



Environment scanning workshop and report 2



Workshop participants during the third Scenario Workshop Yamal 2040, September 2018, IASS Potsdam
Photo Credit: Kathrin Stephen, IASS Potsdam

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Lead authors

Institute for Advanced Sustainability Studies (IASS): Vilena Valeeva, Kathrin Stephen

Foresight Intelligence (FI): Johannes Gabriel

Other contributing authors

Primakov National Research Institute of World Economy and International Relations (IMEMO): Elena Nikitina, Aleksei Kuznetsov

National Oceanography Centre (UKRI-NOC): Yevgeny Aksenov

M. Obukhov Institute of Atmospheric Physics Russian Academy of Sciences (IAP-RAS): Vladimir A. Semenov

Reviewers

Danish Meteorological Institute (DMI): Chiara Bearzotti, Steffen M. Olsen

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Summary for publication

This report presents the results of the third and the last workshop in the series “Yamal 2040” organised within Blue-Action work package WP5 “Delivering and valuing climate and information services”. The Blue-Action team at the Institute for Advanced Sustainability Studies (IASS) in cooperation with the Primakov National Institute of World Economy and International Relations of the Russian Academy of Science (IMEMO) and Foresight Intelligence, and with inputs provided by the National Oceanographic Center (UKRI-NOC) and the M. Obukhov Institute of Atmospheric Physics Russian Academy of Sciences (IAP-RAS) in the Blue-Action work package WP2 “Lower latitude drivers of Arctic changes” developed forward-looking scenarios to better understand the risks and opportunities associated with multiple developments in the Arctic and help stakeholders to adapt to them. This case study looks at a specific region, the Yamal-Nenets Autonomous Okrug in Arctic Russia (YNAO or Yamal region), a region with substantial ongoing and planned petroleum and shipping activities. Together with stakeholder groups, the team has co-developed a suite of scenarios to describe possible futures for this region in 2040 by incorporating cutting edge climate predictions with environmental, social and cultural concerns, economic opportunities, and political and legal developments. The scenarios are the outcome of a truly co-design and co-development process involving partners, stakeholders and using various foresight methods tailored to the project’s needs. These methods allow to constructively deal with cognitive biases, thus enabling participants to think out of the box when planning the future. This approach is very helpful in tackling complex issues linked to numerous interacting uncertainties.

Work carried out

1. Introduction

The oil- and gas-rich Yamal region (YNAO) in Arctic Russia is a highly relevant case to explore current and future interactions of Arctic and global change processes. The YNAO produces more than 80% of Russia’s natural gas (Nalimov and Rudenko 2015). Oil and gas condensate are also extracted in YNAO but in less substantial volumes. The region hosts a number of ambitious and complex petroleum investment projects with worldwide export plans¹. The oil and gas industry plays a crucial role for the economy of the YNAO and transformed it into one of the richest regions in Russia (Larsen and Fondahl 2014).

However, in 2040, the situation might look very different.

The future of this region is a complex issue afflicted with many uncertainties. Examples for such **uncertainties** are:

- the impact of climate change,
- global supply and demand trends for energy resources (including oil price trends),
- progress in energy efficiency and market share of renewable energy sources,
- the macroeconomic situation in Russia and specifically the future of Russian energy policy,
- the geopolitical situation in the Arctic and in other regions,
- the development of climate policies to tackle global warming and its consequences (like the implementation of the Paris Agreement), and

¹ See Stephen, Kathrin, Valeeva, Vilena, Gabriel, Johannes, Nikitina, Elena, & Kuznetsov, Alexei. (2018). Arctic Stakeholder Map Stakeholder groups involved in Yamal oil and gas development Blue-Action Case Study Nr. 5 (D5.20). Zenodo.

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- the regional and national regulations for resource development, transportation, and environmental protection².

To help stakeholders from and outside YNAO to deal with multiple uncertainties regarding the future of the region, Blue-Action initiated a series of three workshops: the “Yamal 2040”. The time horizon 2040 was chosen because, on the one hand, this 20 year time-horizon offers a suitable number of uncertainties to take into account, such as the development of resource extraction projects, changes in political institutions and processes, and climate change impacts. On the other hand, it is a compromise between interests of different stakeholder groups, i.e. climate scientists who are usually focused on longer timeframes and Yamal communities as well business actors who are rather engaged in planning for shorter periods.

During the first workshop in December 2017, a diverse group of stakeholders and scientists exchanged their views about the multitude of factors influencing the future of the Yamal region and identified a set of key uncertainties and their projections. At the second workshop in March 2018, participants used these projections to elaborate three different scenarios as to what the region could look like by 2040 (see [D5.21](#) on the details of the foresight methodology and the report of the first two workshops). At the third workshop, which took place in September 2018, stakeholders:

- learned how to use the developed scenarios in their long-term planning and strategic decision making, and
- elaborated strategic options for three different stakeholder groups with respect to each scenario,
- got concrete ideas what they can do to be prepared for different futures of the Yamal region.
- elaborated strategic options on what stakeholders can or need to do already today in order to proactively prepare for potential long-term developments in Yamal.

2. Participants

As part of the Yamal scenario case study, the Blue-Action team produced a stakeholder map³ showing the large number and diversity of stakeholders engaged in or influenced by Yamal oil and gas projects. The Yamal stakeholder map includes 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 communities,
- Indigenous rights NGOs such as the Center for support of the indigenous peoples of the North, and the Association of World Reindeer Herders,
- Environmental NGOs such as Greenpeace Russia, WWF Russia, German-Russian Office of Environmental Information,
- Intergovernmental organizations such as Northern Forum,
- Oil and gas business such as Wintershall,
- Consulting companies focussing on the development of the Russian Arctic, such as Gecon,
- Media such as Kommersant, Reuters, Klimaretter, and Science Magazine,

² See Valeeva, Vilena, Stephen, Kathrin, Gabriel, Johannes, Nikitina, Elena, & Kuznetsov, Aleksei. (2018). Environment scanning workshop and report 1 - Blue-Action Case Study Nr. 5 (D5.21). Zenodo.

³ See Stephen, Kathrin, Valeeva, Vilena, Gabriel, Johannes, Nikitina, Elena, & Kuznetsov, Alexei. (2018). Arctic Stakeholder Map Stakeholder groups involved in Yamal oil and gas development Blue-Action Case Study Nr. 5 (D5.20). Zenodo.

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- Climate scientists of partners organisations in Blue-Action WP2: National Oceanography Centre (UKRI-NOC) and the A. M. Obukhov Institute of Atmospheric Physics Russian Academy of Sciences (IAP-RAS),
- Climate scientists from other research institutions not part of the Blue-Action consortium but strongly connected to the Blue-Action project: Climate Service Center Germany of the Helmholtz-Zentrum Geesthacht, Alfred-Wegener-Institute, Helmholtz-Zentrum für Polar- und Meeresforschung, Saint Petersburg State University.

3. Methodology

The ultimate purposes of the workshops were to:

- Improve the capacity to respond to potential impacts of climate change.
- Improve stakeholders capacity to adapt (in face of uncertain developments).
- Strengthen the science-policy link in Arctic inter- and transdisciplinary research efforts.

The methodology setup for this strategic foresight project consists of two phases: the first phase is about exploring alternative developments (**foresight**), the second phase focuses on the question on how to act in face of uncertain developments and various opportunities and threats (**strategic foresight**).

The methodological approach to create scenarios and to draw practical implications as developed by Johannes Gabriel (Foresight Intelligence) are presented in the deliverable D5.21⁴.

Main results achieved

Two concrete results were achieved at the third workshop:

- Scenarios for the YNAO in 2040 (“Yamal 2040”) were refined together with the stakeholders.
- From the scenarios, the stakeholders involved could derive strategic implications for how to plan and respond **already today** to these possible futures of YNAO.

1. Scenario descriptions

During the first and the second workshops, participants developed three alternative scenarios of the future of the Yamal region⁵. These scenarios were then further elaborated by the team in order to create communicable and criticisable scenario descriptions to make the scenarios accessible to a broader audience. The scenario descriptions were several times revised by the project participants after the second workshop and during the third workshop. The scenarios were also presented in form of posters⁶ at the Blue-Action Annual Meeting in Portugal in November 2018 where climate scientists from other work packages, who didn’t participate in the scenario workshops, had opportunity to revise and contribute to the climate parts of the scenarios. The final versions of the descriptions of the three scenarios and one additional scenario elaborated at the third workshop can be found here below.

1.1 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

⁴ Valeeva, Vilena, Stephen, Kathrin, Gabriel, Johannes, Nikitina, Elena, & Kuznetsov, Aleksei. (2018). Environment scanning workshop and report 1 - Blue-Action Case Study Nr. 5 (D5.21). Zenodo

⁵ For more information about the scenario construction process see Valeeva, Vilena, Stephen, Kathrin, Gabriel, Johannes, Nikitina, Elena, & Kuznetsov, Aleksei. (2018). Environment scanning workshop and report 1 - Blue-Action Case Study Nr. 5 (D5.21). Zenodo

⁶ Posters are available in Zenodo: The first scenario: <https://zenodo.org/record/2203886#.XLh27mf8K71> The second scenario: <https://zenodo.org/record/1887608#.XLhLRDAza70> The third scenario: <https://zenodo.org/record/2204432#.XLh3pzAza71>

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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. This rise in mean temperature leads to an 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 about 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 condensates, 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 on 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

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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.

1.2 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, climate change related air quality problems are prevailing, 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 Agreement.

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. In 2023, Russia finally ratifies COP21 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

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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.

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 the kind 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.

1.3 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 warming. Permafrost is stable and the Kara Sea is covered with pack ice even in summer, impeding shipping activities and the LNG industry. LNG from

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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 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 educational 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.

1.4 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

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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.

2. Stakeholder Perspectives

At the third workshop, participants learned 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 identified in the stakeholder map (D5.20). Hence, participants were asked to select three to four stakeholder groups from the list suggested by the organisers. During the selection process, the following criteria were taken into account: importance of the stakeholders and of their decisions for the future of the Yamal region, their capacity to act as well as the interests and expertise of the workshop participants.

At first, the list contained the following options:

- Russian Federal authorities,
- Yamal government,
- Yamal indigenous peoples,
- Local population in general including indigenous peoples,
- Oil and gas companies,
- Environmental NGOs,
- Indigenous rights NGOs.

After an intense discussion, participants agreed on downsizing the list to three stakeholder groups:

- Federal government of the Russian Federation,
- Domestic and international oil and gas companies,
- Local population including indigenous people.

2.1 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 (Report “The government of YNAO 2017”). Several foreign companies are involved in hydrocarbon extraction in Yamal. Among them are French Total and the China National Petroleum Corporation (CNPC) who participate in the Yamal LNG project. German Wintershall 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 in the new huge Arctic LNG 2 project, which is also located in the YNAO and is planned to start production in 2025. Looking for further partners and investors for this project, Novatek currently negotiates with companies from China, Japan, and Saudi Arabia (Reuters 2018).

2.2 Federal Government of the Russian Federation

Responsibilities of several Russian ministries interact in the Yamal region. Among them are: 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.

2.3 Local population including indigenous people

About 534.000 people live in the YNAO. 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 Okrug’s population. This includes titular Nenets, Khanty, and Selkup. Because of the petroleum industry and labour migration, the YNAO is one of the few regions in the Russian Arctic which experiences population growth. 70% of the people who now live in the YNAO were born outside the region (S. Glomsrød, G. Duhaime and I. Aslaksen 2015). However, in the rich Okrug the wealth is distributed unequally resulting in the stratification of its population. Whilst petroleum employees who moved to the YNAO 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 YNAO overlap with territories relied upon by indigenous nomads for their livelihoods (reindeer herding, hunting, fishing, gathering).

3. Consequences and strategic options

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

3.1 Domestic and international oil and gas companies

In all but the “Snow Queen” scenario, oil and gas companies will have to deal with an increasingly challenging environment due to climate change impacts. Under these scenarios’ conditions, there is an elevated risk for a gas infrastructure breakdown as described in the wild card scenario. 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 affect Yamal’s transformed economy very hard. There are Anthrax outbreaks.

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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 additions, 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 (CSR) and environmental protection programs in the end.	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.

Wild Card: Breakdown of Gas Infrastructure	
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 Federal Government of the Russian Federation

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 are 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,

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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.

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

3.3 Local Population including indigenous people

Again, the “Snow Queen” scenario stands out a bit as it seems to be the only scenario in which the local population will not directly suffer from 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 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 populations and fly in/fly out workers.

Scenario 3: Snow Queen	
Opportunities	Threats
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 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

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There is funding for social, scientific, and educational programmes.	conditions for the local population. Indigenous peoples have been excluded from decision-making processes and only receive support and attention towards the end of the scenario timeline. Those of them who transformed to the settled way of life, face social and psychological problems to adapt to the new lifestyle.
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Wild Card: Breakdown of Gas Infrastructure	
Opportunities	Threats
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.	Overall increase of health risks. Deaths, injuries, and psychological traumas of affected workers and population. 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.

3.4 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 rather 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 no 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.

3.4.1 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,

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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.

3.4.2 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.

3.4.3 Local Population including indigenous people

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.

Progress beyond the state of the art

- This is the first time co-designed scenarios for the future of the Yamal-Nenets Autonomous Okrug by 2040 as well as strategic options to handle an uncertain future of this region have been developed. Significant progress was achieved beyond the state of the art with respect to engagement of stakeholders in a large scientific project and use of new scientific findings in a co-development process with stakeholders from a specific regional context.
- The case study set-up offered the project team an ideal opportunity **to test the Strategic Foresight method** as a tool for inter- and transdisciplinary research methods, especially engaging researchers and societal stakeholders in a process to bridge the gap between scientific research approaches and findings and required input for stakeholders' decision-planning and –making.

Impact

How has this work contributed to the expected impacts of Blue-Action?

The work done within Case Study 5 improved the capacity of different Yamal stakeholders including environmental and indigenous NGOs, petroleum sector, officials, and local communities to adapt to consequences of climate change by enhancing their knowledge about different aspects of climate change impacts on the region. Within the case study, a set of scenarios was co-developed together with stakeholders to show how climate change impacts may interplay with other factors and what consequences this may have for concrete stakeholder groups. Further, strategic options were developed for three stakeholder groups, namely “oil and gas business”, “local population”, and “Russian Federal Government” to help stakeholders better adapt to changes in the future, better use the opportunities that might emerge, and mitigate risks.

Improve the professional skills and competences for those working and being trained to work within this subject area

The empirical and methodological findings from the Yamal 2040 case study exercise form the basis of a PhD thesis conducted at the University of Potsdam and the Institute for Advanced Sustainability Studies (IASS), thus improving the professional skills and competences of early career researchers in the field of information services, stakeholder engagement, and science-policy interactions.

Impact on the business sector

Scenarios and developed strategic options are useful tools especially also for the business sector active in Yamal, including business stakeholders from European countries. Especially interesting is the consideration of the possible development of the existing, petroleum-focused industry base in Yamal and the outlook for fostering new and innovative business sectors – e.g. tourism, renewable energy, education, services sector –, and especially those that would work towards achieving the climate goals of the Paris Agreement. Put differently, the scenarios provide information about the necessary framework conditions for business innovations to occur or under which conditions the petroleum-focused industry outlook in Yamal will rather prevail. Business actors could then invest strategically to support regional development in the Russian Arctic while also helping to push the Paris ambitions forward.

With respect to the petroleum sector, scenarios show the options how to do gas business in more sustainable ways by reducing harmful impacts on the environment and indigenous peoples, and increasing their social programs.

Lessons learned and Links built

- One of the most important lessons learned is that building trust is one of the key tasks that must be achieved in order to engage stakeholders in a research project about a politically controversial topic. A key challenge we encountered is the necessarily incomplete engagement of all relevant stakeholder groups in spite of major efforts to get as many diverse stakeholder groups involved as possible. However, it can in general be concluded that the Strategic Foresight method of scenario construction is an effective tool to engage stakeholders in a research project and to help them to adapt to changes in the future (for a quantitative and qualitative analysis of the engagement of stakeholders as used in this case study see D5.23, available in Zenodo from June 2019).
- The Yamal 2040 case study successfully built links with other Blue-Action Work Packages and in particular with WP2 and WP3. The case study 5 is an information service rather than a climate service project and WP2 and WP3 interacted with the Yamal project not by transferring data but by participating in the scenario workshops and by reviewing the climate aspects of developed scenarios. Vladimir Semenov (M. Obukhov Institute of Atmospheric Physics Russian Academy of Sciences (IAP-RAS), WP2) took part in the first workshop of the “Yamal 2040” series and played a leading role in the discussions about the impact of climate change on the Yamal region. Dr. Semenov contributed significantly to the development of the list of the key factors that influence the future of Yamal (the factor collection is available in the deliverable D5.21) by providing consultations on the projections of the sea ice decline, changes in precipitation patterns, frequency of extreme weather events, coastal erosion, and permafrost thaw in the Yamal region. The projections of the key factors were used for the development of the scenarios at the second workshop. Vladimir Semenov also participated as a speaker in the outreach event organized by IMEMO in March 2015 to present the “Yamal 2040” scenarios to broader Russian audience. Another Blue-Action scientist Yevgeny Aksenov (National Oceanography Centre (UKRI-NOC), of WP2) took part in the second and the third scenario workshops where he played an important role in the development of the climate change parts of the scenarios and made sure that climate aspects of the scenarios parts are scientifically plausible. Yevgeny Aksenov also participated in the revisions of the scenarios after the second workshop and contributed to the development of the strategic options for stakeholders at the third workshop. At the Annual Meeting of Blue-Action in Costa-Caparrica in 2018, the WP3 scientists Guillaume Gastineau (Centre National de la Recherche Scientifique (CNRS) and Annalisa Cherchi (Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici) revised the climate aspects of the developed scenarios and gave ideas for further development of the “Snow Queen” scenario.

Contribution to the top level objectives of Blue-Action

Objective 7 Fostering the capacity of key stakeholders to adapt and respond to climate change and boosting their economic growth and Objective 8 Transferring knowledge to a wide range of interested key stakeholders

The workshop series “Yamal 2040” became a platform where stakeholders from in- and outside of the Russian Arctic worked together with climate scientists to create scenarios for the possible development of the Yamal region by 2040. Such cooperation enabled stakeholders to deepen their knowledge about the current and future impact of climate change on the Yamal region and their own activities, and to better understand the interplay between climate, environmental, and socio-economic changes occurring in the Arctic.

Adaptation strategies developed for three stakeholder groups in order to prepare for the potential consequences of a certain scenario enhance the capacity of stakeholders to adapt to the impact of climate change and other uncertain developments in Yamal. The scenario project “Yamal 2040” as a whole enables stakeholders to make unbiased and more information-based decisions about the future

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of the Arctic, to prepare for developments they have not considered before, and thus to reduce risks and find new economic opportunities.

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Dissemination and exploitation of Blue-Action results

Dissemination activities

Type of dissemination activity	Title	Location and full date of the event	Type of Audience	Estimated number of persons reached	Link to Zenodo
Organisation of a workshop	Scenario Planning Project "Yamal 2040" – Workshop Nr. 1 of 3	Moscow (RU), 7-8 December 2017	Scientific community, Policy makers, Media, Industry, Civil society	20	http://www.blue-action.eu/index.php?id=4146
Organisation of a workshop	Scenario Planning Project "Yamal 2040" – Workshop Nr. 2 of 3	Potsdam (DE), 22-23 March 2018	Scientific community, Policy makers, Media, Industry, Civil society	20	http://www.blue-action.eu/index.php?id=4146
Organisation of a workshop	Scenario Planning Project "Yamal 2040" – Workshop Nr. 3 of 3	Potsdam (DE), 26-26 September 2018	Scientific community, Policy makers, Media, Industry, Civil society	20	http://www.blue-action.eu/index.php?id=4146
Press release	Press release of 16 Jan 2018: Scientists and stakeholders anticipate alternative futures for remote Russian Arctic Region	Published on 16 Jan 2018	General public	400	http://www.blue-action.eu/fileadmin/user_upload/blueaction/Media-Materials/News_release_first_Yamal_workshop.pdf
Press release	Istorii o budushem: kak pomoch ustoychevomu razvitiyu Arktiki/ Stories about the future: how to facilitate sustainable development in the Arctic	17 August 2017, online-media "Plus One"	General public	300	http://plus-one.ru/blog/ecology/istorii-o-budushchem-kak-pomoch-ustoychivomu-razvitiyu-

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Others (Poster)	Vilena Valeeva (IASS), Poster "Impact on Stakeholders in a Changing Arctic - Oil and Gas Development in the Russian Arctic". Authors: Valeeva, Vilena, Keil, Kathrin, Gabriel, Johannes, Nikitina, Elena	Reston, Virginia (USA), 24-27 April 2017	Scientific community, policy makers	150	https://zenodo.org/record/571304#.Wi_23NLia71
Others (Poster)	Payne, Mark, Keil, Kathrin, Kolstad, Erik, Ballester, Joan, Mettinen, Ilona, Vangsbo, Peter, ... Olsen, Steffen. (2017). Translating advances in Arctic climate science to climate services across the Northern Hemisphere (Version November 2017). Zenodo	23 November 2017	General public, policy makers	200	http://doi.org/10.5281/zenodo.1065467
Others (Poster)	Vilena Valeeva (IASS), Poster presentation 3887712 Translating advances in Arctic climate science to climate services across the Northern Hemisphere at the 21-26 Jan 2018, Arctic Frontiers-Connecting the Arctic, Tromsø (NO)	21-26 Jan 2018, Tromsø (NO)	Scientific community, policy makers	200	http://www.arcticfrontiers.com/
Presentation	Mark Payne (DTU) An Introduction to Climate Services, opportunities and benefits. Zenodo	Reykjavik, (IS), 13-15 October 2018	Scientific community, policy makers	200	http://doi.org/10.5281/zenodo.1064734

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Others (Poster)	Steffen Olsen (DMI) Poster 3885047 Blue-Action: Understanding the impact of a changing Arctic on Northern Hemisphere weather and climate, Presenter:	Tromsø (NO), 21-26 Jan 2018,	Scientific community, policy makers	200	http://www.arcticfrontiers.com/
Others (Poster)	Vilena Valeeva (IASS) Poster 3887697 Improving stakeholders' capacity for adapting effectively to changing conditions: the case of oil and gas development in the Russian Arctic,	Tromsø (NO), 21-26 Jan 2018	Scientific community, policy makers	200	http://www.arcticfrontiers.com/
Publication	Dale, Thomas, Miller, Raeanne, Vangsbo, Peter, Mettiäinen, Ilona, Ballester, Joan, Kolstad, Erik, ... Nikitina, Elena. (2018, January 18). Climate Service Case Studies Booklet	18 Jan 2018	General public, policy makers	Publication	https://zenodo.org/record/1407834
Participation to a conference	Elena Nikitina (IMEMO), Presentation at the Expert Meeting "Transfer to Green Economy in Russia: Designing Action Plan" organised by Russian Federation Ministry on Natural Resources and Environment; Cadaster Science and Technology Center. Event on invitation only	Yaroslavl State Technical University, Yaroslavl (RU), 16-17 March 2017	Scientific community and policy makers	100	https://zenodo.org/record/439912
Others Poster	Raeanne Miller (SRSL), Poster "Translating advances in Arctic climate science to climate services across the Northern Hemisphere", European Climate Change Adaptation Assembly (ECCA) Conference, Glasgow (UK) P	Glasgow (UK), 6-7 June 2017	Scientific community and policy makers	250	https://zenodo.org/record/827081

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Non-scientific and non-peer reviewed publications popularised publications	International Cooperation in Natural Disasters Risk Reduction in the Arctic: Adaptation to Impacts of Climate Changes. Author: Elena Nikitina. Appeared in GLOBAL AND NATIONAL STRATEGIES IN DISASTER RISK MANAGEMENT, 2017. Vereskyn A., Jdanenko I. (eds.). Moscow, RF MCHS, Research institute for civil defense and emergencies, Moscow (RU)	published in 2017 ISBN 978-5-93970-202-7, p.85-91	General public, policy makers, civil society	200	https://zenodo.org/record/1255111#.XPFK9RYzbix
Presentation	Vilena Valeeva (IASS Potsdam) Oral presentation "Scenarios as a tool for the improvement of stakeholders' capacity for adapting effectively to multiple changes in the Arctic: The case of the Yamal region" at the Arctic Frontiers Conference, Tromso, Norway	Arctic Frontiers-Smart Arctic, Tromsø (NO), 21-26 Jan 2019	Scientific community, policy makers	100	https://zenodo.org/record/2553960#.XFhMnlxKjIU
Participation to a conference	Vilena Valeeva (IASS Potsdam) Oral presentation: Yamal 2040 Scenario Project at the International Forum "Arctic: today and the Future", St. Petersburg, Russia, December 2018	St Petersburg (RF), 5-7 December 2018	Scientific community, policy makers, industry	100	https://zenodo.org/record/2223028#.XBEXQdJKi70
Participation to a conference	Vilena Valeeva (IASS) Yamal oil and gas forum	Novy Urengoy (RU) 15 March 2019	Policy makers, industry	100	

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Participation to a conference	Vilena Valeeva (IASS), oral presentation "Uncertain futures in the Arctic: Strategic options for Yamal business actors", Arctic Science Summit Week 2019, https://en.assw2019.science/	Arkhangelsk (RU), 22 - 30 May 2019	Policy makers, industry	100	https://zenodo.org/record/3236284#.XPEh8RYzblU
Organization of a workshop	MEMO "Changing Arctic: Vision for Yamal Sustainable Development", outreach event to present scenarios to the broader audience	Moscow (Ru), 15 March 2019	Scientific community, industry, media	40	www.blue-action.eu

Other publications

See the dissemination table above.

Uptake by the targeted audiences

As indicated in the Description of the Action, the audience for this deliverable is the general public (PU) is and is made available to the world via CORDIS and Zenodo.

This is how we are going to ensure the uptake of this deliverable by the targeted audiences:

- The team of this case study plans the following dissemination activities by the end of 2019: Presentation of the scenarios and strategic options to the Yamal government, date to be confirmed
- Publication of a Discussion Paper to present results of the case study to the expert community
- Translation of the Discussion Paper into Russian.
- Publication of a scientific-popular article in Russian media outlet "RBK".