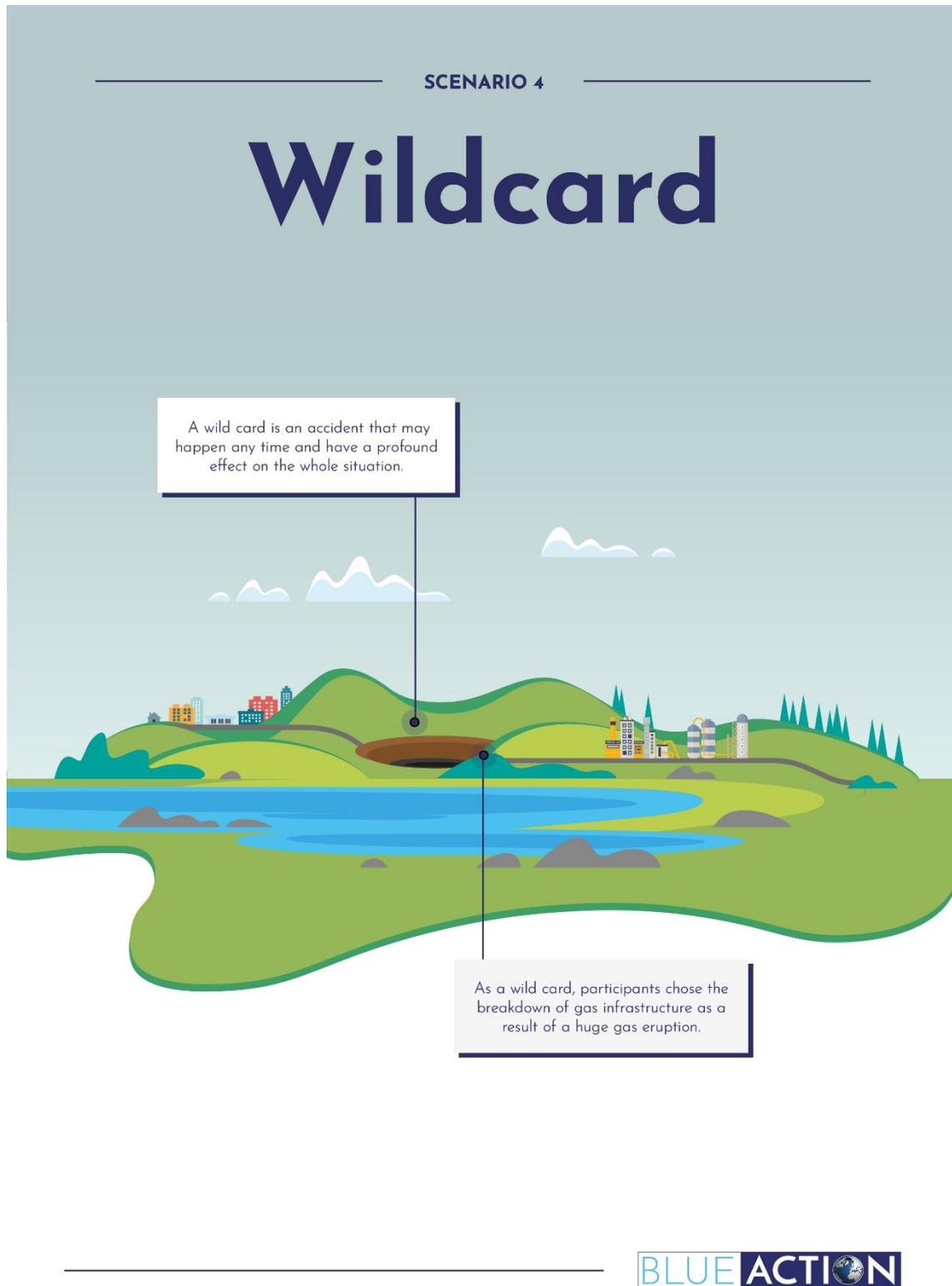


Figure 7. Scenario 4

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3. Strategic Options

3.1 Stakeholder perspectives

At the third workshop of the “Yamal 2040” series, participants were shown how to use scenarios for their decision making by deriving consequences and strategic options with respect to each scenario for concrete stakeholder groups. Due to time and human resources limitations, it was not possible to develop strategic options for all Yamal stakeholders. Hence, participants were asked to select three to four stakeholder groups to focus on. During the selection process, the following criteria were taken into account: importance of the stakeholders’ decisions for the future of the Yamal region, their capacity to act, as well as the interests and expertise of the workshop participants.

After an intense discussion, participants agreed on the following list of stakeholder groups:

- Local population including Indigenous Peoples
- Domestic and international oil and gas companies
- Federal government of the Russian Federation

3.1.1 Local population including Indigenous Peoples



Figure 8. Yamal reindeer herder

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About 534.000 people live in the Yamal region. Ethnic Russians constitute 60% of them, followed by Ukrainians with 9% (Russian Federation Federal State Statistics Service, no date). Indigenous groups account for 8% of the region’s population. This includes titular Nenets, Khanty, and Selkup. Because of the petroleum industry and labour migration, the Yamal region is one of the few regions in the Russian Arctic which experiences population growth. 70% of the people who now live in the Yamal region were born outside it (S. Glomsrød, G.

Duhaime and I. Aslaksen 2015). However, in the rich Yamal region the wealth is distributed unequally resulting in the stratification of its population. Whilst petroleum employees who moved to the Yamal region enjoy high incomes and living standards, little of the money reaches tundra dwellers (ibid). Moreover, Indigenous communities are those who are affected most by oil and gas developments. Current and planned oil and gas fields in the Yamal region overlap with territories relied upon by Indigenous nomads for their livelihoods (reindeer herding, hunting, fishing, gathering).

3.1.2 Domestic and international oil and gas companies

This group comprises more than 30 companies extracting gas and more than 20 companies extracting oil in the Yamal region. The largest share of extracted gas in Yamal is attributed to Gazprom and Novatek and their subsidiaries. The biggest oil developers in Yamal are subsidiaries of Gazprom Neft, Rosneft, and Novatek (The government of YNAO 2018). Several foreign companies are involved in hydrocarbon extraction in Yamal. Among them are France's Total and the China National Petroleum Corporation (CNPC) who participate in the Yamal LNG project. German Wintershall Dea is involved in two Yamal projects, the Yuzhnorusskoe oil field and the Achimgaz gas field, partnering with Gazprom. Novatek also agreed to cooperate with Total, China National Oil and Gas Exploration and Development Company (CNODC), China National Offshore Corporation Limited (CNOOC) and Japan Oil, Gas and Metals National Corp JOGMEC and Mitsui & Co in the new huge Arctic LNG 2 project, which is also located in the YNAO and is planned to start production in 2023 (Reuters 2019).

3.1.3 Federal Government of the Russian Federation

Responsibilities of several Russian ministries interact in the Yamal region. Among them are: Russian Ministry for Development of the Russian Far East and the Arctic, Russian Ministry of Energy, Russian Ministry of Natural Resources and Environmental Protection, Russian Ministry of Economic Development, Russian Ministry of Finance, Russian Ministry of Industry and Trade, Russian Ministry of Transport, Russian Ministry of Civil Defence, Emergencies and Mitigation of Natural Disasters, and the Russian state commission for Arctic development. The workshop participants decided to consider all of them by developing strategic options for Russia's federal government as a whole.

3.2 Consequences

After selecting relevant stakeholders, participants of the third workshop identified potential opportunities and threats the scenarios would pose for these stakeholders. Consequently, participants developed strategic options for each stakeholder group to deal with opportunities and threats of a specific scenario, before revising these options by stress-testing them under the conditions of other scenarios.

3.2.1 Consequences for local population including Indigenous Peoples

In all but the “Snow Queen” scenario, the Yamal population will have to deal with an increasingly challenging environment due to climate change impacts. The scenario “Gas Boom” is the most unpleasant for the Indigenous population (not local population) as it increases socio-economic conflicts and seriously threatens the reindeer economy.

Scenario 1: Reinventing Itself	
Opportunities	Threats
High socio-economic development, in particular in the agricultural sector and in new business sectors such as IT and alternative tourism. There are new educational centers in the region. Indigenous people can maintain their way of life by adapting to new business ideas. The public is engaged in policy-planning and -making.	The population suffers from climate related health problems. There is a major decline in the reindeer population with associated rising unemployment among Indigenous peoples. Permafrost thawing induces infrastructure and housing destruction, causing climate induced mobility. Corporate Social Responsibility programs and Indigenous subsidies are reduced.
Scenario 2: Gas Boom	
Opportunities	Threats
Due to increasing gas development, new expertise and investments are coming to the region and the infrastructure of Yamal cities is improved. Petroleum companies invest more resources in corporate social responsibility (CSR) programs, which creates more cultural and educational opportunities for the local population. Oil and gas businesses involve local communities in environmental control and invest in their environmental education.	Air, water, and soil pollution from the extraction industry increases during the 2020s. The emergence of new technologies that allow customers to monitor the gas production process motivates business and officials to enhance environment protection measures. But mercury pollution resulting from permafrost thaw keeps threatening the reindeer meat production and may lead to the extinction of reindeer herding culture in Yamal. There are increasing social conflicts between the local population and fly in/fly out workers.

Scenario 3: Snow Queen	
Opportunities	Threats
<p>Improved infrastructure (roads and buildings) as well as better environmental standards. Eventually, there is also more governmental support for indigenous cultural development. The climate conditions are in general favourable for reindeer herding and traditional hunting. There is funding for social, scientific, and educational programmes.</p>	<p>There are social conflicts between oil and gas workers on the one hand, and local people on the other due to a gas boom. There are also conflicts between shipping and fishing industries. Due to ongoing petroleum development, there are less pastures for reindeers. There are severe cold conditions for the local population.</p> <p>Indigenous peoples have been excluded from decision-making processes and only receive support and attention towards the end of the scenario timeline. Those who transformed to the settled way of life, face social and psychological problems to adapt to the new lifestyle.</p>
Scenario 4: Wild Card	
Opportunities	Threats
<p>There would be new jobs in reparation works and the scenario would motivate people to change occupation and profession. NGOs and media would use this accident to raise public awareness about climate change to facilitate shift in mindsets.</p>	<p>Overall increase of health risks. Deaths, injuries, and psychological traumas of affected workers and population.</p> <p>Deteriorating socio-economic situation of the entire region, directly (gas businesses) and indirectly (reduced tax income and reduction of public services). Reduction of CSR programs; reparation works will occupy arable and farm land.</p>

3.2.2 Consequences for domestic and international oil and gas companies

Again, the “Snow Queen” scenario stands out as it seems to be the only scenario in which oil and gas companies will not directly suffer from climate change impacts. Under other scenarios’ conditions, there is an elevated risk for a gas infrastructure breakdown. Although there are opportunities for oil and gas companies also under “Snow Queen” conditions, the best case scenario for oil and gas companies is “Gas Boom” as it offers additional LNG shipping capacity.

Scenario 1: Reinventing Itself	
Opportunities	Threats
Although Yamal reinvented itself by fostering the development of non-carbon sectors such as tourism and agriculture, and although gas prices are low, there is still gas infrastructure to use and gas fields to exploit. The operational costs are low.	High risk of large scale soil instability. In addition, regular floods are severely threatening gas infrastructure. The risk of accidents is increased. Further, accidents would have larger impacts as any accident would badly affect Yamal's transformed economy. There are Anthrax outbreaks.
Scenario 2: Gas Boom	
Opportunities	Threats
Operational costs are low due to existing gas infrastructure. There is high-level political support for any gas projects in Yamal within Russia and also from other countries because gas is an important transition fuel. There is a favourable investment climate, sanctions have been lifted. Environmental regulations are not strict.	Risk of large scale soil instability. In addition, floods are threatening gas infrastructure. There are some Anthrax outbreaks and mercury releases.
Scenario 3: Snow Queen	
Opportunities	Threats
Operational costs are low due to existing gas infrastructure. The Russian economy is booming, gas demand and prices are high. Environmental regulations are not strict. Companies have a positive image due to successful corporate social responsibility and environmental protection programs in the end of the affected period.	Unexpectedly low temperatures increase material fatigue and might affect pipelines. Extreme weather and especially sharp winters worsen working conditions and prevents shipments of LNG eastwards. Oil/gas spills due to an initial lack of regulations. The business environment is politicised and can change unexpectedly.
Scenario 4: Wild Card	
Opportunities	Threats
None. However, it might trigger a reassessment of risky gas operations.	Commercial disaster: Production stop for several months at least. Additional costs coming from reparation and compensation fees. Reputational costs, fading political support, and dropping share prices.

3.2.3 Consequences for the Government of Russia

The assessment of opportunities and threats for Russia’s Federal government that emerge from alternative scenarios for Yamal 2040 is difficult as

- the scenarios do not explicitly refer to the federal government because of their regional scope and
- the participants do not represent the perspective of any federal government entity.

Hence, participants were forced to make assumptions about the federal government’s preferences and motivations as well as about the impact of a changing Yamal on the federal government. Nevertheless, participants concluded that the scenarios “Snow Queen” and “Gas Boom” offer more opportunities than threats, especially considering that the threats described could be tackled by timely reforms. “Reinventing Itself” could be a challenging scenario from the Federal government’s perspective, as it would require a substantial reform of the federalist political system.

Scenario 1: Reinventing Itself	
Opportunities	Threats
By reinventing itself, Yamal became a financially and politically stable region the Federal Government does not have to take special care of. The Federal Government can apply concepts and development models that were used in Yamal to foster development in other remote Russian regions.	The Federal Government needs to find a balance between letting Yamal develop its own international cooperation in tourism and food exports on the one hand, and Russia’s central system of economic and political control in the regions on the other.
Scenario 2: Gas Boom	
Opportunities	Threats
Sanctions have ended, the investment climate has improved and with it Russia’s image in the world. Connectivity between Yamal and other Russian regions has grown, fostering Yamal’s socio-economic development.	Protests against environmental degradation in Yamal.
Scenario 3: Snow Queen	
Opportunities	Threats
Connectivity between Yamal and other Russian regions has grown as a result of infrastructure development, fostering Russia’s socio-economic development. Any new model for cooperation between the federal and regional level must have been successful in this scenario. Economic diversification succeeds.	Protests against socio-economic hardships.

Scenario 4: Wild Card	
Opportunities	Threats
None.	Budget losses, international reputation of Russia and Russian gas industry in steep decline, protests.

3.3 Strategic options to handle an uncertain future of Yamal

Multiple actors are confronted with various opportunities and threats under alternative scenario conditions. All actors need to address the questions of how to act in face of such an uncertain future for Yamal and what can or needs to be done today in order to proactively prepare for potential long-term developments.

Actors are indeed confronted by a double challenge:

- First, no one can prepare for every possible development because resources and attention are limited.
- Second, preparing for just one scenario (regardless of the selection criterion) would be betting on a single future.

In the following, we summarize the strategic options that might be robust against alternative possible developments and could thus be useful under alternative scenario conditions. A strategic option describes what an actor could do in order to manage strategic opportunities and threats. Strategic options can provide direction, however, they are neither concrete measures nor actionable recommendations.

The following strategic options have been developed by the participants during the third workshop. These options are not policy recommendations and they do not reflect the opinion of the authors of this report. Rather, they are first ideas to illustrate approaches of how to manage uncertain long-term developments. They should encourage stakeholders to develop their own options and define their room to manoeuvre.

3.3.1 Local population including Indigenous peoples

Among all stakeholders, the local population faces the biggest changes until 2040. There are two main strategies to prepare for the future of their home region.

- First: Invest in education. Only through education can the local population increase its awareness of future challenges and strengthen adaptation capabilities. Education is the precondition for exploring new approaches to socio-economic development. English language programs, tourism, and international exchange programs might play an important role here as well as the targeted enrolment of Indigenous communities. Self-education through massive open online courses (MOOCs) could be instrumental to enable people to maintain a traditional lifestyle because a) MOOCs mostly require only digital infrastructure (although this might often be missing in

remote locations in the Russian Arctic), b) they offer distance learning opportunities, and c) a flexible schedule.

- Second: Promote political participation. Political participation is the precondition to have a voice in shaping the long-term development of Yamal. Businesses and other stakeholders in Yamal are well organized and can exert political influence, which is not yet possible for the local population, in particular Indigenous people. Through low-level grass-root political activities, political awareness and participation can build up slowly.

3.3.2 Domestic and international oil and gas companies

- No matter what scenario evolves over the coming years, oil and gas companies are very likely to find themselves exposed to climate and environmental risks. Soil instabilities, methane sink holes, floods, and even declining temperatures (Snow Queen) pose threats to infrastructures. Thus, understanding these risks and integrating them into the companies risk assessment and management procedures might prove very useful. Oil and gas companies therefore could intensify research on these risks and also invest in research and educational facilities in Yamal. In addition, they could engage in a real-time emergency response exercise with local authorities and civil society to simulate a massive infrastructure breakdown (wild card).
- Not only in face of a “Gas Boom” but also in multiple other scenarios, oil and gas companies would profit from a business environment with low political risks. Political risks in the scenarios emerge due to sanctions (except in “Gas Boom”) and due to tensions between the federal and the regional government. In order to ensure a business environment that would allow the continuation of extraction businesses in Yamal (even in the scenario “Reinventing Itself”), companies could promote and facilitate dialogue between Russian and international partners on a variety of topics (from investment schemes, over sanctions, to environmental risk research) and different administrative (federal, regional, city) and organizational (mid- to top-level management) levels.

3.3.3 Federal Government of the Russian Federation

- In order to make use of the opportunities offered in all three scenarios – such as in “Yamal Reinventing Itself”, connectivity and positive spillover effects from Yamal to the Russian economy as a whole, as well as a favourable investment climate – the Federal Government could establish a permanent Inter-Agency Federal Commission on Yamal Sustainable Development 2040. Such a commission could integrate the various interests vis-a-vis Yamal and engage the regional and local levels of administration, Indigenous communities, as well as large companies. The vice prime minister could head this commission, while every federal ministry dealing with Yamal could send its deputy minister and gas companies their vice CEO. There could also be a place for universities and scientific institutions at the table. This idea was critically discussed in the workshop as the effectiveness of the similar institutions already existing in the Russian Government is rather low.

- Promoting education and research in Yamal – in particular in the fields relevant for Yamal’s future development such as Arctic engineering or environmental studies and impact assessments, ideally with an international component linking with the other Arctic countries – can never harm in order to prepare the region for its long-term challenges.

4. Reflection

The ultimate aim of the Foresight Exercise was to increase stakeholders' capacity to adapt and respond in novel and improved ways to climate and other changes in the future and ideally combining this with their strategic goals, among them economic growth. By helping them to develop multiple scenarios for the future development of the Yamal region with the help of a rigorous methodology, the scenario team hopes to have better prepared them for an uncertain future and shared with them the sense of active participation and shaping of the region's future. Another goal of the scenario exercise was to reflect on Strategic Foresight as a method of stakeholder engagement in research process⁶. In accordance with this, the following strengths and weaknesses of the Strategic Foresight method were identified.

The weaknesses of the Foresight Exercise:

- It is never possible to get all relevant stakeholders to the scenario table, both because of the large number of stakeholder groups involved and because of the infeasibility to reach them.
- The key uncertainties, that were identified for the concrete case study during the initial phase of the Foresight Exercise are only a selection of a large number of factors affecting the future of the Yamal-Nenets Autonomous Okrug. In other words, we cannot avoid simplifying reality in order to have a workable amount of data. Although the selection of factors is conducted in a co-design, interactive mode by stakeholders themselves, this will not and cannot provide a holistic picture of reality, also because of the necessary limited number of stakeholders involved as stated before, but can only try through deliberation, iteration, and constant exchange of arguments to approach reality as much as possible. In turn, this reduction of complexity allows the conceivability of a complex issue and to deal with it within a heterogeneous group.
- A clear-cut separation between the factors determining or influencing different scenarios is often artificial, since in reality there is a large amount of complexity attached to each factor and various interlinkages between them. For the sake of the methodology to work, these factors were nevertheless treated as separate. However, during the exercise a lot of discussion time was devoted to identifying exactly those factors that are as distinct from each other as possible, and this exercise in the end allowed participants to fruitfully work with the identified key uncertainties.
- A simultaneous translation at Foresight workshops is not practical since for the Foresight Exercise to work, direct interaction among all workshop participants is crucial. Hence, all workshop participants had to share a common language. Given the key role of the scenario expert from Foresight Intelligence for the conduct and

⁶ The quantitative and qualitative analysis of the engagement of stakeholders is presented in the deliverable D5.23: Stephen, K., Valeeva, V., & Gabriel, J. (2019)

moderation of the exercise – and their lack of Russian language skills – the workshops had to be conducted in English and all participants had to have a level of English suitable for extensive group work and discussion. This led to a rather elitist character of the exercise, excluding stakeholder groups who are less likely to possess sufficient English language capabilities.

The strengths of the Foresight Exercise are the following:

- The iterative character of the research process with three workshops and inter-workshop exchange between the research group and the stakeholders. For example, it is possible during the exercise and the workshops to reconsider the overall theme of the exercise or the selected key uncertainties and thus to add to or change earlier decisions.
- The exercise is completely stakeholder driven and owned, starting from the decision about the concrete focus question of the exercise, up to the strategic implications of the developed scenarios.
- There is no specific preparation necessary for the stakeholder groups in order to participate in the exercise beyond their academic, societal, or political expertise that they already possess. This makes for a generally low hurdle for everyone to join the exercise.
- Stakeholders see early on that a concrete output will be produced during the exercise, which they are able to shape themselves and thus adjust according to their own strategic needs for future planning. Related to this, stakeholders take away a concrete output from the exercise (the developed scenarios and the strategic implications thereof), which will even be tailored to their own specific needs.

No method is perfect, Strategic Foresight is not an exception from this rule. However, as long as one is honest and open about the shortcomings of one's methodology, there is still a good chance to yield good results from the research project and for consumers of the results to put the results into perspective.

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