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SUSTAINABLE INVESTMENT OPPORTUNITIES IN THE ARCTIC

Business cases from the Arctic Region following the Arctic Investment Protocol principles

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INTRODUCTION

The Arctic is a region defined by both its diversity and its opportunity. It is home to developed cities, subsistence communities, international universities, and vast wilderness utilized for millennia by the ancestors of the region's inhabitants. Hunting and fishing have formed the lynchpin of economic activity for centuries, but in modern times the Arctic is host to major industrial operations, world-class technology start-ups, as well as communities proudly continuing their traditional ways of life.

This vast region is taking advantage of the unique knowledge of its inhabitants and its abundant resources to show the world that sustainable development is not only necessary, but that businesses in the Arctic are setting an example to the rest of the world on how best to do it.

Those four million of us living in the Arctic understand the conditions very well. We live with the northern lights and the midnight sun. We experience the challenges from a lack of sufficient infrastructure and investments in roads, power grids, and houses. During the pandemic, we felt the digital divide in the north where many struggle with low-speed internet and high costs. However, we also see the opportunities around us and understand the value that this region can provide to the people living south of the Arctic circle.

The Arctic has emerged and is taking its place on the international stage. The region is no longer separated or isolated but is a part of the global economy.

The Arctic is feeling the effects of the same megatrends of changing demographics, urbanization and of course climate change, as the rest of the world but it also has the tools to deal with these megatrends.

The region has a lot of business opportunities to offer. We have sustainably harvested food to feed a growing world, renewable energy to power up economic development and the raw materials needed in the green transformation.

The Arctic region needs investments in infrastructure. Infrastructure will not only facilitate business development and job creation but also work as climate mitigation and security in a region where global warming happens at 4 times the global average.

The Arctic needs people. The most valuable resources is not the oil in the ground or the nickel in the rocks. Without the people we cannot utilize all the wealth of the region. Through investing in the infrastructure, we will be able to attract more people.

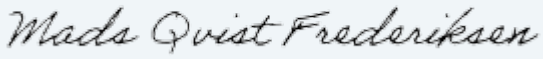
The starting point for every investment decision should be ESG: environmental, social and governance. ESG is about taking care of the environment, treating the local indigenous communities well and have honest, far and transparent governance procedures. We cannot compromise on those three.

That is why the AEC has the Arctic Investment Protocol to guide investors operating in the North.

With this report, we want to showcase some immense opportunities across the Arctic. We present a small selection, but there are many more exciting projects in battery production, hydrogen development, new tourism facilities, and many other industries. Some of the cases we describe have already been financed, while others are looking for investments. Some of them are publicly funded and some are privately funded. Some are large multi-million-dollar projects, and others are much smaller. In this way, they reflect the investment opportunities and mechanisms in the Arctic.

The cases in this report should work as an inspiration for how to work with these six principles. Rather than being abstract, these cases are real projects and real companies, giving concrete examples of the AIP principles at work. They give a small peak into the vast and varied array of opportunities and innovations in the region.

We have to shape the Arctic of tomorrow, today. The Arctic region is open for business!



Mads Qvist Frederiksen
AEC Executive director

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The Arctic Economic Council is an independent business membership organisation that facilitates partnerships, develop policy proposals and promotes sustainable economic development in the Arctic.

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The Arctic Economic Council (AEC) is an independent business membership organisation that facilitates partnerships, develops policies, and promotes sustainable economic development in the Arctic. The members of AEC are both Arctic and non-Arctic companies, the smallest are SMEs and entrepreneurs and the largest are multinationals and other business organisations. The headquarter is located in Tromsø in Northern Norway but engages in activities across the region and with international partners.

The Arctic Economic Council was created following the Arctic Council's acknowledgment of the key role business plays in the development of the Arctic. The Arctic states' Senior Arctic Officials endorsed the creation of the Arctic Economic Council in March 2014, and the organization held its inaugural meeting in September of that same year. Its headquarters were established in 2015 in Tromsø, Norway, close to the Arctic Council secretariat.

Like the Arctic Council, the chairmanship of the AEC changes every two years between one of the eight Arctic states, mirroring the chair of the Arctic Council. Similarly, the permanent participants are represented, along with other indigenous groups.

AEC is the only organisation that has a Memorandum of Understanding with the Arctic Council. This highlights the unique position of the organisation as the only voice of the pan-Arctic business community.

The AEC advocates improving policy and framework conditions in the Arctic to key stakeholders and political decision-makers at both the regional, national, and international levels. The AEC has several working groups that connect members with similar interests in the Arctic. One of the key tasks for the AEC is to promote the Arctic region as a place for doing business and investing, not forgetting the important role that companies play in creating local jobs and sustaining a healthy and sustainable economy.

AEC focuses on three key activities: policy advocacy, networking, and communication on Arctic opportunities. Over the years, the AEC has produced several reports, position papers, and recommendations on Arctic business development. Some of these reports have been about connectivity infrastructure, business finance, mapping the state of maritime transportation, best practices, recommendations for undertaking environmental impact assessments in the Arctic, and much more.

The gavel of the AEC

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Arctic Investment Protocol aspires to promote sustainable and equitable economic growth in the region that furthers community well-being and builds resilient societies in a fair, inclusive and environmentally sound manner.

Arctic Investment Protocol

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Arctic Investment Protocol
Guidelines for Responsible Investment in the Arctic

SIX BASIC PRINCIPLES FOR INVESTORS TO FOLLOW

1. Build Resilient Societies Through Economic Development
2. Respect and Include Local Communities and Indigenous Peoples
3. Pursue Measures to Protect the Environment of the Arctic
4. Practice Responsible and Transparent Business Methods
5. Consult and Integrate Science and Traditional Ecological Knowledge
6. Strengthen Pan-Arctic Collaboration and Sharing of Best Practices

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ARCTIC INVESTMENT PROTOCOL

In 2015, the World Economic Forum's (WEF) Global Agenda Council on the Arctic published the Arctic Investment Protocol (AIP) with the intention of starting a discussion and building a coalition around promoting responsible investments in the Arctic.

The AIP aspires to promote sustainable and equitable economic growth in the region that furthers community well-being and resilient societies in a fair, inclusive and environmentally sound manner. The group that developed the AIP came from across the Arctic region as well as key outside stakeholders. It included indigenous groups, investment firms, environmental groups, and industry representatives.

In 2016 the World Economic Forum wanted to see the work on the Arctic Investment Protocol taken forward. The AEC decided to endorse the intent of the AIP at its Annual Meeting in 2017, and the Protocol was transferred to the AEC later that year.

The Arctic Investment Protocol is an important step forward and a solid foundation to build upon for the future. It advocates for the highest standards in economic, social, and environmental stewardship and responsibility, providing investors with a framework for operating in a region that is constantly changing.

The AIP is an inspiration but cannot stand alone, like the Sustainable Development Goals it is not binding law for any but a place to start the work of ESG in the Arctic.

The Arctic Investment Protocol is a set of guidelines for responsible investments in the Arctic. It consists of six foundational and formative principles. These principles—more defined and rigorous than any others now in place—are designed to guide investment in the region by establishing a set of clear standards for sustainable and responsible business practices, governance, and environmental stewardship:

1. **Build resilient societies through economic development**
2. **Respect and include local communities and indigenous peoples**
3. **Pursue measures to protect the environment of the Arctic**
4. **Practice responsible and transparent business methods**
5. **Consult and integrate science and traditional ecological knowledge**
6. **Strengthen pan-Arctic collaboration and sharing of best practices**

Read the whole protocol on the AEC website

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BACKGROUND OF THE REPORT

The Arctic has always been connected to the rest of the world via trade for centuries. Indigenous communities traded with each other across vast distances and the Vikings traded across the region. Walrus ivory from Greenland was sold in England centuries ago, while whale oil from the Bering Sea lit the streets of American cities. Today, the Arctic is part of a global village, connecting major economies via transport routes, pipelines, and electricity grids.

Still, global media and policymakers often write about the region as a final frontier; a frozen, untouched, isolated area with rising geopolitical tensions. The Arctic is rarely seen as the center of some of the most exciting innovations in energy, resource development, and the blue economy. This report will highlight some of the amazing investments across the Arctic region; both as examples to follow and as current opportunities. Because the region has the potential to be a green test hub and a place for innovative solutions.

One of the challenges to attract investments to the region is the lack of awareness by investors of the immense opportunities combined with some organizations and outside policy makers wanting to eliminate activity and development in the name of environmental protection.

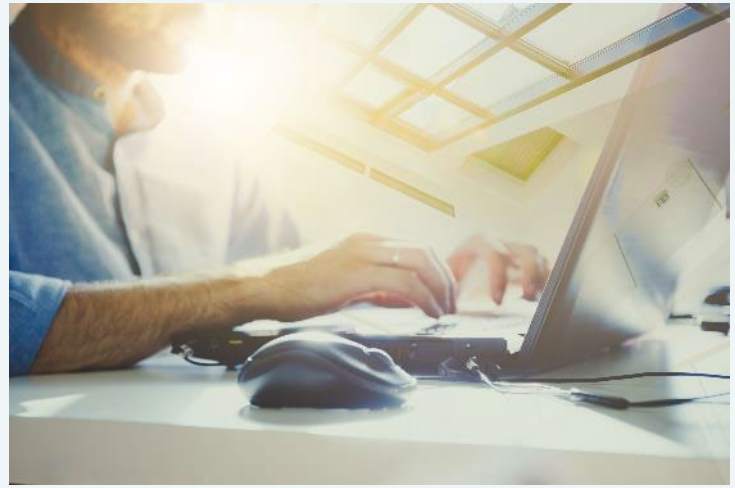
According to the Intergovernmental Panel on Climate Change, global warming is happening at three times the average rate in the Arctic region – this number has already increased to four times and in some parts seven times, creating a greater sense of urgency for adaptation. Importantly, this disproportionate impact is not because of the activities in the Arctic, but rather those outside the region.

This report gives an insight into how the Arctic can help solve some global challenges. The region has food to feed a growing population, many forms of energy to power industries, and the raw materials required for the green transition.

The report has been developed by the members of the Infrastructure and Investment Working Group under the Arctic Economic Council. Its members come from around the world and represent SMEs, large companies, indigenous groups, academia, NGOs, and investors. The ambition for the group has been to inspire other project owners in the Arctic on how to work with sustainability and investments. The Arctic Investment Protocol has been the guiding light throughout the process.

The structure of the report is simple. The first part is a simple introduction to the region. Following that are selected cases that have basic financial data followed by a short interview about the project. After the cases you will find an investor square with links to various investors with an interest or potential interest in the Arctic. Lastly come recommendations of how to increase the investments and sustainable development in the Arctic.

This report was developed during ultimo 2021 but has changed its scope in early 2022.



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THE ARCTIC REGION

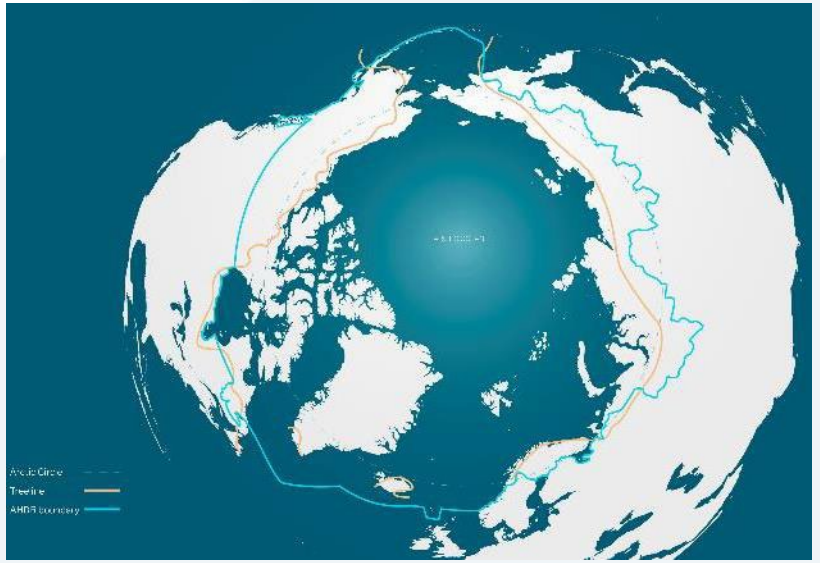
There are various many of what constitutes the Arctic. The most common and straightforward is everything north of the Arctic Circle (66 degrees 33'N). However, it is sometimes defined by with lies north of the treeline or where the permafrost begins. This report follows the Arctic Council's Arctic Human Development Report (AHDR) boundary which includes an estimated four million people; a number that has remained largely unchanged since the 2004 report. The region encompasses eight Arctic states and covers 20,000,000 km (7,700,000 square miles). The vast and varied landscape is sparsely populated, with about two thirds of the population living in urban areas. The Arctic's scale, demographics, and geography offer challenges as well opportunities for investors.

The Arctic's road networks are very sparse, particularly in Alaska (where only 20% of the state is accessible by road), Canada's Northwest Territories, Nunavut, and the Krasnoyarsk region of Russia. In Greenland there aren't any roads between the cities at all. The exception is the European Arctic, where road networks and infrastructure in general is better developed. That aside, most transportation in the region takes place via sea or air. In terms of air and heliports there are approximately 1300 within the Arctic circle. This includes 7 large and 260 medium sized airports that facilitate most of the passenger travel. The Anchorage, Alaska airport, for example, is now the fourth largest air cargo distribution hub in the world.

In Greenland they are currently investing in expanding the runways in some of the major cities and across the region we see investments in electric airplanes to service the more smaller settlements and communities that characterises big parts of the Arctic.

Approximately 350 ports serve the maritime needs of the Arctic, though only a small handful are deep-water ports, the majority of which are Russian; Canada, the United States, Greenland, and Norway also have some, with the potential for many more. Around 200 of these ports remain ice-free year-round. Almost 90% of all goods traded are transported on sea and the Arctic connects more than 80% of the world's economy with increasingly accessible shipping channels. With investments in hydrogen and new sailing routes opening, this could change the life for many.

Politically, the Arctic is a region without significant border disputes, where sovereign territory is demarcated and respected. It is historically a region of low tension. The most significant political organization in the region is the Arctic Council, which consists of all eight nations with territory above the Arctic circle, as well as six permanent participant groups representing the region's indigenous peoples. This organization convenes senior government figures for discussions on the region, though it focuses largely on scientific and environmental issues – economic and security issues are not an explicit part of its mandate.



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Anchorage
Fairbanks
Anadyr
Yakutsk
Yellowknife
ARCTIC OCEAN
Dudinka
Qaanaaq
Iqaluit
Salekhard
Ilulissat
Sisimiut
Nuuk
Longyearbyen
Ust-Tsilma
Vadsø
Murmansk
Qaqortoq
Tromsø
Inari
Arkhangelsk
Akureyri
Bodø
Rovaniemi
Reykjavik
Population 2020
< 5000
< 30000
< 100000
> 100000

ECONOMY OF THE NORTH

Estimates regarding the prosperity and productivity within the Arctic vary greatly. This is in large part due to differing conceptions of where the Arctic begins as well as difficulties measuring the GDP of provinces and local polities that sit on the border of the Arctic circle. This report will cover some areas of the Arctic's economy, providing a glimpse into a more complex area.

The economic activity in the Arctic depends substantially on trade and resource development, partially because its remoteness and lack of transport infrastructure often make traditional manufacturing or agricultural businesses uncompetitive. For example, when a company contemplates the business model for a manufacturing plant in Berlin, building a road or port is not typically part of the start-up investment costs. When looking at that same opportunity in northern Canada, where the access may be via a small, poorly served port, that infrastructure becomes a substantial portion of the investment cost, potentially causing the project to be uncompetitive. In general, the Arctic region's primary economic drivers have become resource development because it gives developers a simple justification for infrastructure development.

Furthermore, with four million people living in the Arctic, the recruitment of qualified and competent staff is also a major obstacle. In some regions, it is not the lack of investment, but the lack of people that is the major obstacle for economic growth. The younger generation increasingly moves south for more lucrative opportunities, leaving region with a declining population and skill-base.

Although the region faces significant challenges due to its lack of infrastructure, it also serves as a source of innovation as the world transitions to lower carbon emissions and manages climate change. The Arctic region has developed solutions to compensate for the lack of infrastructure, with the potential to be deployed globally. Good examples include renewable energy projects, transport solutions, major logistics hubs, specialized data analytics, and satellite communications. The blue bioeconomy showcases this continuing innovation: companies are using innovative technologies to reduce fishing waste and utilize by-products in new industrial, medical, and consumer goods.

Key industries that drive the Arctic economy and investment opportunities include mining, oil and gas, renewables, the blue economy, tourism, logistics, and technology. All of these industries require infrastructure development to sustain existing operations and promote growth. The Arctic offers fish to feed the world, energy to power industries and homes, raw materials to help the world reduce its carbon footprint and lower greenhouse gases, ports and airports to facilitate global travel and logistics, beautiful scenery to encourage memorable vacations, and well-educated people that love living in the unique Arctic environment.

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INDIGENOUS GROUPS

Indigenous Peoples have lived in the Arctic for millennia and have learned to adapt to a changing environment over time. These people hold fundamental and insightful knowledge about their lands and waters. Roughly 10 percent of the four million Arctic inhabitants are indigenous, made up of over 40 different ethnic groups.

Examples of Arctic indigenous include: the Saami in the circumpolar areas of Finland, Sweden, Norway and Northwest Russia; the Nenets, Khanty, Evenk and Chukchi in Russia; Aleut, Yupik and Inuit (Iñupiat) in Alaska; Inuit (Inuvialuit) in Canada; and Inuit (Kalaallit) in Greenland. Every Arctic state except Iceland has indigenous peoples living within their Arctic territory.

The diversity of the Arctic's people is reflected in many ways – in culture, music, dress, and how people relate to the land and environment. There are similarities, too: continued social, economic, and spiritual ties to the land and environment. The Arctic Economic Council acknowledges that the inclusion of traditional knowledge and local knowledge gathered and passed down from generation to generation is vital for exploring solutions to emerging issues in the Arctic, and to provide the best available knowledge as a basis for decision-making. Therefore, traditional knowledge is also a key principle in the Arctic Investment Protocol.

Several indigenous organisations and groups are members of the AEC and they all have the same focus on creating liveable communities for their people through development of infrastructure, job creation and opportunities to live their traditional lives.

The indigenous peoples of the Arctic are as diverse in opinions as anyone else and this can be seen in the approach to attracting investments. Therefore, dialogue from outside investors should always be the starting point.

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BLUE BIO-ECONOMY

Fishing has been an important part of the economies of the Arctic for hundreds of years. Exports from countries like Greenland and Iceland are dependent on their sustainable fishing. Companies in the north can charge a higher price for their products if they are MSC certified.

The UN estimates that there will be 9.7 billion people on this planet in 2050 and today fish only composes a small amount of global protein intake (6.7%). Arctic companies are now using innovative technologies to ensure that less fish by-products are going to waste. A cod fillet, for instance, only makes up 35 to 45% of the fish's weight; but the skin, bones and intestines can become value-added inputs into other products like medicine and food supplements. The potential for sustainable Arctic fishing with zero waste is huge.

Kelp or seaweed has a big potential in the Arctic. Both as an indicator of climate change because they are temperature-dependent but even more important as a food source for humans and animals. In 2019 the global production of cultivated aquatic algae was 34.7 billion tonnes. This is 24 times the biomass of salmon production in Norway. The economic value of cultivated seaweed was 15 billion USD.

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BLUE BIO-ECONOMY

In a region which for generations was known for the harvesting of its biological resources - fishing, hunting, trapping - it is no surprise that in modern times this vast biological wealth provides the basis for some of the most innovative activities in the region. The bioeconomy is taking off in the Arctic as detailed in the 2021 Arctic Council Blue Bioeconomy report.

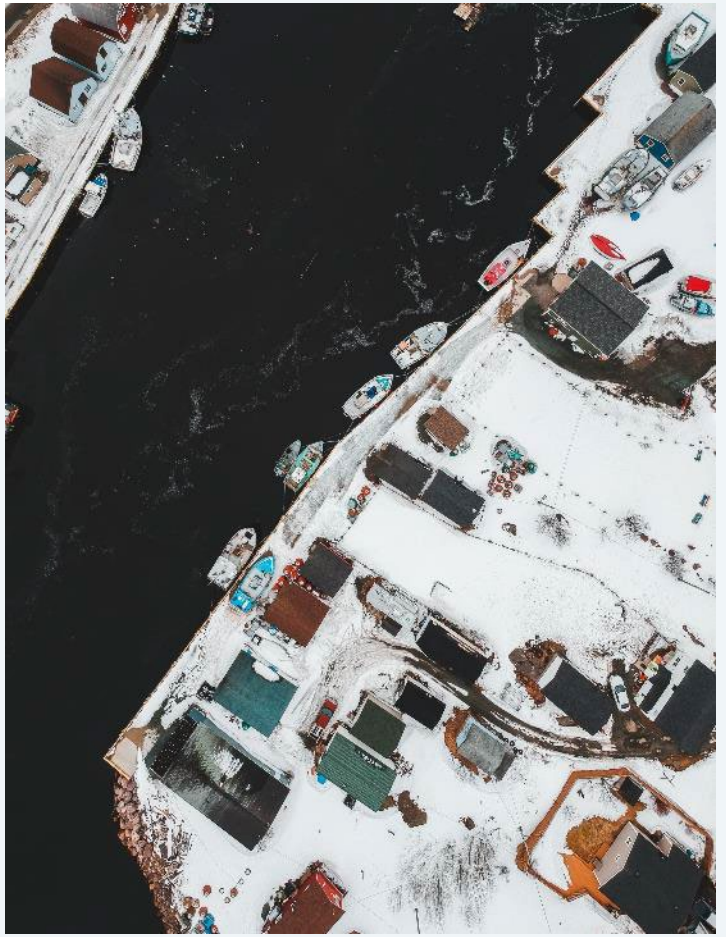
This transformation is being led by innovative companies intent on transforming traditional industries like fishing and forestry by utilizing their products in inventive new ways. With no shortage of harvestable materials at their disposal, companies have created ways to utilize otherwise wasted byproducts, providing a massive value-added opportunity for their partners, and creating valuable consumer goods at the same time. Through bio-innovation the Icelandic demersal fisheries doubled in value since 2006 through a series of sustainable practices and has been highlighted as one of many examples the region can look towards.

These companies require a host of high-skilled employees to succeed, driving community growth and helping to reverse the trend of educated Arctic residents leaving the region for better opportunities. Even small bio-innovation firms can serve as a lifeline to a community, bringing in much-needed revenue, forging global connections, and providing educational and training opportunities to the younger generation.

Already innovations and concepts developed in the Arctic are being emulated across the world, making the Arctic a leader in the bio-innovation space; the Finnish firm Arctic Biomaterials fought off strong global competition to win Innovation Award 2016 “Biobased Material of the Year” with its bio-based plastic alternative reinforced with degradable glass fiber.

By linking extractive activities to modern technology and innovation, these companies provide a stepping-stone for Arctic communities to stay at the forefront of development. They also form valuable partnerships with research institutions and industry partners as they work with the unique Arctic flora and fauna to discover new ways to utilize marine and terrestrial biological resources, or their byproducts. Examples of these partnerships have been highlighted by the Arctic Council; companies like Codland, Geniss, Blue Lagoon and the Government-led Nunavut Fisheries Association continue to promote and create new forms of technology that promote sustainable business.

The Arctic, as a unique ecosystem, has many benefits to offer the rest of the globe in terms of medical, nutritional, and industrial innovations. The companies researching these are a prime target for investment into the blue economy, bioeconomy, and a plethora of sustainable, unique opportunities.



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More people are living inside the circle than outside of it

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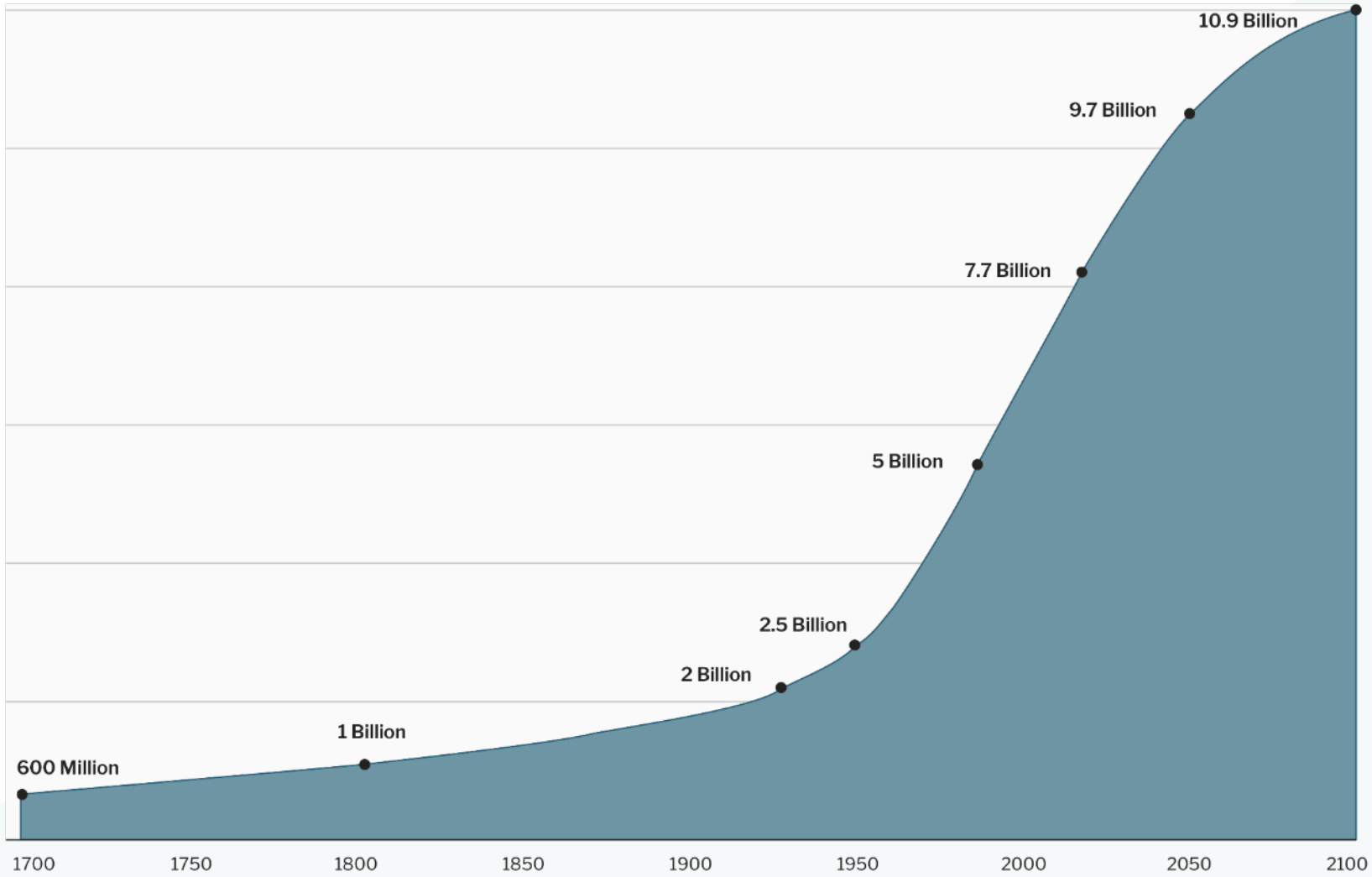

UN's World Population Prospects

ENERGY IN THE ARCTIC

The Arctic is rich on energy - everything from coal, oil, and gas, to wind, hydro, solar, and geothermal, to future energy sources like hydrogen, is present in the region. The Arctic currently provides approximately 22% of the world's energy despite hosting only .05% of the world's population. Historically, the European Union produced only 39% percent of its own energy; much of the rest is imported from the Russian Arctic. In the new situation this is changing despite LNG still being transported from the Russian Arctic to European markets. The U.S. Geologic Survey estimates the Arctic holds 13% of undiscovered oil and 30% of undiscovered natural gas reserves but many of them in places with no access and therefore no business case to develop it. Nevertheless, the Arctic has a history of responsible resource development, with some of the highest quality and lowest carbon intensive oil and gas projects in the world.

The future of the Arctic is green energy. The region has plenty of renewable energy sources and the potential to develop them. This renewable energy can be used to power the many data centres that the world needs, or converted to hydrogen as a future fuel in ships and planes. The main limitation is the energy infrastructures like grids that will make it more difficult to fully utilize the potential.

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ENERGY IN THE ARCTIC

The Arctic has long been associated with fossil fuel extraction, and such activities still account for a major portion of economic output in many regions. Alaska, Norway, and parts of Russia have long-established oil and gas industries operating in the region, which have generated thousands of jobs and sprouted entire communities around the associated infrastructure. Some countries lean very heavily on hydrocarbon extraction in their Arctic regions, such as Russia which in 2020 extracted 83% of its gas and 12% of its oil from the polar north.

Because the region's "fragile northern ecosystems" are particularly at risk of pollution, and the region's geographical sparsity makes it difficult to conduct "clean up and rescue operations", Arctic fossil fuel extraction has a reputation of adhering to the highest safety and environmental standards. For example, the Governor of Alaska, Mike Dunleavy, argued in response to a federal suspension of drilling licenses in the region that "Alaska does responsible oil and gas development in the Arctic under stricter environmental standards than anywhere else in the world". As such, many of the companies operating in the region continue to set examples to the rest of the industry on how to pursue such developments responsibly. The Arctic Council liaises with its constituent members to ensure safety standards and regulate fossil fuel extraction in the region with an up-to-date status reports detailing new and ongoing fossil fuel developments.

Beyond the region's vast fossil fuel reserves, however, is an even greater abundance of renewable energy potential; the region, particularly the European Arctic, is characterized by abundant sources of hydroelectric and wind power. Some of this potential has already been recognized, particularly by the Nordic constituents in the Arctic whose northern territories' renewable energy portfolio (80% hydroelectric and 10% wind power) produces an energy surplus of a third more than they require. However, many remote communities in continue to rely on fossil fuels due to a lack of renewable energy infrastructure.

The open landscape has made wind power a stand-out solution, with companies harnessing this method of generating electricity to help isolated communities and industrial developments reduce diesel fuel usage. Hydropower continues to be a practical solution for much of the Arctic as well, which has no lack of rivers running to the ocean. Meanwhile, in Iceland and increasingly elsewhere, geothermal power is being harnessed to power everything from on-shore aquaculture to biodome greenhouses.

The Arctic, in fact, has such an abundance of renewable energy potential that massive investments are already being made into hydrogen generating stations powered from green energy, allowing the energy resources of the Arctic to provide clean power to the rest of the globe - most notably through the burgeoning number of cargo ships transiting the area.

As economic activity in the region increases, energy to fuel new industries and new communities will be needed. Just as the Arctic will be the key to supplying many of the key materials for the global green transition, so will it be key to supplying green energy to power it. Investment into the energy resources of the Arctic has spawned many projects already, from green server farms and battery manufacturers to new urban developments.

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RESOURCE DEVELOPMENT

Successful mineral development projects build trust and create relationships with local communities directly impacted by resource development projects. The development stage of a mining project can take 10 to 15 years and, of the several thousand active capital projects in the mining industry, only a few hundred are realized each year. Therefore long-term partnerships and predictable stable framework conditions are key.

Economically viable concentrations of mineral deposits are relatively rare and often not found near existing infrastructure. Determining a site to be viable requires considering various common factors like the value of the mineral(s) to be extracted, the cost of bringing supplies into the mine site, the location of the market as well as the site, the availability of a qualified workforce, and the environmental circumstances. In the Arctic some mining projects have the difficulty of a short ice-free shipping season, a lack of infrastructure, cold weather, and summer swamps. While others have easy access to deep-sea ports and good infrastructure

Companies like Sweden's LKAB are showing how mining can be done responsibly by using innovative green mining technologies to ensure that their 130 year old iron mine in Kiruna in Sweden will emit less CO_2. Many mining projects in the Arctic are taking special consideration of their local communities, holding consultations, guaranteeing jobs, and building much-needed infrastructure in the area.

Companies seeking investment can be those conducting mining exploration, in which a company is developing a potential mining site and gathering relevant data before proposing an active mine; or it can be into a proposed or operating mine. Many larger mining companies are publicly traded and thus can benefit from equity financing. Others are private or seeking funds from institutional investors.

One of the major costs for any mining project is building the associated infrastructure, as many mines operate in areas far from regular transportation links, electrical grids, or community services. Mining settlements operate like small cities in many places, building roads, airports, ports, housing, power plants, and more to support the operation through its lifecycle.

This infrastructure can often be repurposed later on to benefit nearby communities. Investment into mines is therefore an investment into both the fundamental infrastructure needed for Arctic economic development, and into the communities that depend on these pioneering firms.

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RESOURCE DEVELOPMENT

Among the first movers in the remote Arctic regions are often mining companies. A classic resource extraction industry, mining companies provide employment in remote regions and build infrastructure which forms the backbone for future developments in the region; in 2016, the mining sector in Lapland, Finland generated a turnover of EUR 460 million while amounting to around 33% of total employment in Lapland

The significance of the sector is mirrored in other parts of the Arctic with the direct benefits of mining accounting for roughly 20% of GDP in Canada's Northwest Territories. Mining remains an indispensable part of the Arctic's economy, and the companies operating there are taking major steps to operate sustainably.

Many are reducing chemical inputs and using low-waste technological solutions to separate ore components. In areas with no available energy infrastructure, many are helping to fund renewable energy installations to reduce their reliance on diesel fuels. And their community engagement programs are growing more robust and more impactful through consultations, grants, and training opportunities. In some Arctic regions, such as Canada's Nunavut and NWT, mining companies are the single largest private sector employers, as well as the largest employer of Indigenous.

Many of the key raw materials needed to reduce carbon emissions exist in the Arctic. The European Union has a list of critical raw materials that are crucial to Europe's economy. They form a strong industrial base and are present in a broad range of goods and applications in everyday life and modern technologies. Reliable and unhindered access to certain raw materials is a growing concern within the EU and across the globe.

The current supply of many critical raw materials is highly centralized. For example, China provides 98 % of the EU's supply of rare earth elements (REE). These raw materials are used in the production of products like wind turbines, permanent magnet motors, communications technology, and satellites. Turkey provides 98% of the EU's supply of borate, and South Africa provides 71% of the EU's needs for platinum, and an even higher share of the platinum group metals iridium, rhodium, and ruthenium. The EU relies on a handful of European companies for its supply of hafnium and strontium. The Arctic can diversify these supplies, with important security, economic, and sustainability consequences.

Mining of the raw materials is just one aspect, processing, production and recycling are other key points to ensure a responsible development of the raw materials.

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TOURISM IN THE ARCTIC

Tourism is one of the largest and fastest growing sectors in the world. The ambition for many in and outside of the Arctic region is to make the region a sustainable tourism hotspot. Where large-scale industrial operations are absent, it is often tourism which injects much-needed cash into the local economy. In a region as captivating and beautiful as the Arctic, the main barrier to tourism development is not a lack of suitable locations, but the infrastructure and promotion needed to attract tourists to the area

The potential is definitely there for adventure tourism and cruise ships, but the pandemic also showed how fragile some Arctic communities both when the tourists stop coming or if the tourism come and the healthcare systems fail. While tourist numbers in the Arctic are still relatively low in comparison to other parts of the world, tourism is currently experiencing unprecedented attention in Arctic regions. The entire region presents unparalleled natural beauty and experiences. Some come to see the effects of climate change and others to taste the food of the region.

Some areas have far more advanced tourism sectors than others. Tourism companies and organizations are working on striking a balance between adventure tourism, wilderness tourism, and cultural tourism, but in such a large region there is room for every kind of experience. The discussion in some points of the Arctic is though to limit the amount of certain type of tourists because an overwhelming amount in a short time will be impossible for the small communities to serve.

This balance between economic income and still being able to provide the silence and beauty of the region is a delicate one.

Tourism in its many forms provides Arctic residents with jobs and income, and is a relatively low-cost business to get into, meaning that local residents can participate in the industry based more on familiarity with local activities and locations, rather than technical skills. It often provides supplementary income to families who can offer accommodation or guide services and allows smaller communities to participate rather than being centralized in urban areas: tourism in Iceland contributes to around 9% of the national GDP and employs around 30,000 people – representing 15% of the workforce

A lot of investment goes into infrastructure in the region to support a potential tourism boom. Some say that tourism is “more than an industry” because of the social and educational force is has, and its ability to be a catalyst for change in several remote communities. Cultural heritage and local knowledge can be developed and empowered through tourism and, in many ways, it can help develop entrepreneurship.

The investment opportunities in tourism range from major infrastructure projects to provide access to remote areas, to small family-owned businesses providing catered trips to adventurous travelers. The industry will likely grow through the near future as the region becomes more prominent in the global consciousness, and more accessible.

Tourism has already found strong roots in the Arctic through Alaska cruises, Greenland dog sledding, and polar bear sightings in Svalbard. Tourism offers much more than pretty pictures, though. It provides communities a way to showcase their culture, pairing historic preservation and cultural vibrancy with economic incentives.

In the Arctic, tourism is essential in educating others about the region’s peoples and environment; by mobilizing tourism as “not merely an industry but rather a social force with deep transformative capacities for societies, cultures, and the environment,” it is possible to ‘re-activate’ cultural conversations.

AEC
ARCTIC ECONOMIC COUNCIL

Infrastructure requirements in the Arctic region alone are expected to reach nearly $1 trillion over the next 15 years

Guggenheim Partners (2015)

INFRASTRUCTURE

Infrastructure in the Arctic is as complex and diverse as the eight Arctic states that host it. In Greenland there are no roads between the towns and settlements and most transport takes place by air or sea. In Norway, Sweden and Finland the infrastructure is more developed, including extensive road and tunnel networks and reliable power grids.

The challenges for infrastructure development remain the logistical challenges of building in an Arctic environment, achieving economies of scale and, the lack of available workforce. Another major challenge in some parts of the north is the effect of melting permafrost, where existing infrastructure are badly affected as the ground shifts and repairs and replacement of large amounts of existing infrastructure becomes necessary.

It is often the private sector in large parts of the Arctic that drives the infrastructure development, and which will be increasingly necessary for maintenance. Mining companies are constructing roads and ports and energy providers are building housing and schools for their employees. Companies are investing in improving the local digital connectivity, helping boost access and productivity in nearby communities

Likewise, new publicly funded infrastructure also sparks economic development in other sectors. Providing easy access for the work force as well as access to international markets makes a big difference when calculating business and investment cases. Several infrastructure projects are also Public-Private Partnerships, where funding might be the public partner but the construction and running of the infrastructure is private. This is useful to overcome some of the investment challenges but not all. The AEC supports the use of Public-Private Partnerships in the Arctic where suitable to overcome these challenges and provide the necessary benefits.

The Wilson Center has been developing the Arctic Infrastructure Inventory (AII) to showcase the many infrastructure projects present or planned in the Arctic. The inventory is the centrepiece of an initiative tracking infrastructure projects and economic development and activity trends across the Arctic, with an initial 8,000 projects listed. As the Arctic grows in political and economic importance across the globe, the Inventory aims to become a public resource for all stakeholders in Arctic infrastructure—including policymakers, industry, researchers, non-governmental organizations, investors, and more.

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INFRASTRUCTURE

From roads to ports to telecommunications, infrastructure is a broad and wide-ranging category, and indeed one of the most important when considering the future development of the Arctic region.

In an area made up of predominantly isolated communities, transportation and communications infrastructure can provide a vital link to the outside world. In 2015 the most developed Arctic region – the European Arctic - had a mean population density (0.26 inhabitants/km2) of 1/50th the average of the Arctic States' entire territories (13.23 inhabitants/km2). Several areas fall well below the global average for urban habitation, such as the Faroe Islands, Nunavut and the Northwest Territories.

Beyond serving as a solid basis for investments and public/private partnerships, infrastructure is the necessary ingredient for social services and healthcare, opening benefits that extend far beyond the economy. Infrastructure in this report is largely defined as transportation and communications infrastructure, which is to say infrastructure which links disparate geographic areas to the wider world.

The motivation for major transportation infrastructure investments in the Arctic are often one of two different types: either a publicly-financed project providing a critical link to a community or government installation, or else as an addendum to an industrial project, most typically resource extraction. This underscores the role that this infrastructure plays - it is viewed as a necessary first step towards future economic activity.

At the global level, shipping and transit increasingly uses routes through the Arctic, reducing the time and cost of shipping goods between Europe and Asia by as much as 35%. Infrastructure to support this increased activity is increasingly necessary, and investment in infrastructure has the potential to provide an anchor across the region for further community and economic development.

At the local level, it is increasingly common that local or regional governments or public development funds partner with private capital to finance important projects which are expected to boost the local economy. For example, the regional Qeqqata Municipality in Greenland has sought to utilize public funding from the Greenland Government and private loans and investment from private equity and venture capital firms to deliver on the Arctic Circle Road project. This project connects Greenland's largest airport in Kangerlussuaq to the second-largest town in Greenland, Sisimiut, and represents a concerted effort to rejuvenate the national economy through investment in infrastructure.

This kind of long-term investment via partnering with public bodies provides a safe, reliable place for investors to put their money. In the short term, this infrastructure also provides commercial and industrial opportunities, whether in providing services for maintenance, consumer-facing businesses like hotels and stores, or developing tourism in a more accessible area.

In the modern world, infrastructure for communication and internet access is nearly as important as physical transportation. Infrastructure development and digital connectivity are equally important as investment in both reduces transportation costs and shortens delivery time, thus, integrating Arctic economy into the global market.

During Finland's Arctic Council chairmanship in 2017 and Iceland's in 2019, both sought to make telecommunications infrastructure a major priority. This fosters social connections, decreasing the marginalization that some residents may feel by allowing them to share their stories more easily with the outside world and linking together others in similar situations. Whether it's remote medical consultations, distance working, connecting to far-away family members, or enabling data-intensive activities in remote areas, connectivity infrastructure is a crucial part of the puzzle in encouraging Arctic development.

When speaking of sustainable investment opportunities in the Arctic, infrastructure projects such as these provide a solid, long-term investment into the future development of the region.

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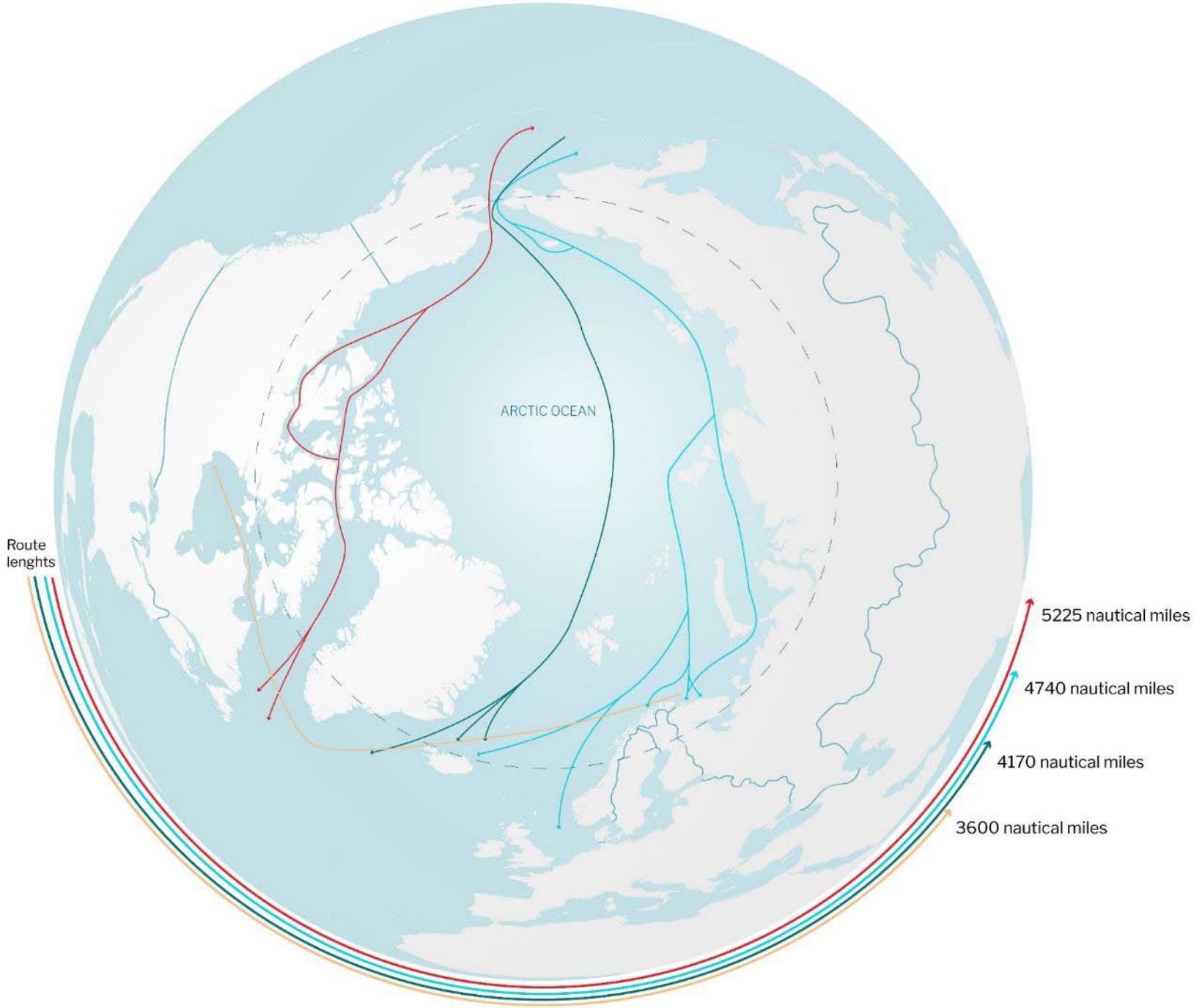
ARCTIC OCEAN
Route lenghts
5225 nautical miles
4740 nautical miles
4170 nautical miles
3600 nautical miles
Routes
Northwest passage
Northeast passage
Northern sea route
Arctic bridge route

TECHNOLOGY

Technological innovation is a necessity born out of the Arctic's extreme climatic conditions, its unique and dangerous obstacles, and its vast and sprawling size. Within this distinctive arena, firms are forced to adapt and create "polar capable" technologies that are smart and resilient to the specific challenges of the environment.

Due to this blend of influences, technology firms in the Arctic are often global leaders within their specialized niche, bringing much needed solutions that open up the region to increased investment and interest. From AI-powered sea ice predicting software, to autonomous driving testing facilities, technology firms in the Arctic represent a glimpse into the world's future. Importantly, much of this polar capable technology being utilized within the Arctic region is home-grown, showing the region's capacity for innovation while also concentrating economic benefits entirely within the region.

There is a need to invest in technological education in order to ensure the economic development driven by such technological advances is inclusive; doing so will guarantee the sustainability of such economic growth. To this end, Globe Tracker, a maritime shipping technology company, is partnering with local universities across the Arctic to develop the digital skills of students. It is actions like these that push the Arctic forward towards being recognized as a key, global technology hub.

Technology is firmly part of the region's toolbox when it comes to tackling the negative impacts of climate change. Arctic communities are spearheading the application of clean energy technologies, leading the U.S. Department of Energy to recognize the potential of the Arctic as a "living laboratory of clean energy innovation". Technology is essential to diversifying the region's economy as well its energy portfolio; clean energy technologies are driving the boom in hydroelectric, wind, solar, and geothermal power, and the associated energy storage and energy efficient buildings.

Also, technology is essential to averting critical environmental catastrophes in the region whether it be acoustic technology to understand wave conditions or machine-learning technology to predict sea ice patterns; both are instrumental to avoiding deadly collisions at sea as declining sea ice leads to increased maritime activity in the Arctic waters. Technology is also helping Indigenous populations adapt and react to the vulnerabilities borne out of climate change; thawing permafrost, loss of coastal sea ice and sea level rise all hinder the ability to engage in fishing and hunting activities.

Technology is essential to the Arctic's diverse economic development as it increases the efficiency, utility and sustainability of other industries such as infrastructure, shipping energy, mining, bio-innovation and even tourism. This is instrumental in attracting foreign direct investment (FDI) in numerous ways; investment in digital infrastructure such as delivering high speed internet to remote regions of the Arctic not only provides increased connectivity that stimulates economic activity within local communities, but also increases the likelihood of outside investment in the region as the spatial distance of the Arctic shrinks. This digital infrastructure is often being funded in joint public-private, or federal-provincial partnerships which highlights the interaction of state and non-state actors: the Government of Canada's Connect to Innovate program, the Government of Quebec, and the Kativik Regional Government are all contributing to the $124.2 million subsea fiber cable project to bring high speed Internet to the region.

While this investment should be lauded, it is often long overdue, and the northern parts of the Arctic states remain behind in digital connectivity when compared to the rest of the country. Nonetheless, this makes investment in technology, especially the right technology, vital to the region's economic and social development. It will bring countless benefits to the local communities and Indigenous populations while also laying the digital foundations for the diversification of the Arctic economy.

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The indigenous peoples have been very innovative on technology in the Arctic for centuries. Developing snow glasses, kayaks and this rain jacket.

This inuit “rain jacket” is made from the intestines of the seal and sown together with the tenders of a hare, whales or reindeer.

It weights just 114 gram and is breathable.

The oldest jackets found are from the 1300 but scientists expect it to be much older.

Source: Danish National Museum

INVESTMENT ENVIRONMENT

For a region so rich in resources, large parts still lack the critical infrastructure needed, not only for economic development, but for healthy, prosperous communities as well. This also has the impact on the investment environment that is global, so the Arctic competes with every other region in the world.

The prospects for business development in the Arctic are evolving and many Artic business and economic development opportunities have been well-documented in recent years. In 2015, Guggenheim Partners estimated that infrastructure requirements in the Arctic region alone are expected to reach nearly $1 trillion over the next 15 years.

The opening of previously impassable shipping routes and the expansion of broadband connectivity, create new business opportunities. Every expansion of economic development in the Arctic must be considered in the context of—and with the prior input and participation of—the people in Arctic communities that are most directly impacted by this development. In some parts of the Arctic, this involves coordinating development efforts to support critical community institutions, including schools and healthcare facilities. The role of government services is also important to prevent economic growth becoming dissociated from social well-being.

Sustainable economic development and the resilience of local Arctic communities are two sides of the same coin. Arctic investments must parallel Indigenous and local community priorities with an eye toward cultural sustainability when delving into global economic development. When pursued mindfully, this economic development can foster and sustain cultures into the future.

Beyond the harsh and changing climate, investment opportunities for SMEs and start-ups in the Arctic face challenges related to bank lending and mortgage markets. Competition between banks is limited, particularly in some rural areas. This means that financing for some projects that might have received finance in other areas is denied, and/or the lending rates are higher than elsewhere. In areas outside the biggest towns without bank offices, it can be more difficult for SMEs to obtain credit and bank loans. Mortgage lending is, especially in rural areas, not common in the Arctic, due to low real estate prices. These issues underline the importance of having in place public loan and guarantee schemes.

The biggest challenge concerning access to finance for SMEs is a lack of venture capital for the early expansion and scale-up phase. The problem is not only an insufficient supply of venture capital but also a lack of venture competence, and a lack of tradition among SMEs of receiving and accepting venture capital.

Although some initiatives to expand the provision of venture capital have already been taken in several parts of the Arctic, the creation of a stronger venture capital ecosystem remains an important but also long-term task. This includes the need for “competent capital,” i.e. investors that not only invest but also participate in the development of the enterprise with their sector knowledge and business experience.

Access to foreign capital is essential and in general, more international investments are welcomed in the Arctic. With the exception of fisheries and critical infrastructure, there are few regulatory barriers to foreign investments, and in almost all territories large enterprises which are subsidiaries of foreign companies or conglomerates are present. In some instances, there can be local or regional concerns about the effects of larger projects (both when undertaken by national and by foreign investors) about the effects on the environment or local living conditions. These concerns can be accommodated through stringent investment principles such as those described in the Arctic Investment Protocol.

Despite these challenges, with the right mix of interest, expertise, and commitment to the AIP’s principles, the development of commercial and infrastructural enterprises in the Arctic can be done in a way that benefits local, regional, and global levels.

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BUSINESS CASES

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GREENLANDIC DOG ADVENTURE

ALDIN BIODOME

CGI

IC ALASKA

A MEMBER OF THE C CHANGE GROUP

Nunavut

Northwest Territories

GREENLAND RUBY

PURE NATURA

AMBLER METALS

BlueJay

MINING LIMITED

OCEAN RAINFOREST

SUSTAINABLE NORDIC SEAWEED

AGNICO EAGLE

Marealis

ARCTIC SPACE TECHNOLOGIES

Tugliq Énergie Co.

LKAB

Carbfix

Far North Digital LLC

PolArctic LLC

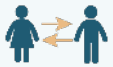
Arva

SNOWBOX

ARCTIC AUTONOMOUS DRIVING

LEGEND

 Production/outputs

 Number of employees

 Location of the project

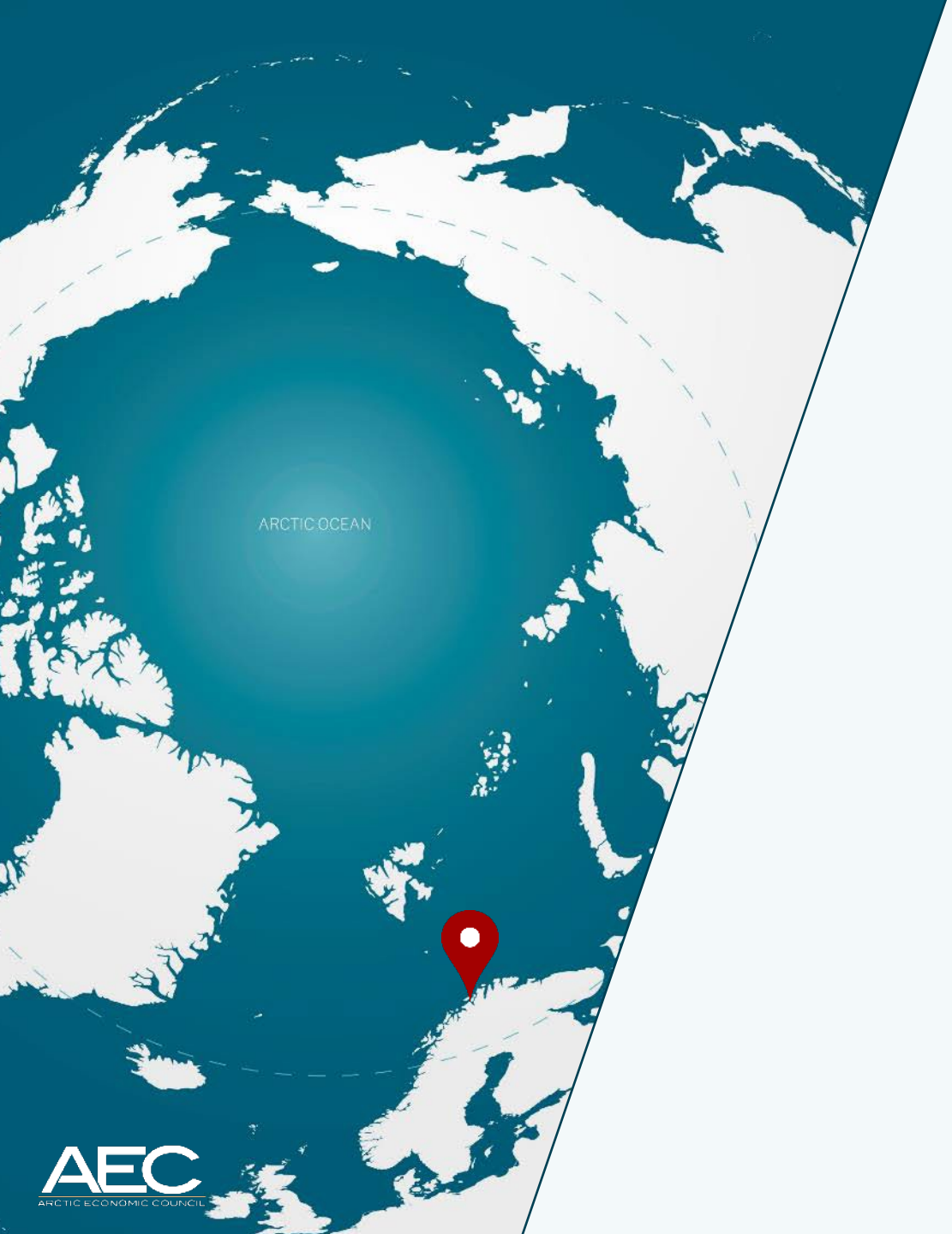
 Project timeline

 Type of industry represented

 Organization type

 Web link

ENERGY



Arva

SMART SENJA

Senja, Troms, Norway

Energy – Utilities

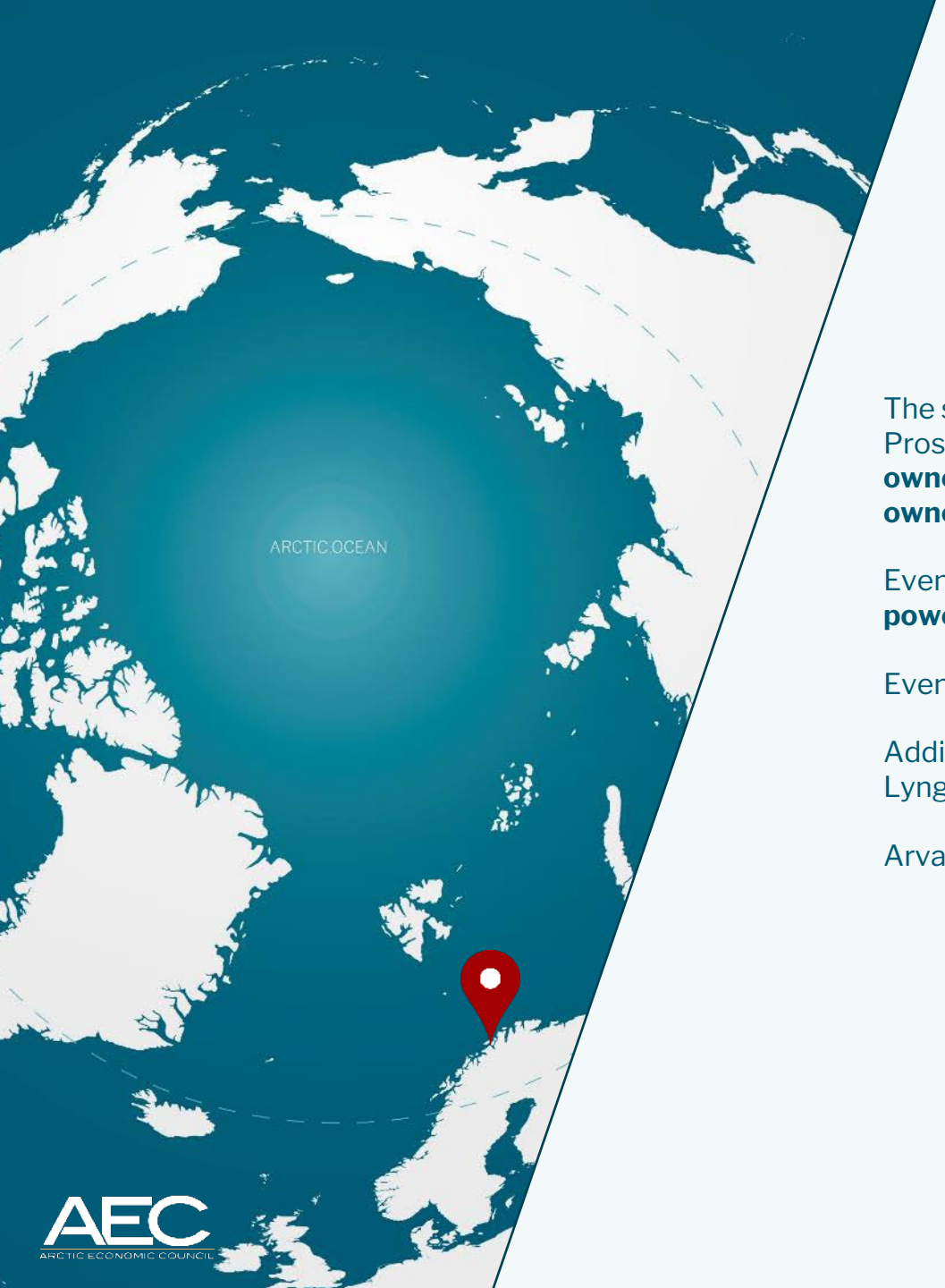
Publicly-owned company

AEC
ARCTIC ECONOMIC COUNCIL

Arva

Smart Senja is carried out by and for the people at Northern Senja. Active involvement of the local communities is at the core of the project.

Arva



ARVA AS

"Making a Smarter Senja by improving local power grids to decarbonize and better distribute energy, using innovations forged through research partnerships."

The story of Nordlandsnett and Troms Kraft Nett is the story of how the company built the region. Prosperity and progress accelerated as cities and countries gained access to electricity. **Local ownership** of development priorities was taken care of through **municipal and county municipal owners**.

Eventually, Troms Kraft Nett and Nordlandsnett became Arva AS. The company has provided **a secure power supply** in Nordland and Troms for more than 100 years.

Even though Arva continues to grow and expand its business, it will always be available locally.

Additionally, Arva's head office is in Bodø, with local offices from Tonnes in the south, Tromsø and Lyngseidet in the north.

Arva has close to 220 employees and more than 120,000 customers.

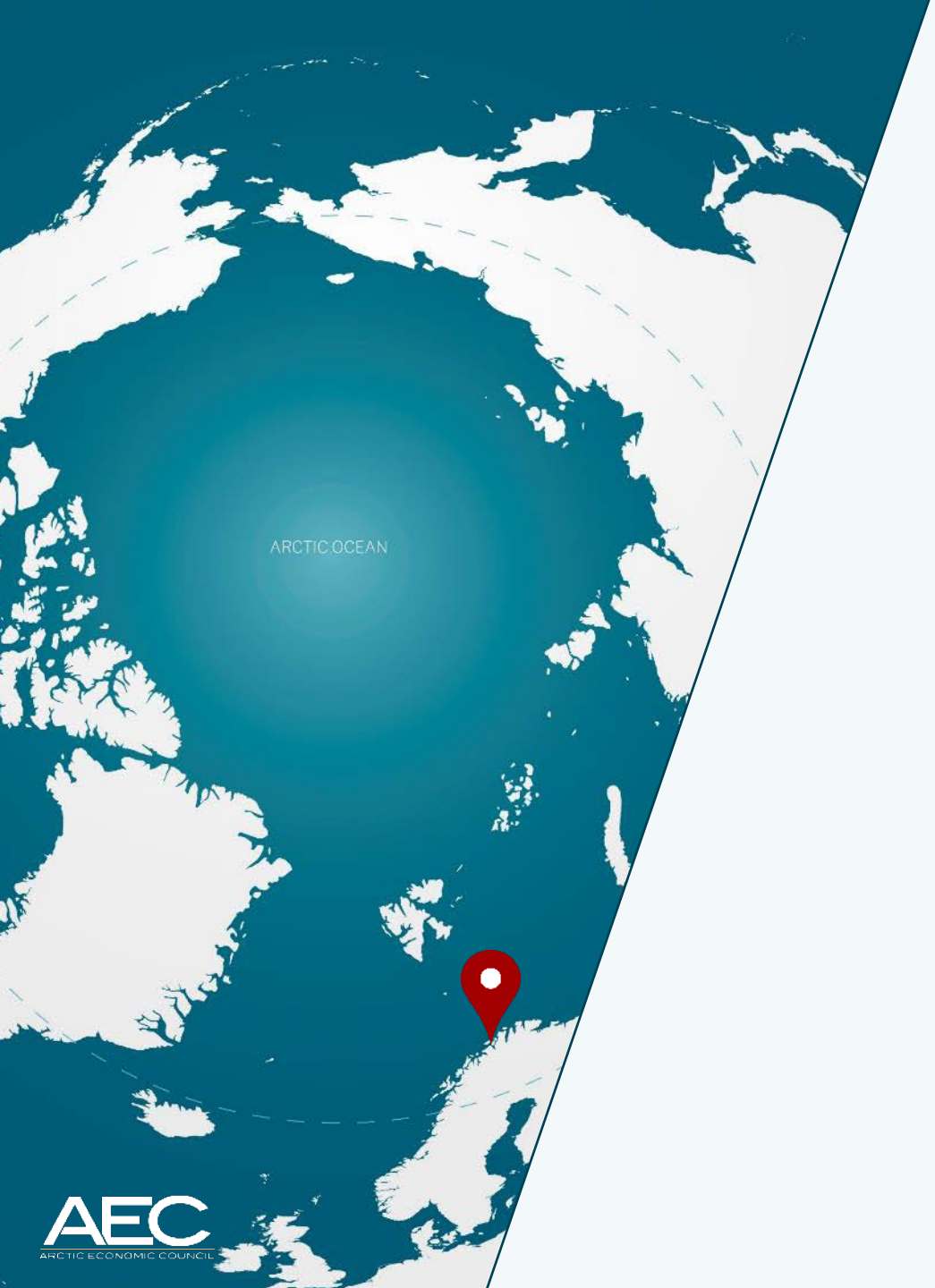
Senja, Troms, Norway

Energy – Utilities

Publicly-owned company

AEC
ARCTIC ECONOMIC COUNCIL

Arva



KEY DATA

"Making a Smarter Senja by improving local power grids to decarbonize and better distribute energy, using innovations forged through research partnerships."

PRODUCTION/OUTPUTS

- technological solutions to relieve pressure local power grid

PERSONNEL

- 200 employees

PROJECT TIMELINE

- 2019-2025
- **Project status:** funded - ongoing

Senja, Troms, Norway

Energy – Utilities

Publicly-owned company

AEC ARCTIC ECONOMIC COUNCIL

Arva

FINANCIALS

"Making a Smarter Senja by improving local power grids to decarbonize and better distribute energy, using innovations forged through research partnerships."

$10.3M

TOTAL COST

97M NOK (US$10.30M)

INVESTMENT

ENOVA support – 40% of approved costs

FUNDING

Project partners and public support (ENOVA)

Senja, Troms, Norway

Energy – Utilities

Publicly-owned company

AEC ARCTIC ECONOMIC COUNCIL

Arva

SUSTAINABILITY

"Making a Smarter Senja by improving local power grids to decarbonize and better distribute energy, using innovations forged through research partnerships."

Company and project work towards the realization of electrification and access to clean energy in local communities, as grid owners.

Senja, Troms, Norway

Energy – Utilities

Publicly-owned company

Arva

PROJECT PITCH

"Making a Smarter Senja by improving local power grids to decarbonize and better distribute energy, using innovations forged through research partnerships."

SMART SENJA

In Norway, there is a strong focus on transformation through a green re-industrialization, which is power intensive. Senja is no exception and is at the forefront of economic development in Arctic Norway. Even though the power grid to Senja has been modernized in recent years, industrial development is pushing the electrical infrastructure to its limits.

The two fishing communities are supplied through very long overhead power cables that are not necessarily designed to handle the additional loads from the expected industrial growth, especially from the seafood industry. Significant challenges in the stability and security of electrical supplies are already apparent. The problem is most serious in the winter season when fisheries' activity is at its peak, and locals use a lot of energy for heating at the same time.

These challenges are expected to intensify in the coming years with the current growth rates. The establishment of new businesses, the electrification of aquaculture and the fishing fleet, as well as the electrification of transportation in general, are going to require more power than the current transmission lines can handle.

The situation seen on Senja is of course not unique. Similar challenges are surfacing in many ageing electrical grids, both in Norway and in the Arctic. The traditional solution is to construct new power lines with more capacity or used diesel-fueled aggregates, which is costly and often has a substantial environmental footprint.

Environmental considerations and traditional land usage, especially related to the indigenous Samis, must be weighed against the security of supply and other industrial interests.

In this project the company aims to relieve pressure on the current grid at Husøy and Senjahopen (Northern Senja) by distributing consumption more evenly over the day, thereby securing enough power to sustain the development of the communities. This is the primary focus of the innovation activities of Smart Senja: to develop and demonstrate how new technologies and local flexibility markets can solve the challenges of stability and security of power supply in an efficient and well-designed way.

However, the project is also novel in Norway and in the Arctic in terms of community and industry involvement.

PROJECT PITCH

"Making a Smarter Senja by improving local power grids to decarbonize and better distribute energy, using innovations forged through research partnerships."

Smart Senja contributes to an action-based power grid and community transition by co-designing technological solutions that fit the present viability and future visions for coastal communities in the Arctic.

A range of industry partners together with UiT – The Arctic University of Norway concretely design energy storage solutions (2 large batteries), a local energy market, and suggest different models for local renewable energy systems.

Community involvement, especially related to how and why we implement different technologies, is important to succeed. The project, therefore, organizes energy teaching and collaboration with the local schools, co-organizes energy cafes with the locals (grendelag) and takes part in various local events that are relevant for the project.

The combination of these technological and community-based solutions from the fishing communities is set to have transfer value to other grid companies in the Arctic, the international research forefront and robust energy transformation relevant for other Arctic communities.

As such, Smart Senja is a cross-scalar project about innovation developing energy systems for the future - not just for Senja - but also to support the global transition towards renewable energy and an electrical future.

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

Smart Senja is about addressing the demand and supply of clean energy at Northern Senja, at the edge of a radial power grid. Essentially, it is about showing the world how 'green' and 'smart' solutions can maintain rural areas, with minimal strain on climate and nature.

Ideally, the project plans to include Arctic communities in taking part in the green transformation; electrify industry and infrastructure while enabling further green growth. Such challenges are relevant for other communities in the Arctic, i.e. remote and coastal settings.

How does your project help develop human capital in the communities where it's located?

Smart Senja addresses local challenges related to the power supply at Husøy and Senjahopen. The solutions developed in the project will contribute to improving the current situation and allow the seafood industry and other industries present to grow further and create jobs.

This means that the communities will be able to retain and attract new talents. The solutions would also encourage and motivate more people to start further businesses in the local area.

Furthermore, the solutions developed through the project are very much dependent on the contribution of the local population (for example, the flexibility market and local energy cafes that are organized within the community).

Through local engagement, the project aims to share knowledge about green transformation, local challenges ahead and how residents can contribute to reducing energy consumption that will affect energy uses in the future.

How does your project balance economic and social goals with environmental protection?

Building new powerlines to fulfil decarbonization of the energy systems in use has a significant environmental footprint and can be in conflict with indigenous land usage or public use of the outdoor area.

Solutions developed in Smart Senja represent new tools in the energy companies' toolbox. For example, a flexibility market is about using the existing capacity in the power network to its full extent by shaving off-peak consumption and delaying power use.

The mechanism at stake at Northern Senja is to compensate consumers for reducing or delaying power consumption when fish processing plants are producing at maximum capacity.

One overarching theme in the science part of the project is on the relationship between society and technology, and the relationship between the project (visioneering) and the local social and economic values (commercial and community).

Thus, Smart Senja is set to explore what it takes for a society to find interest in and be involved in energy transition processes.

Q&A

What channels have you set up to effectively communicate with local communities, including addressing grievances and requests for information?

Smart Senja is carried out by and for the people at Northern Senja. Active involvement of the local communities is at the core of the project.

UiT – The Arctic University of Norway through the Arctic Center for Sustainable Energy (ARC) and the project Renew (Transformation to Renewable Smart rural power systems) have developed effective ways to engage the communities and is carrying out research on the transition to new energy systems (for instance, setting up local renewable power in the form of solar plants).

To add, the project has invited local communities to join energy cafés, where residents can meet, get an update on the project, ask questions, and make suggestions through informal discussion with project members around a cup of coffee and a piece of cake.

These events are organized on a regular basis, though it has been challenging due to the Covid-19 pandemic. The project has, in addition, established a website and shared updates on social media. Newsletters in the form of postcards are also regularly sent to the locals.

How have you tried to set best practices for Arctic investment and what best practices have you followed from others?

Through UiT – The Arctic University of Norway, the project has engaged with similar Arctic projects aiming at solving local energy supply challenges through innovation both in Norway and internationally; For example, the Community Appropriate Sustainable Energy Security (CASES) Partnership hosted by the University of Saskatchewan and Cordova's microgrid in Alaska, USA.

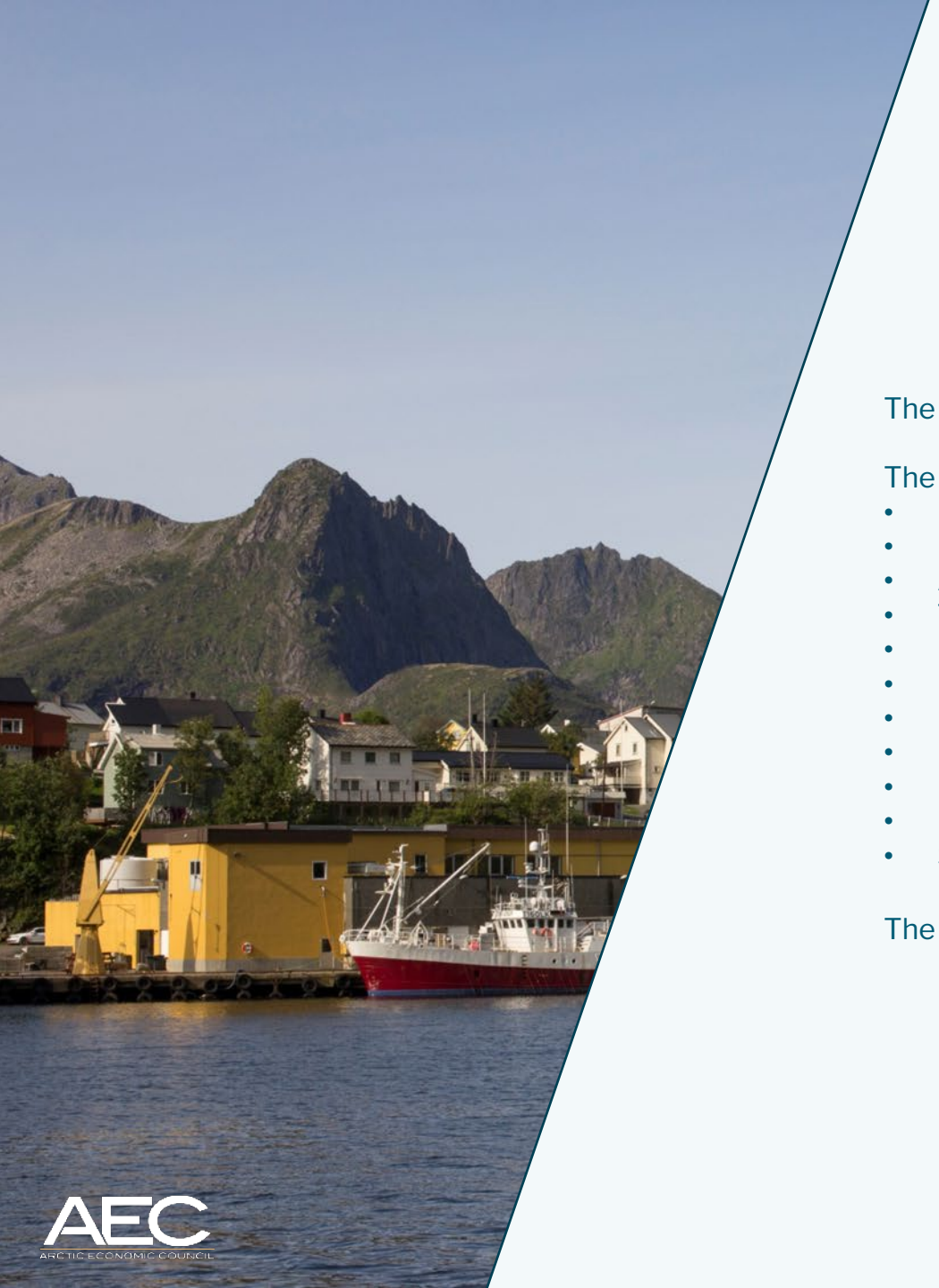
Sharing experiences and learning from others is important for Smart Senja. The project itself has not created best practices at this stage but combining experiences from Smart Senja and other similar Arctic projects could be beneficial.

Do you have anything else to add about your project? What are your next steps?

Smart Senja has been ongoing since late 2019. As part of the innovative solutions developed, the project has suggested different models for local renewable energy systems.

In addition, the project has designed a flexibility market where the power grid company (Arva) is able to buy flexibility for the most critical hours, meaning a reduction in consumption, from private households and the local industry. (Examples of power that can be controlled are water heaters in households or cooling plants in the industry).

Two large energy storage facilities have been ordered and will be delivered to Husøy and Senjahopen later this autumn. This is the largest investment in the project and the battery facility at Husøy will be the largest to be connected to the Norwegian grid to date (approximately 2 MW/2MWh). These facilities will stabilize the power grid, be used for peak shaving and be able to operate in island mode in case of a power outage.



STAKEHOLDERS

"Making a Smarter Senja by improving local power grids to decarbonize and better distribute energy, using innovations forged through research partnerships."

The project is established as a consortium.

The partners in the Smart Senja project are:

- Br. Karlsen,
- Nergård AS,
- Arva AS,
- Tromskraft Produksjon AS,
- Ishavskraft,
- UiT – The Arctic University of Norway,
- Enfo,
- Nodes AS,
- Powel AS,
- Rolls Royce Solutions Berlin GmbH and
- Solbes AS.

The project is owned by Arva AS and financially supported by ENOVA.

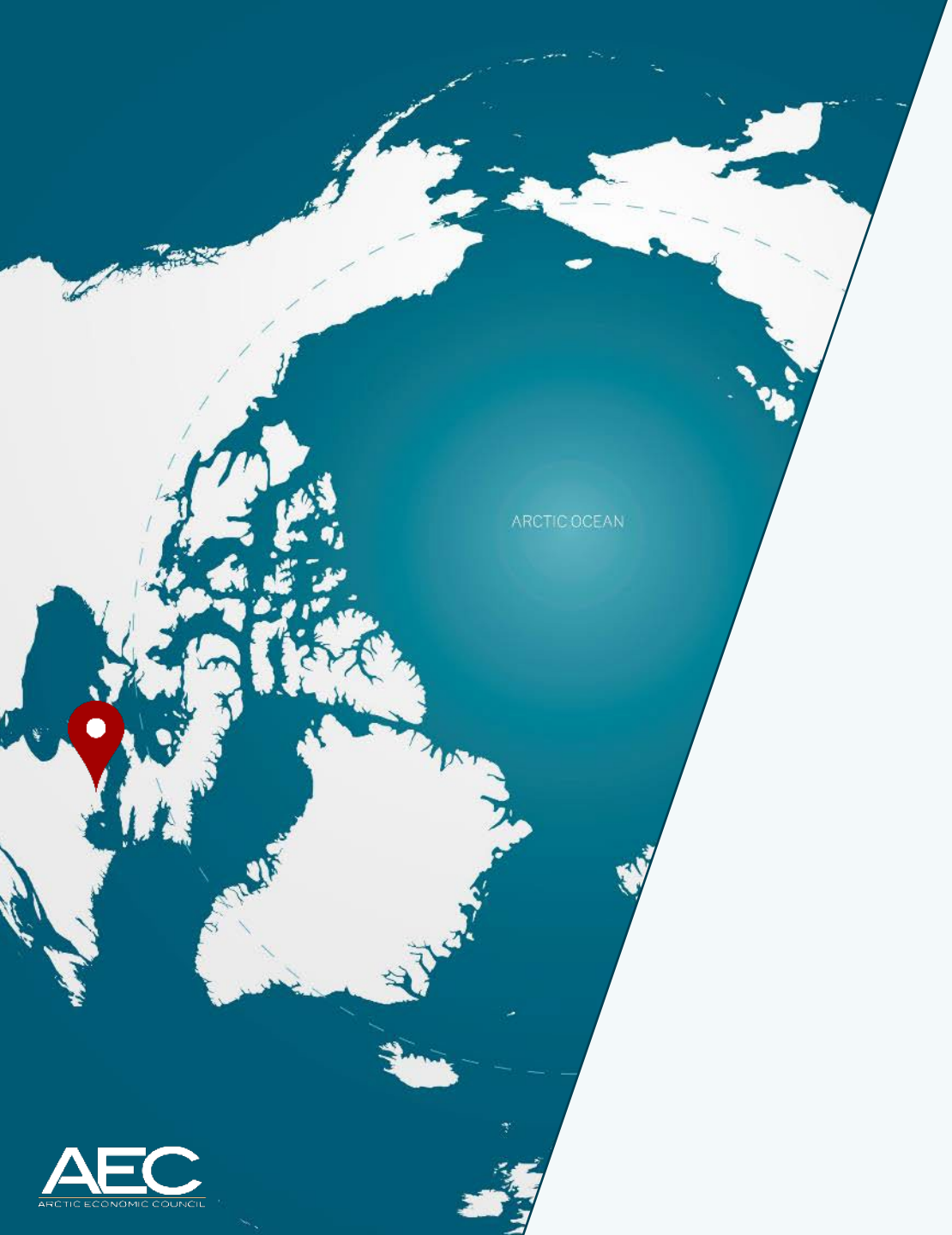
Senja, Troms, Norway

Energy – Utilities

Publicly-owned company

AEC ARCTIC ECONOMIC COUNCIL

Arva



Tugliq Énergie Co.

RAGLAN MINE
WIND ENERGY AND STORAGE PROJECT

AEC
ARCTIC ECONOMIC COUNCIL

Raglan, QC
Canada

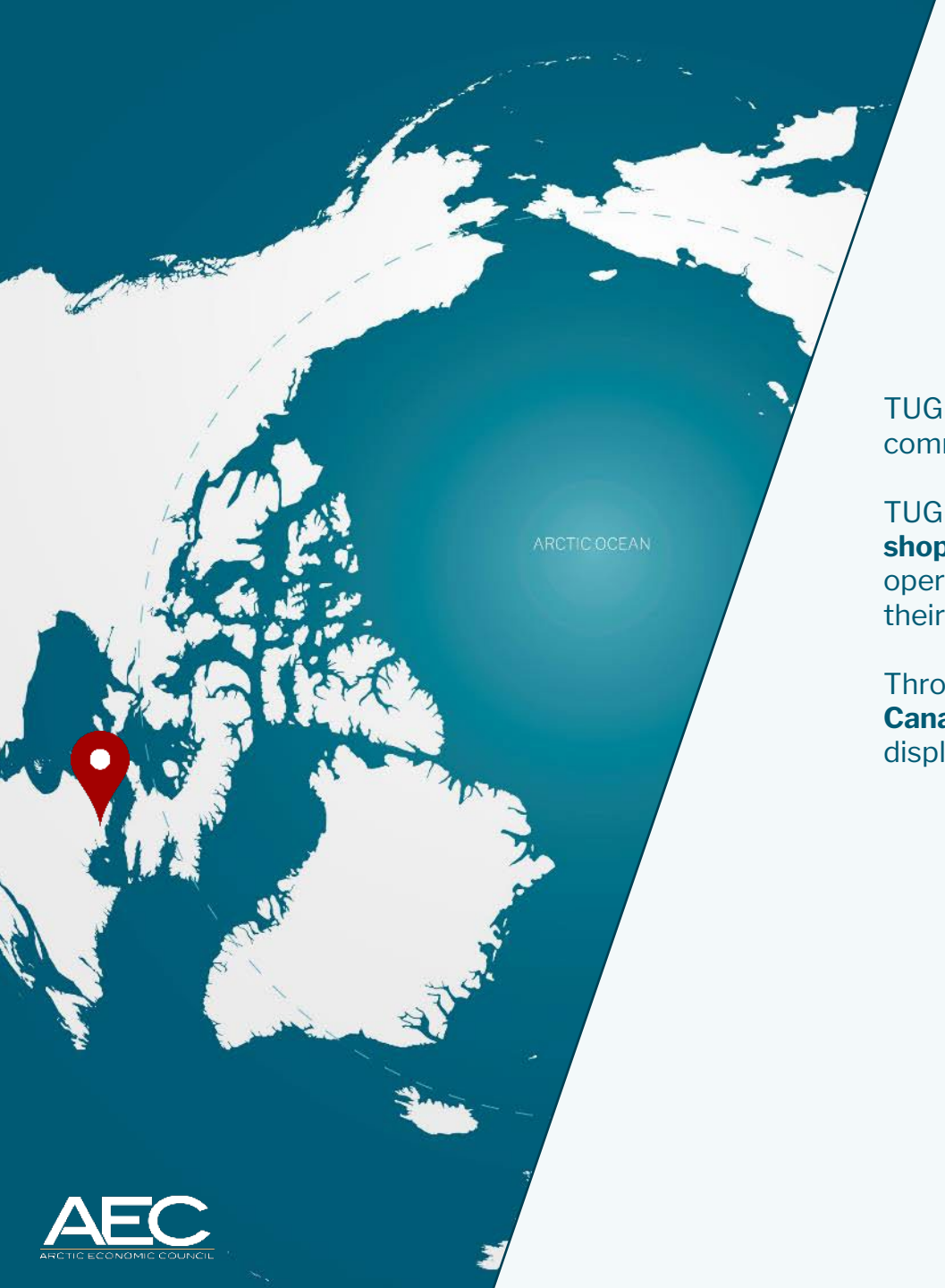
Energy –
Renewable

Private

Tugliq Énergie Co.

Tugliq's project has proven to local communities and, most importantly, to local electric utilities that integrating renewable energy (wind) production and storage is technically and economically feasible in the Arctic, without spending decades and millions of dollars on studies.

Tugliq



TUGLIC ENERGY CORP.

"Energy services provider helping to offset diesel consumption in one of Canada's largest mines by integrating renewable energy into its power grid."

TUGLIQ Energy Corp. is an Independent Power Producer (IPP) serving industries and remote communities through **specialized microgrid solutions to reduce fossil fuel** dependency.

TUGLIQ's mission is to displace fossil fuels with clean, local proximity resources. We offer **a one-stop-shop**, freeing industrial customers from the design, procurement, financing, deployment, ownership, operation, maintenance, decommissioning of islanded grids that are mission-critical yet non-core to their main line of business.

Through award-winning projects, TUGLIQ has successfully **pioneered proximity-energy in the Canadian Arctic** for years, pioneering proximity-energy in harsh climates where prior attempts to displace diesel had failed.

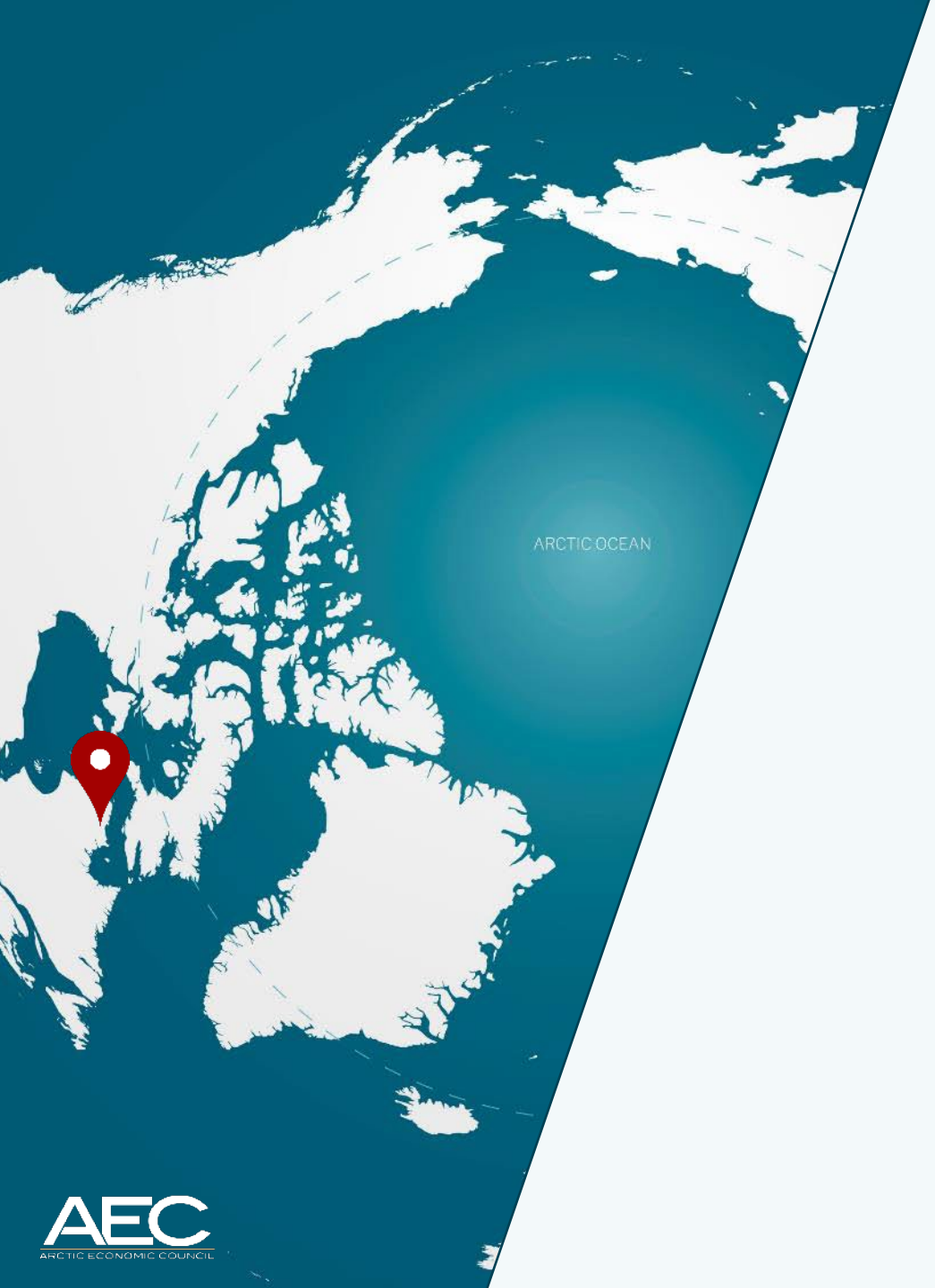
AEC
ARCTIC ECONOMIC COUNCIL

Raglan, QC
Canada

Energy –
Renewable

Private

Tugliq
Énergie Co.



KEY DATA

"Energy services provider helping to offset diesel consumption in one of Canada's largest mines by integrating renewable energy into its power grid."

PRODUCTION/OUTPUTS

- Current: 19 000MWh
- Projected by 2024: 44 000MWh

PERSONNEL

- Currently 12 full time staff, 2 based in the Arctic
- Projected by 2024 18 full time staff, 5 based in the Arctic

PROJECT TIMELINE

- 2014: 1st wind turbine installed at Raglan
- 2018: 2nd turbine with large scale BESS
- 2023: projected 3rd and 4th turbine in Raglan
- **Project status:** Raglan phase 1 and 2 is completed and phase 3 is in the final negotiation stage.

Raglan, QC Canada

Energy – Renewable

Private

Tugliq Énergie Co.

AEC ARCTIC ECONOMIC COUNCIL

FINANCIALS

"Energy services provider helping to offset diesel consumption in one of Canada's largest mines by integrating renewable energy into its power grid."

$58.1M TOTAL COST

Raglan Phase 1 : CA$22M (US$16.4M)
Raglan Phase 2 : CA$20M (US$14.9M)
Raglan Phase 3 : CA$36M (US$26.8M)

$78 M TOTAL ASSETS IN ARCTIC

Current: CN$42M (US$31M) from Raglan Projects.
Projected by 2024: is CN$105M (US$78M), including projects other than Raglan.

INVESTMENT

Fully funded

AEC ARCTIC ECONOMIC COUNCIL

Raglan, QC Canada | Energy – Renewable | Private | Tugliq Énergie Co.

FINANCIALS

“Energy services provider helping to offset diesel consumption in one of Canada’s largest mines by integrating renewable energy into its power grid.”

FUNDING

Equity from founders, senior debt lenders and grants.

$5.3M

The Canadian federal government is providing CA$7.1M (US$5.3M) to Tugliq Energy to help fund the installation of two more wind turbines at Glencore‘s remote Raglan nickel mine.

$164M

Funding for the project comes from Natural Resources Canada’s eight-year, CA$220M (US$164M) Clean Energy for Rural and Remote Communities program.

Raglan, QC Canada

Energy – Renewable

Private

Tugliq Énergie Co.

SUSTAINABILITY

"Energy services provider helping to offset diesel consumption in one of Canada's largest mines by integrating renewable energy into its power grid."

Other significant metrics:

Project's financials will aptly sustain operations for the next 5 years at RAGLAN:

- ecoEII Contribution: CA$7.8m (US$5.8m);
- EIP Contribution of RAGLAN mine II: CA$3.9m (US$2.9m).

Projects went through provincial and regional permitting processes, including impacted communities' consultations and full ESIA (environmental and social impact assessments).

SUSTAINABLE DEVELOPMENT GOALS

Raglan, QC
Canada

Energy –
Renewable

Private

Tugliq
Énergie Co.

PROJECT PITCH

"Energy services provider helping to offset diesel consumption in one of Canada's largest mines by integrating renewable energy into its power grid."

RAGLAN MINE WIND ENERGY AND STORAGE PROJECT

The RAGLAN projects are a multi-phase strategy to **integrate renewable energy into the Raglan Mine power grid, a remote mining operation in Arctic Canada**. The RAGLAN I project represents a first of its kind **autonomous industry-scale microgrid** project in Arctic Canada.

The 3MW Arctic-rated **wind turbine is coupled with three energy storage technologies:** a flywheel for rapid fluctuations, a hydrogen loop with electrolyser and fuel cells for long term storage, and a Li-Ion battery system for a spinning reserve and backup power. Led by a state-of-the-art microgrid controller, the system is seamlessly integrated into the Raglan Mine diesel grid.

The project allowed the previously 100% diesel dependent Raglan Mine to diversify its energy generation and benefit from long-term energy cost reductions.

The project also aims to **minimize the wear and tear on backup diesel gensets** by frequent on-off resulting from low storage of bridging renewable energy; it is also aimed at substantially reducing the diesel spinning reserves required to maintain micro-grid responsiveness and stability.

Raglan, QC Canada

Energy – Renewable

Private

Tugliq Énergie Co.

AEC ARCTIC ECONOMIC COUNCIL

PROJECT PITCH

"Energy services provider helping to offset diesel consumption in one of Canada's largest mines by integrating renewable energy into its power grid."

RAGLAN MINE WIND ENERGY AND STORAGE PROJECT

No substantial deployment of renewable energy existed among the North's largest greenhouse gas emitters until recently.

The success of RAGLAN I laid the foundation for RAGLAN II, a repeat order for a second 3MW wind turbine coupled with **a large-scale, bi-directional Li-Ion battery system storage installation** of 3 MW / 1MWh.

Renewable energy penetration now reaches close to 40%, with storage energy and control systems playing a critical role in managing variations due to wind fluctuations as well as preventing grid failure in the event of turbine malfunctions.

The second installation increased the total diesel displacement of the mine site to 4.2M litres annually leading to **major fuel and transport cost reductions** for the company as well as a significant decrease in the mine's environmental footprint.

Raglan, QC Canada

Energy – Renewable

Private

Tugliq Énergie Co.

AEC ARCTIC ECONOMIC COUNCIL

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

Tugliq's project has proven to local communities and, most importantly, to local electric utilities that integrating renewable energy (wind) production and storage is technically and economically feasible in the Arctic, without spending decades and millions of dollars on studies.

It also proved that it can be operated and achieve the highest level of asset availability. Lastly, it is a source of motivation and inspiration to learn new skills for Inuit in the region, seeing that Renewable energy could (and will) be deployed in their own communities. The collaboration between TUGLIQ and Raglan mine won the *2019 Sustainable Development Strategy (large enterprise)* award.

What is your fundraising strategy? What barriers or challenges have been greatest in securing funding for your project?

With the off-taker being a mining company, lenders perceive that they are exposed to commodity risk (gold, nickel, copper, etc.) and are not comfortable in a non-conventional PPA.

TUGLIQ had to adapt and be creative to properly share risks with the mining companies and meet all requirements from lenders for these non-standard contracts.

What are your next steps?

With phases 1 and 2 delivering the promised business case to both the mining company and TUGLIQ's shareholders, expansion of the Raglan asset, through the phase 3 (2 x wind turbines) is the next step. This project aims to conclusively break through the barrier of 30% - 50% penetration in renewables, at the largest micro-grid and one of the largest emitters in the Arctic. The wind and storage system will be monitored for a minimum of 5 years under the program.

A protocol was developed to isolate a section of the 28 MW Raglan micro-grid so that the project can be operated as a self-contained subset (or sub-micro-grid) of the larger micro-grid. Penetration levels as high as 50% will therefore be tested and operated for extensive periods to simulate smaller remote community micro-grids.

How have you ensured inclusive and equitable consultations with local/ indigenous communities?

The best example of this is during the Raglan Phase 1 consultation. The project location was in Deception Bay, a traditional hunting and fishing destination for the Salluit community and the Elders of Nunavik. They expressed a concern that sun rays might reflect on the turbine's blades into the bay and scare beluga whales. They were also concerned that the turbine might send vibrations into the ground and disturb marine life.

As these aspects were not covered in the ESIA, TUGLIQ listened to these concerns and decided to move the project site further away, next to the mining operation. Listening and acting upon the concerns of the local Inuit Elders has helped to build trust in the consultation process with the community.

Q&A

How does your project balance economic and social goals with environmental protection?

The exclusive use of diesel fuel for electricity generation has left mining companies exposed to volatility that has caused oil prices to oscillate. Renewable energy proved to significantly reduce operating costs, greenhouse gas emissions, and dependence on diesel fuel, in mining operations and communities of the Canadian North. The design maximizes local sources of aggregates, minimizes imported sources of heavy aggregates which reduces transport GHG.

What specific mitigation measures, technological or otherwise, has your project put in place to safeguard the local environment?

Jointly with the mine's environmental department, a bird survey is performed on a yearly basis, with a precise protocol and use of baits to analyze and document the impact, if any, of the 2 wind turbines on migratory birds.

The Project minimized the loss of wind energy due to wind curtailment (blade-feathering, or load shedding, or blade ice formation) incurred in conventional wind-diesel hybrid installations, in order to maintain grid stability and when wind power generation is greater than the load.

Importantly, it eliminated the need for wasteful diesel-powered spinning reserves running at partial loads, and gainfully captured the waste from wind curtailment occurring during excess wind conditions.

The Project comprises of a fast transient energy storage flywheel to filter out large wind power variations in short durations, a short-term battery storage to start up backup diesel generators or fuel cells as required, and a longer-term hydrogen fuel cell storage to minimize the loss of wind energy over longer time periods and capture energy that would otherwise be wasted.

The wind turbine is elevated above ground on piles, using a "spider-like" structure with steel ring which makes the foundation impervious to melting of Arctic ice lenses in permafrost and will guard against eventual tilting of the wind turbine. The design reduces by 90% the amount of concrete required.

What measures have you taken to increase transparency and guard against corruption in your project's financial and reporting activities?

TUGLIQ goes through in-depth external audits from the Federal government at the end of each project, where all expenses are scrutinized and justified and meet accounting's best practices.

What channels have you set up to effectively communicate with local communities, including addressing grievances and requests for information?

The site originally selected for deployment (i.e., the port at Deception Bay), was subsequently changed to Mine 2, east of RAGLAN's main complex (Katinniq), because of Inuit concerns expressed about the Deception Bay location (strobescopic impact on fishing and wildlife, raptor's nesting in proximity).

Q&A

What technical measures are in place to monitor for local impacts and hazards from your project?

Wind energy can be the lowest cost of energy that is available locally, and is the cleanest and the most socially acceptable current option at the scale required. Not transporting diesel, either by road or by sea, reduces the risk and severity of oil spills in the Arctic.

How have you worked to uphold and strengthen regulatory measures that contribute to healthy Arctic communities and environments?

The Project set out to demonstrate that the risks associated with an overdependence on fossil fuels can be reduced and ultimately eliminated because high-penetration renewable energy at industrial or community scale in the Arctic can be reliable.

The Project accomplished many landmark achievements and demonstrated strategically important results, fulfilling its mandate of regional flagship and as reference site for future deployments.

STAKEHOLDERS

"Energy services provider helping to offset diesel consumption in one of Canada's largest mines by integrating renewable energy into its power grid."

Tugliq is 100% owner and operator of the Raglan asset and performs maintenance and operation for the duration of the contractual agreement with the Mine.

- Multiple strategic partners include:
- Hatch Ltd.,
- BBA Inc.,
- Enercon G.m.b.H.,
- Hydrogenics Corp.,
- KTSI Kinetics Traction Systems Inc.,
- Groupe Ohmega Inc.,
- Gas Metro Renewable Energies,
- Morneau Construction Inc.,
- NEAS Shipping
- Co., Katinniq Transport Ltd.

Tugliq has signed a 20-year Power Purchase agreement with Glencore's RAGLAN Mine..

AEC
ARCTIC ECONOMIC COUNCIL

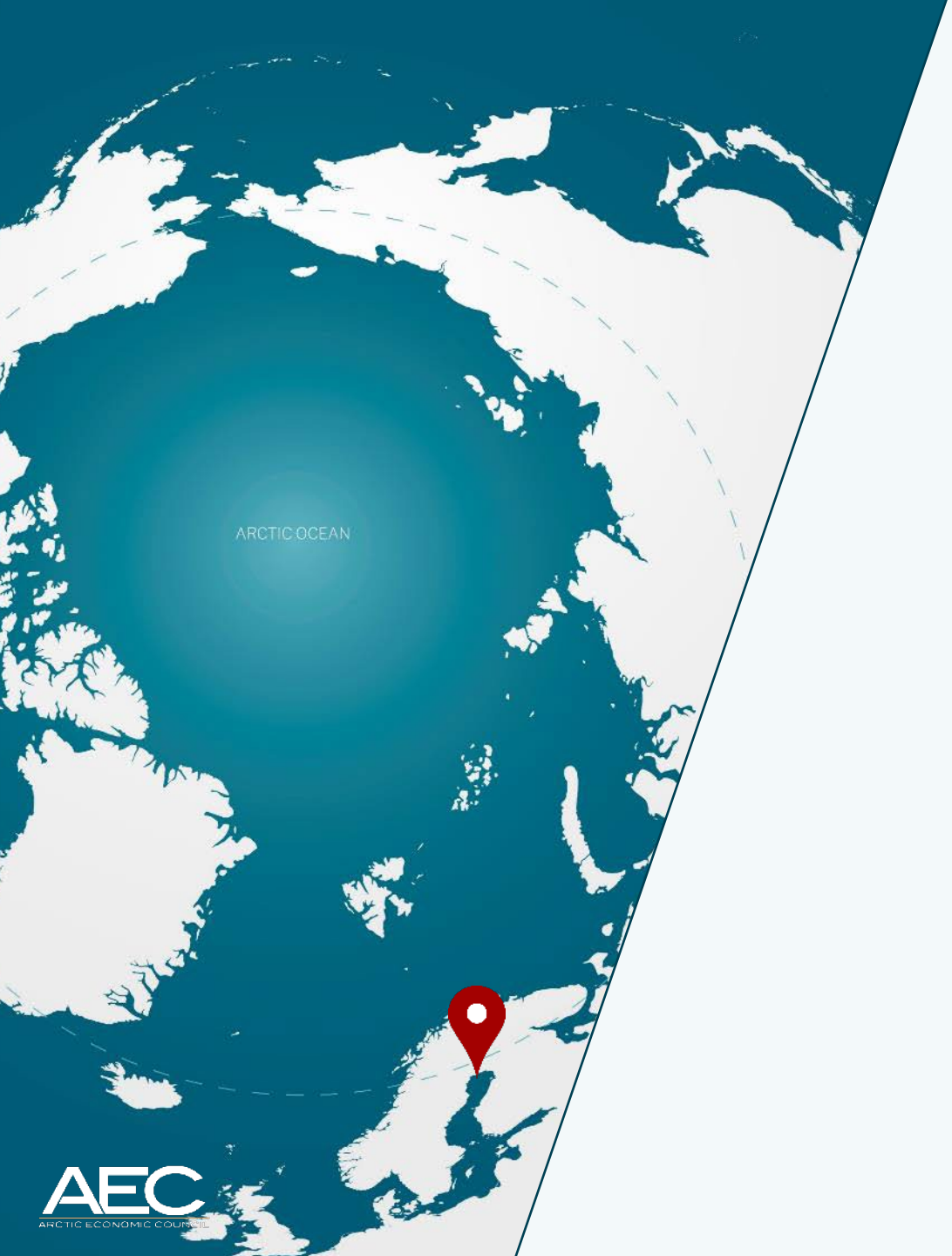
Raglan, QC
Canada

Energy –
Renewable

Private

Tugliq
Énergie Co.

TECHNOLOGY



ARCTIC SPACE TECHNOLOGIES

HIGH LATITUDE DATA CENTER

Luleå, Sweden

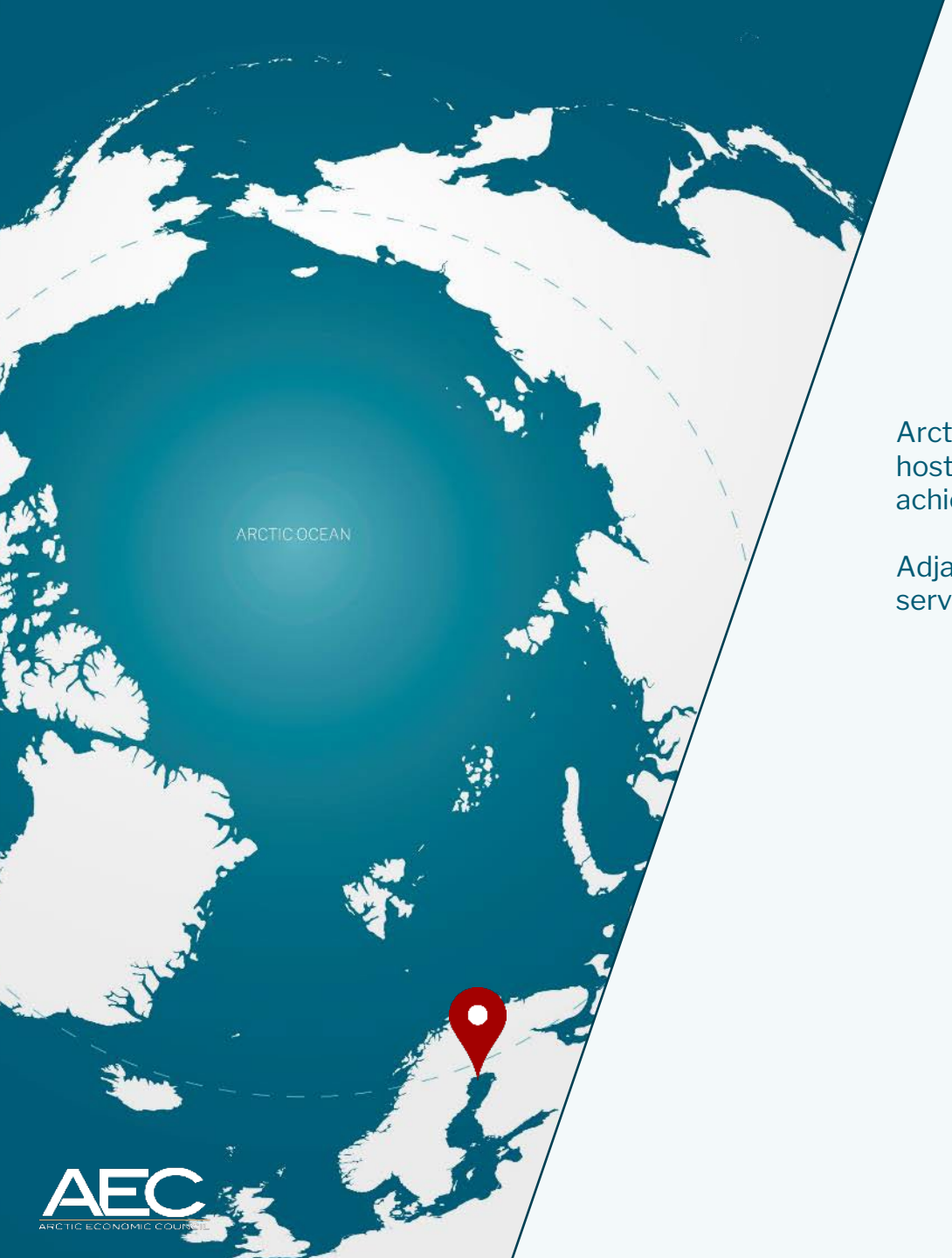
Technology – Satellites

Private

ARCTIC SPACE TECHNOLOGIES

The Arctic is one of the best locations worldwide for satellite communications for polar orbiting satellites. The high latitude provides long communication times, and renewable energy sources and a cold climate for the data centers ensures minimal effect on the environment.

Arctic Space Technologies



ARCTIC SPACE TECHNOLOGIES

"Arctic space technology center in Sweden partnered with a zero-emissions data center."

Arctic Space Technologies provides a high latitude location for our customers (satellite operators) to host their antenna systems. With our infrastructure, they increase the efficiency of their systems by achieving longer communication times than those possible closer to the equator.

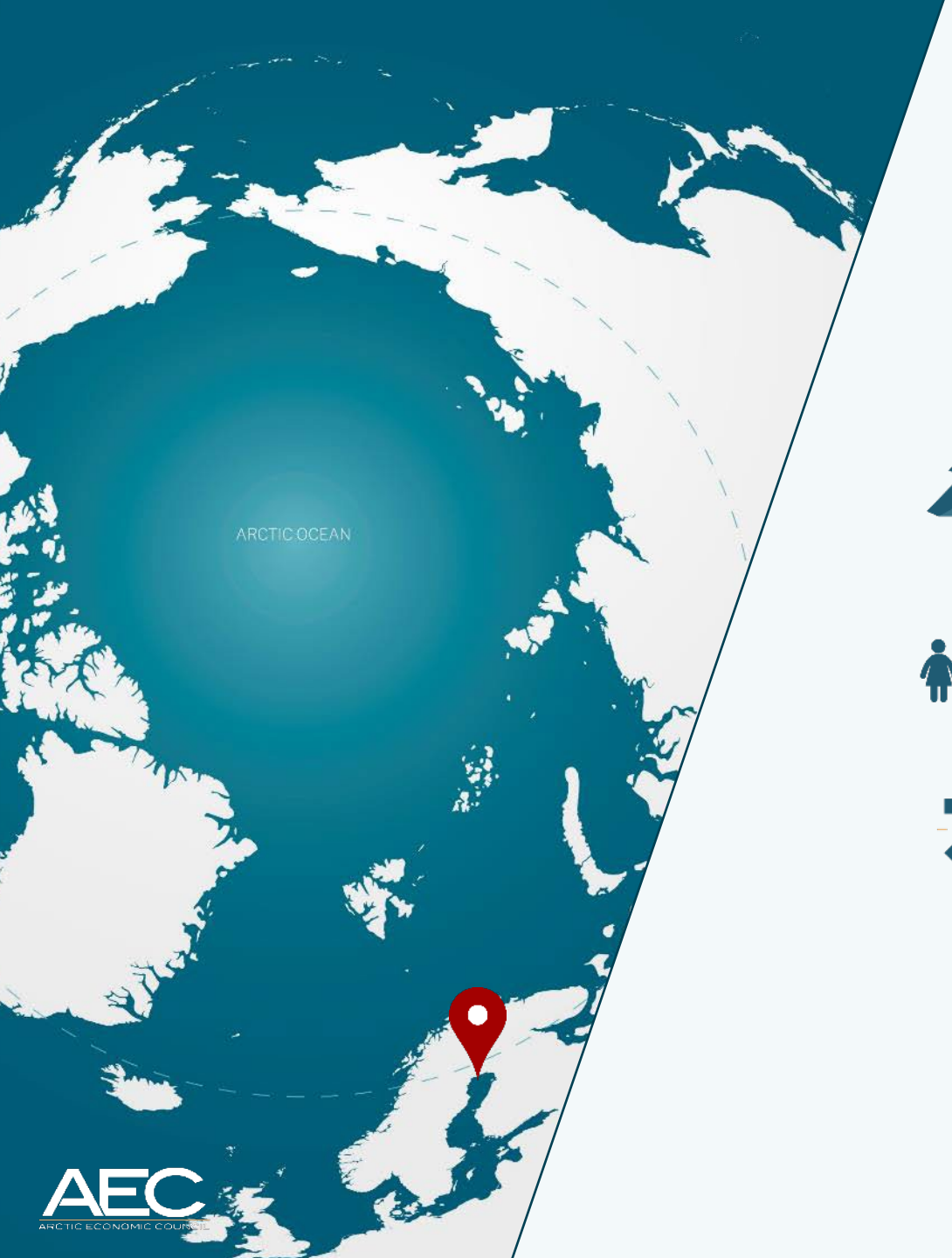
Adjacent to the antenna site, customers can access a CO_2-free data center where private cloud services are available with the highest security level on the market.

Luleå, Sweden

Technology – Satellites

Private

ARCTIC SPACE TECHNOLOGIES



KEY DATA

"Arctic space technology center in Sweden partnered with a zero-emissions data center."

PRODUCTION/OUTPUTS

- Data Centre
- Capacity for 7 antennas currently.
- Projected within project timeline: 20

PERSONNEL

- Currently 4 full time staff

PROJECT TIMELINE

- 3 years
- **Project status:** ongoing

Luleå, Sweden

Technology – Satellites

Private

ARCTIC SPACE TECHNOLOGIES

FINANCIALS

"Arctic space technology center in Sweden partnered with a zero-emissions data center."

$3.4M TOTAL COST

In 2021: 400K EUR (456K USD)
In 2022: 1M EUR (1.140M USD)

$1.1M ANNUAL REVENUE

In 2021: 400K EUR (456K USD)
In 2022: 1M EUR (1.140M USD)

$2.2M INVESTMENT

2M EUR (2.281M USD)

- Site expansion: 10%
- System investment: 50%
- Staff: 20%
- Sales: 20%

Luleå, Sweden

Technology – Satellites

Private

ARCTIC SPACE TECHNOLOGIES

FINANCIALS

"Arctic space technology center in Sweden partnered with a zero-emissions data center."

FUNDING

- AST + investor
- Equity

$507K

ASSETS IN THE ARCTIC

- 500K EUR (570K USD)

Luleå, Sweden

Technology – Satellites

Private

ARCTIC SPACE TECHNOLOGIES

PROJECT PITCH

"Arctic space technology center in Sweden partnered with a zero-emissions data center."

Arctic Space Technologies: a zero or near-zero impact on the environment communication project

One of the best locations worldwide for satellite communications for polar orbiting satellites. Not only making a difference for the climate but also strengthening the Arctic region within the space industry. Partnered with the EcoDataCenter to provide sustainable and safe data center services

Sustainable project

- Renewable energy in the Arctic region has managed to keep down the costs
- Excess heat from the data center is reused in other locations
- Carbon dioxide production is very low when data handling
- Project centered around the partnership with the local data center

Strenghthening the Arctic's place in the space industry

- Hope for increased investment into the Arctic region
- In the future, we hope to carry on building new, green partnerships to contribute to the Arctic
- We will acquire more land to increase our capacity for the increasing number of customers
- Partnership with the local data center: opens up a new market segment for the data center

AEC ARCTIC ECONOMIC COUNCIL

Luleå, Sweden

Technology – Satellites

Private

ARCTIC SPACE TECHNOLOGIES

SUSTAINABILITY

"Arctic space technology center in Sweden partnered with a zero-emissions data center."

The SDG's are fulfilled in numerous ways. These include but are not limited to:

Climate Action via providing CO_2-free satellite communication

Industry Innovation and Infrastructure via increasing the efficiency of satellite antennas

Luleå, Sweden

Technology – Satellites

Private

ARCTIC SPACE TECHNOLOGIES

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

The Arctic is one of the best locations worldwide for satellite communications for polar orbiting satellites. The high latitude provides long communication times, and renewable energy sources and a cold climate for the data centers ensures minimal effect on the environment.

By establishing antenna hosting infrastructures in the Arctic region, Arctic Space is not only making a difference for the climate but also strengthening the Arctic region within the space industry by creating jobs and awareness.

Through this raised awareness, we hope for increased investment into the Arctic region. We have partnered with the EcoDataCenter to provide sustainable and safe datacenter services to our clients. In the future, we hope to carry on building new, green partnerships to contribute to the Arctic region.

Do you have anything else to add about your project? What are your next steps?

Our next steps are to raise investment in order to expand and grow at the same pace as the rest of the space industry (which is now entering a new space era, Space 4.0). With this it will become possible to set up a professional sales team that can reach new markets and geographical locations.

Furthermore, we will aim to investigate and choose the locations based on environmental factors to avoid contributing to climate change. In addition, Arctic Space Technologies will invest in our own antenna system, in order to provide improved communication services.

Doing this will allow us to expand our system while maintaining environmental protection. In parallel, we will acquire more land to increase our capacity for the increasing number of customers.

How does your project balance economic and social goals with environmental protection?

Arctic Space Technologies will continuously provide data handling services for communication purposes that have a zero or near-zero impact on the environment. While this is raising awareness for our customers around the world, it is also something that potential customers are willing to pay for.

Renewable energy in the Arctic region has managed to keep down the costs, and the excess heat from the data center is reused in other locations.

The Arctic space data hub connects an earthbound antenna directly to the data processing hardware inside the data center. This is carried out without latency and through real-time processing, therefore reducing storage requirements on the network.

This ensures that carbon dioxide production is very low when data handling. The high level of sustainability obtained by balancing economic, social and environmental aspects allows us to progress with climate friendly satellites.

Q&A

How has your project integrated local/indigenous knowledge?

Our project is centered around our partnership with the local data center. This opens up a new market segment for the data center, so we can grow together. The data center has 3 centers in operation, one of which is fully powered by renewable hydropower coming from the Luleå river.

The same center has also achieved the highest safety class a building can have in Sweden. Due to these reasons, we are proud of our green partnership and hope to carry on working together whilst having minimal impact on the environment. Furthermore, when expanding we hope to make more sustainable partnerships, hence show the world how success can be achieved whilst being sustainable and green.

How have you entered into public/private partnerships with the local community and/or government?

Arctic Space is currently leasing land for the hosting services from the local municipality, making sure that the land is used in the most efficient way possible. In addition, only local companies are working on the infrastructure on the site, a collaboration that will continue.

Lastly the partnership with the local data center ensures a long relationship where we will continue to develop services for the space market. Furthermore, we will look into expansion and more sustainable options to keep growing and be prosperous.

STAKEHOLDERS

"Arctic space technology center in Sweden partnered with a zero-emissions data center."

4 founders share equally:

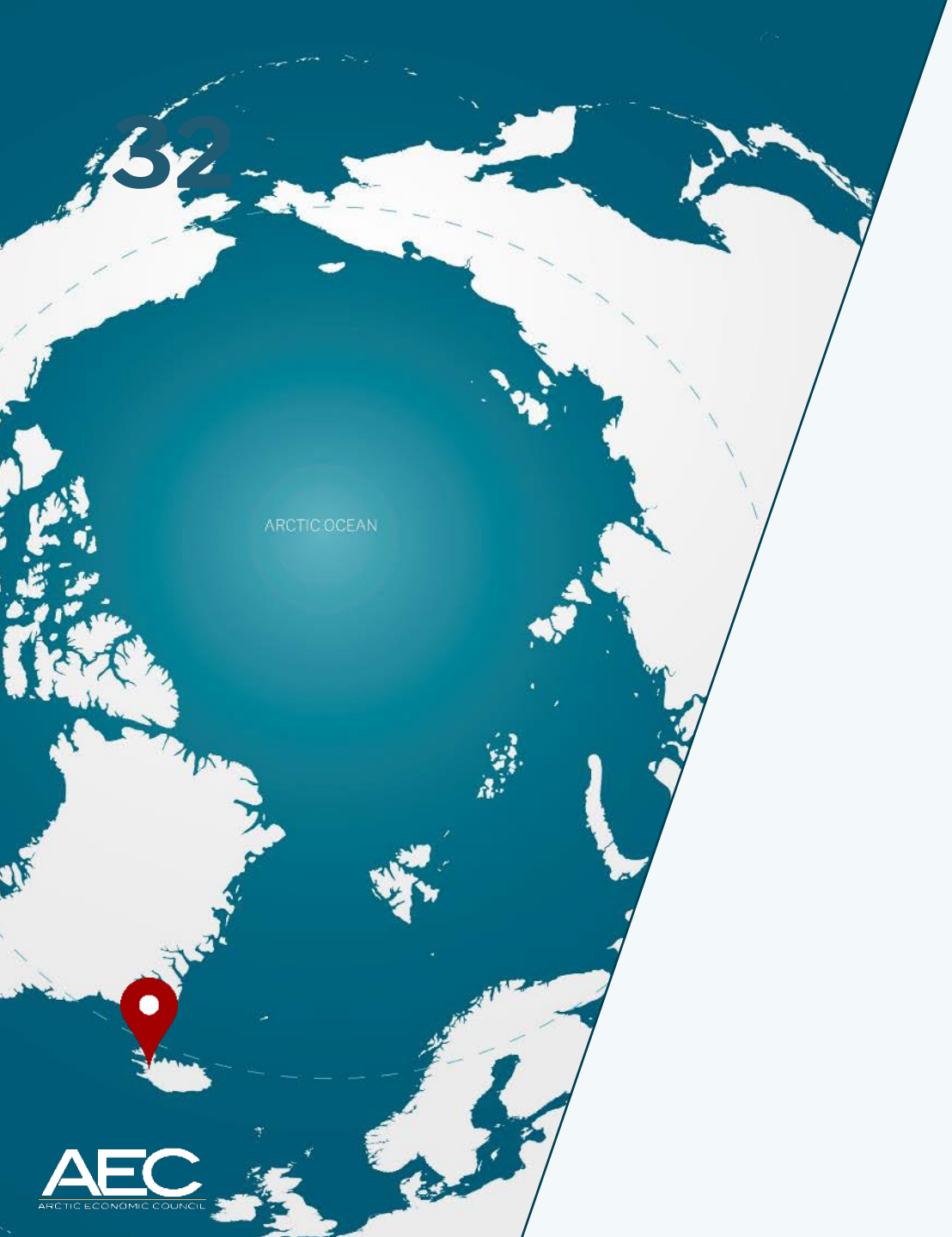
- Sandra Nilsson (COO)
- Benjamin Fischer (CEO)
- Felix Hessinger (CTO)
- and Fredrik Schäder (CSO)

Luleå, Sweden

Technology – Satellites

Private

ARCTIC SPACE TECHNOLOGIES



AEC
ARCTIC ECONOMIC COUNCIL

Carbfix

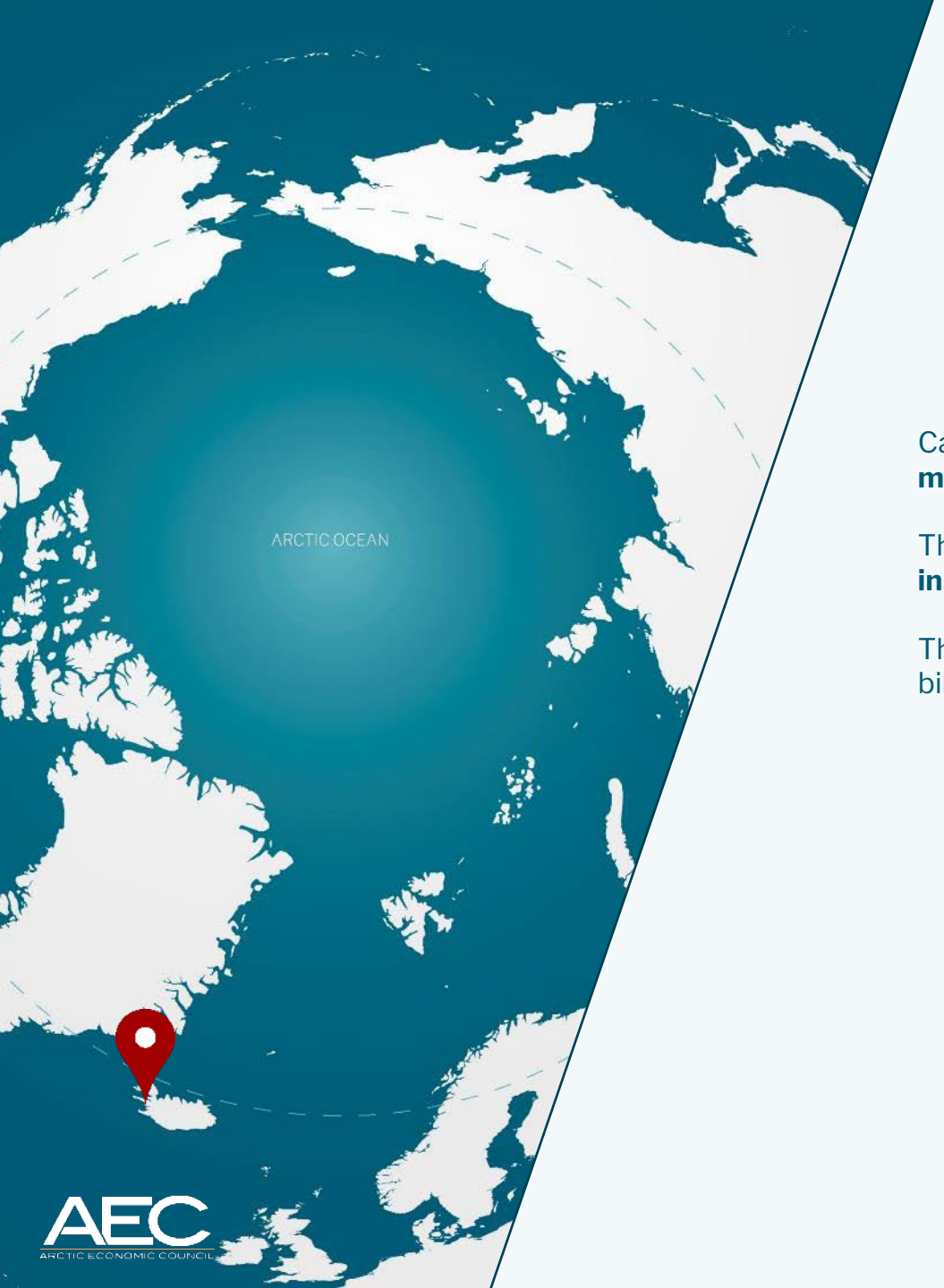
CODA TERMINAL: A SCALABLE ONSHORE CO_2 MINERAL STORAGE HUB

Straumsvík, Iceland

Technology – CCS

Subsidiary

Carbfix



CARBFIX

"A science-driven Icelandic company looking to tackle climate change by turning CO_2 into stone."

Carbfix is the first organization dedicated to facilitating and implementing **carbon capture and mineral storage (CCMS)** worldwide.

The Carbfix technology is built on more than 100 scientific publications and is a **research and innovation driven patented technology**.

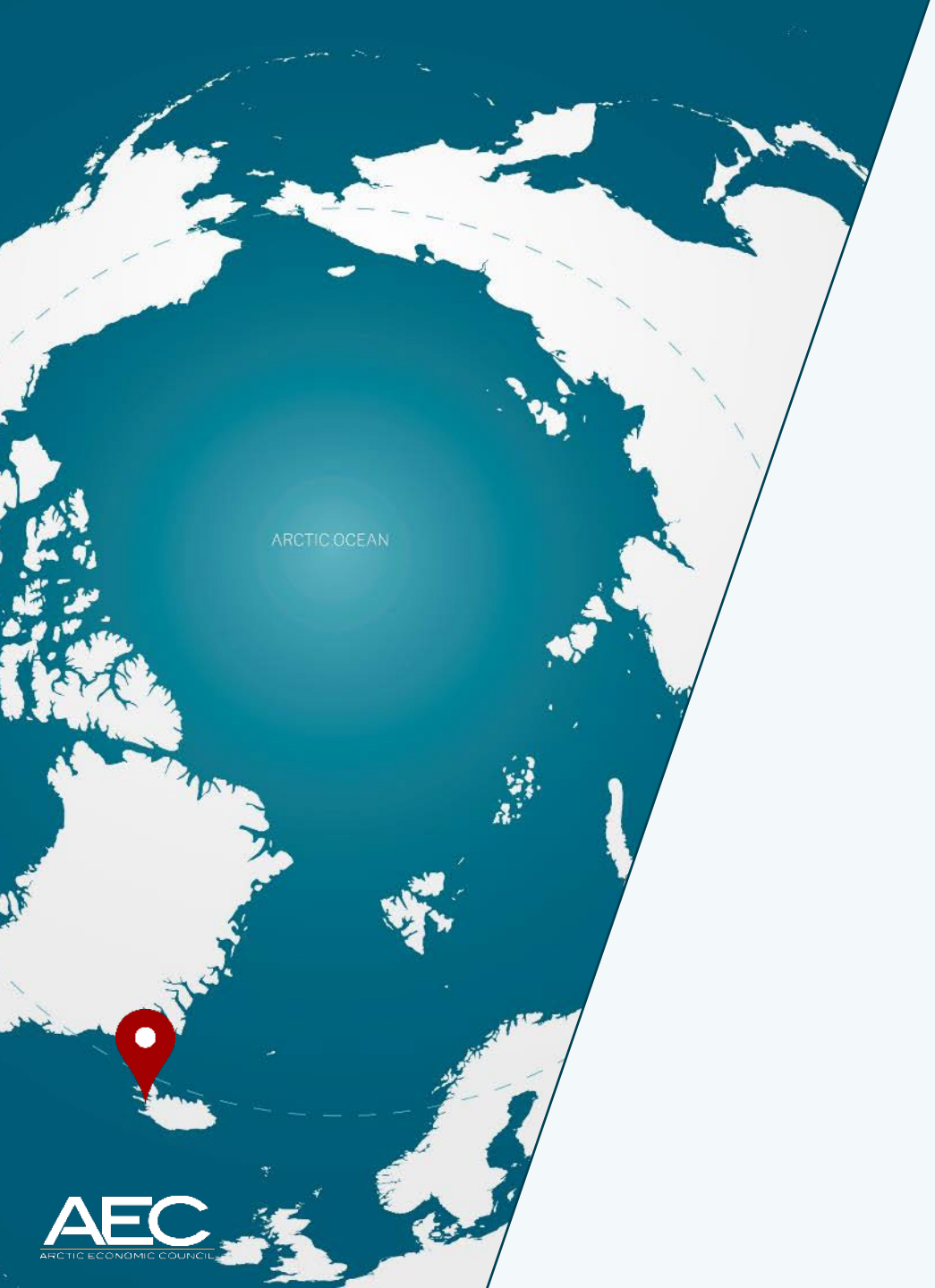
The company's mission is to become a key instrument in **tackling the climate crisis** by reaching one billion tons (1 Gt CO_2) of permanently stored CO_2 by 2030.

Straumsvík, Iceland

Technology – CCS

Subsidiary

Carbfix



PROJECT PITCH

"A science-driven Icelandic company looking to tackle climate change by turning CO_2 into stone."

PRODUCTION/OUTPUTS

- At full scale, the Coda Terminal will have the capacity to inject 3 million tons of CO_2 per year (3 Gt CO 2 /yr) for permanent mineral storage.

PERSONNEL

- 9 full time staff

PROJECT TIMELINE

- Founded in 2020
- Currently scaling up

Straumsvík, Iceland

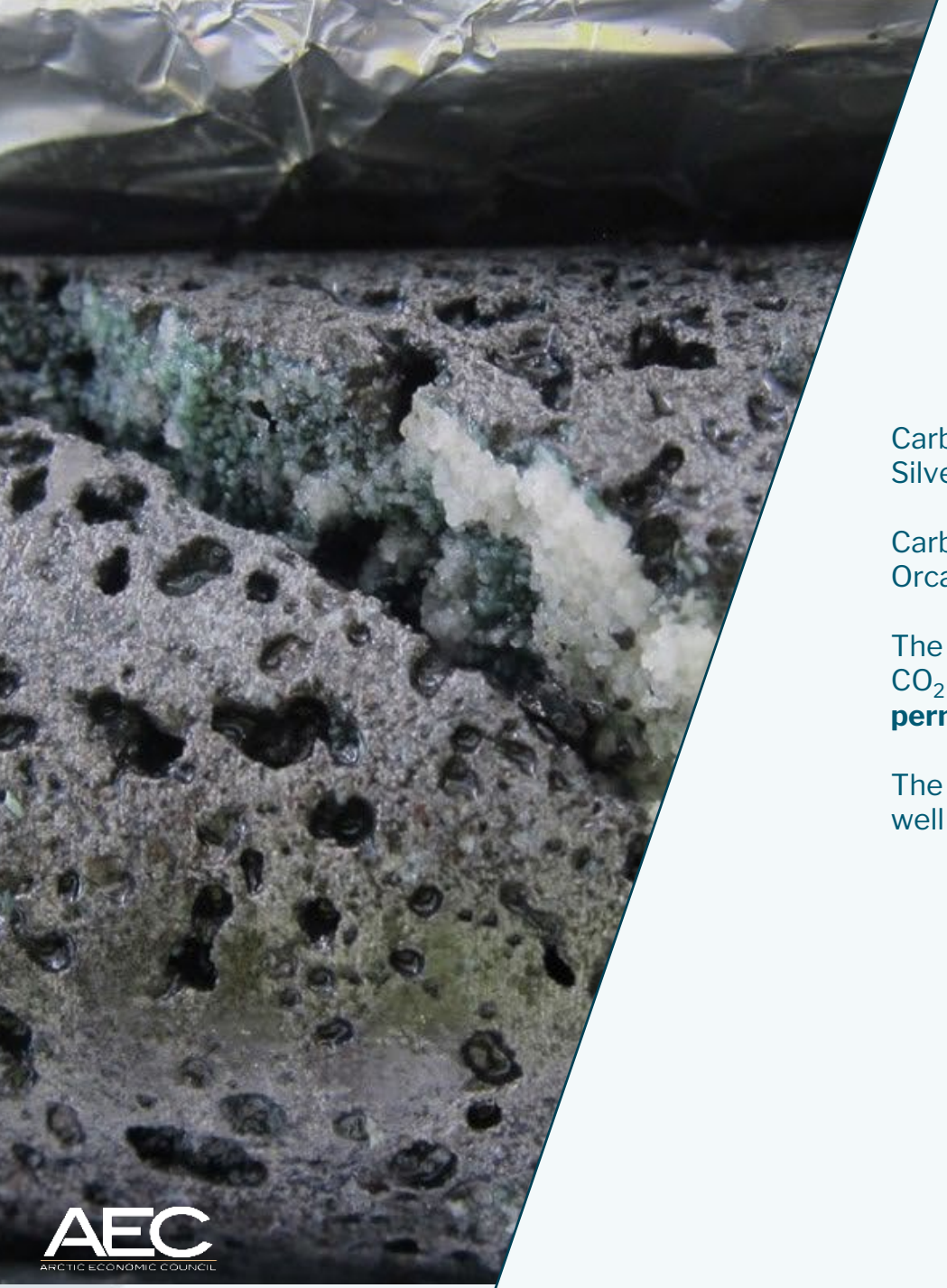
Technology – CCS

Subsidiary

Carbfix

Carbfix acts to facilitate the development of the carbon market in Iceland and worldwide.

Snowbox



PROJECT PITCH

"A science-driven Icelandic company looking to tackle climate change by turning CO_2 into stone."

THE CODA TERMINAL

Carbfix has operated **a full-chain CCMS** at Hellisheidi geothermal power plant since 2014. Project Silverstone is an EU-funded project that will bring CCMS to full-scale at the power plant by 2025.

Carbfix also injects and permanently stores CO_2 captured directly from the atmosphere by Climework's Orca plant, constituting **the world's first commercial direct air capture and storage chain.**

The Coda Terminal in SW-Iceland will be **the world's first CO_2 transport and mineral storage hub**. The CO_2 will be transported to Iceland in specifically engineered ships that run on sustainable fuels, **and permanently stored as solid carbonate minerals via the Carbfix technology.**

The Coda Terminal will additionally accommodate the storage of CO_2 from local industrial emitters, as well as CO_2 directly captured from the atmosphere using direct air capture (DAC) technology in Iceland.

Straumsvík, Iceland

Technology – CCS

Subsidiary

Carbfix

AEC ARCTIC ECONOMIC COUNCIL

PROJECT PITCH

"A science-driven Icelandic company looking to tackle climate change by turning CO_2 into stone."

International scientific project

- Founded in 2007 by four academic and industry partners
- Reykjavík Energy, the University of Iceland, CNRS in Toulouse and Columbia University's Earth Institute
- First organization dedicated to facilitating and implementing carbon capture and mineral storage
- Several universities and research institutes have participated in the project

Climate change mitigation

- Will help meet the 55% reduction target by 2030, jointly pledged by Europe, Iceland, and Norway
- Post-2030, Carbfix aims to scale up to 3 Gt CO_2 stored per year, significantly contributing to the Interna Energy Agency's Clean Technology (CTS) scenario
- Also capturing >95% of H_2S emissions from the Hellisheiði Geothermal Powerplant, Carbfix protects ne populations from the effects of harmful atmospheric chemical pollutants

AEC
ARCTIC ECONOMIC COUNCIL

Straumsvík, Iceland

Technology – CCS

Subsidiary

Carbfix

Q&A

How does your project balance economic and social goals with environmental protection?

The Carbfix project has a means to synchronously combat the effects of climate change whilst benefiting social welfare in the long term. By capturing not only CO_2, but additionally >95% of H_2S emissions from the Hellisheiði Geothermal Powerplant, Carbfix protects nearby populations from the effects of harmful atmospheric chemical pollutants. In addition, Carbfix acts to facilitate the development of the carbon market in Iceland and worldwide.

The cost of onsite Carbfix operations at Hellisheiði is US $24.8/ton CO_2, less than the average price of carbon quotas in the EU Emissions Trading Scheme.

How have you partnered with the research community in measuring project processes and impacts?

Carbfix was founded in 2007 by four partners, three of which are academic institutions: the University of Iceland, CNRS in Toulouse and Columbia University's Earth Institute. As a result, over 100 scientific publications have been published in peer-reviewed journals, as well as PhD, MSc and BSc theses. Since its start-up, several universities and research institutes have participated in the project within EU funded sub-projects, including Amphos 21, Climeworks and many universities including ETH Zurich, UCL etc.

How have you entered public/private partnerships with the local community and/or government?

In June 2019 Carbfix and heavy industrial emitters in Iceland signed a trilateral Declaration of Intent to explore whether the Carbfix process is technologically and economically viable to reduce CO_2 emissions from their industrial facilities.

Members of the consortium include the Government of Iceland, ÍSAL – Rio Tinto Group, Norðurál – Century Aluminum, Fjarðaál -Alcoa, Elkem Iceland, PCC BakkiSilicon and Carbfix – Reykavík Energy Group.

Do you have anything else to add about your project? What are your next steps?

The company's mission is to become a key instrument in tackling the climate crisis by reaching one billion tons (1 Gt CO_2) of permanently stored CO_2 by 2030. To reach the gigaton scale Carbfix is developing a cross-border carbon transport and storage hub in Straumsvík, Iceland: The Coda Terminal. CO_2 captured at industrial sites in North Europe will be shipped to the Terminal.

The emissions will be pumped into a network of nearby injection wells and dissolved in water prior to injection into the basaltic bedrock, for permanent storage. The Coda Terminal will help meet the 55% reduction target by 2030, jointly pledged by Europe, Iceland, and Norway.

Post-2030, Carbfix aims to scale up to 3 Gt CO_2 stored per year, significantly contributing to the International Energy Agency's Clean Technology (CTS) scenario, which requires 107 Gt CO_2 to be stored to reach global climate and energy goals

STAKEHOLDERS

"A science-driven Icelandic company looking to tackle climate change by turning CO_2 into stone."

The Carbfix project was founded in 2007 by four academic and industry partners:

- Reykjavík Energy,
- the University of Iceland, CNRS in Toulouse
- and Columbia University's Earth Institute.

On January 1st 2020, it was established as a company, representing the first organization dedicated to facilitating and implementing carbon capture and mineral storage (CCMS) storage worldwide.

- It is fully owned by its mother company, Reykjavik Energy.

Straumsvík, Iceland

Technology – CCS

Subsidiary

Carbfix

AEC ARCTIC ECONOMIC COUNCIL

SNOWBOX

ARCTIC AUTONOMOUS DRIVING

AURORA INTELLIGENT TRANSPORT CLUSTER

AEC
ARCTIC ECONOMIC COUNCIL

Muonio, Finnland

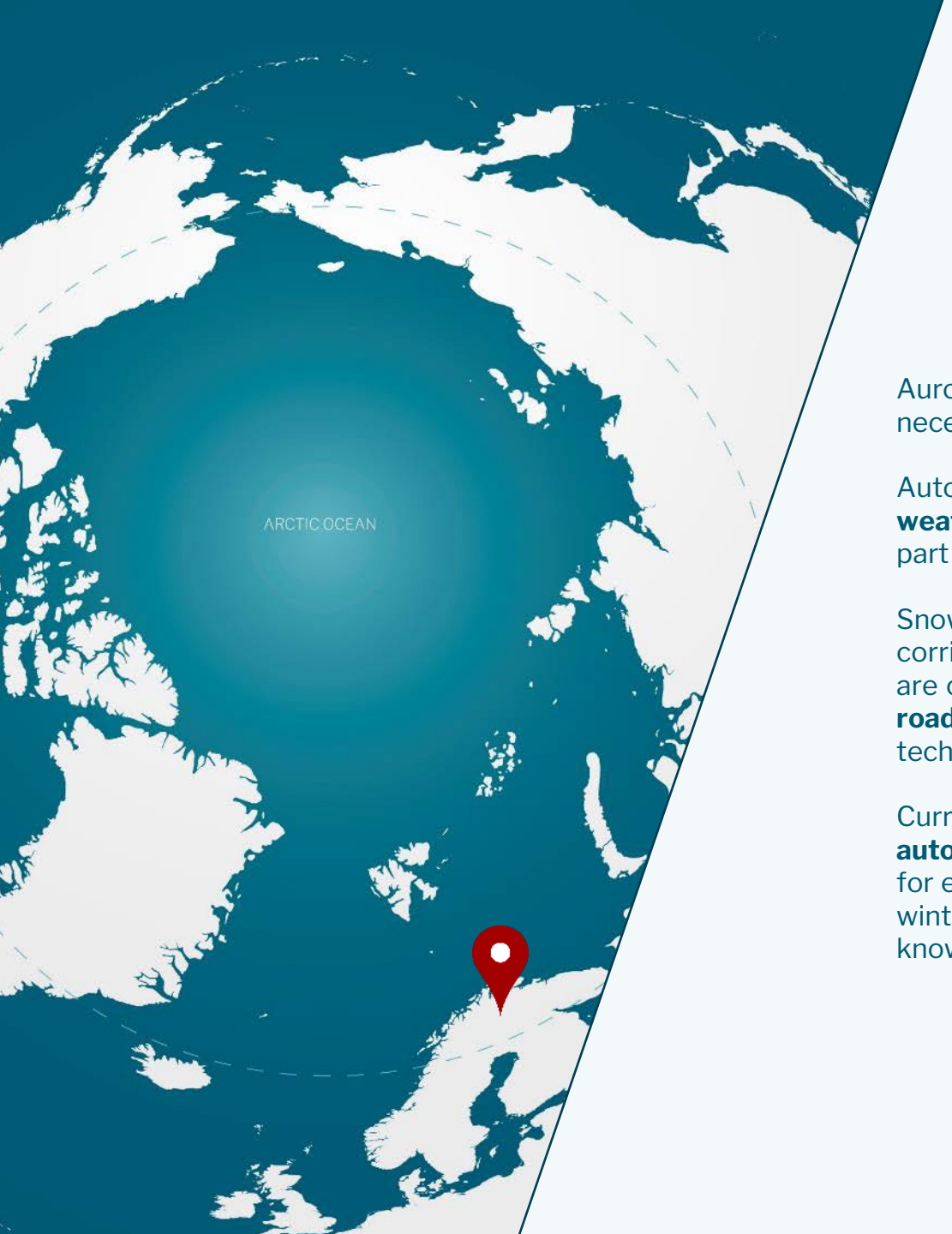
Technology - Road Testing

Public Private Partnership

SNOWBOX

Snowbox´s biggest challenge is being the pioneer in the sector. It is not easy to secure project funding for the Cluster partly because Finland is not an automotive industry-based country, but also because SME partners like to have revenue from the new business as soon as possible.

Snowbox



AURORA SNOWBOX

"Finnish company using their 'snow-how' and test facilities to fill a key market gap with an autonomous vehicle testing cluster in the Arctic"

Aurora Snowbox provides **a winter and cold testing environment** with comprehensive and necessary facilities for connected and automated vehicle technologies.

Automated driving, shared and electric mobility will not become globally widespread without **weather-proof technological solutions.** Therefore, winter, and cold testing is a fundamental part of modern vehicle testing processes.

Snowbox testing environment combines predefined test sections on public roads, cross-border corridors in Sweden and Norway and safe and secure proving grounds via its partners. Facilities are completed with **'snow-how' knowledge, engineering and information services, and digital road infrastructure** to contribute to the self-driving vehicle industry to obtain weather-resilient technological and worldwide scalable solutions.

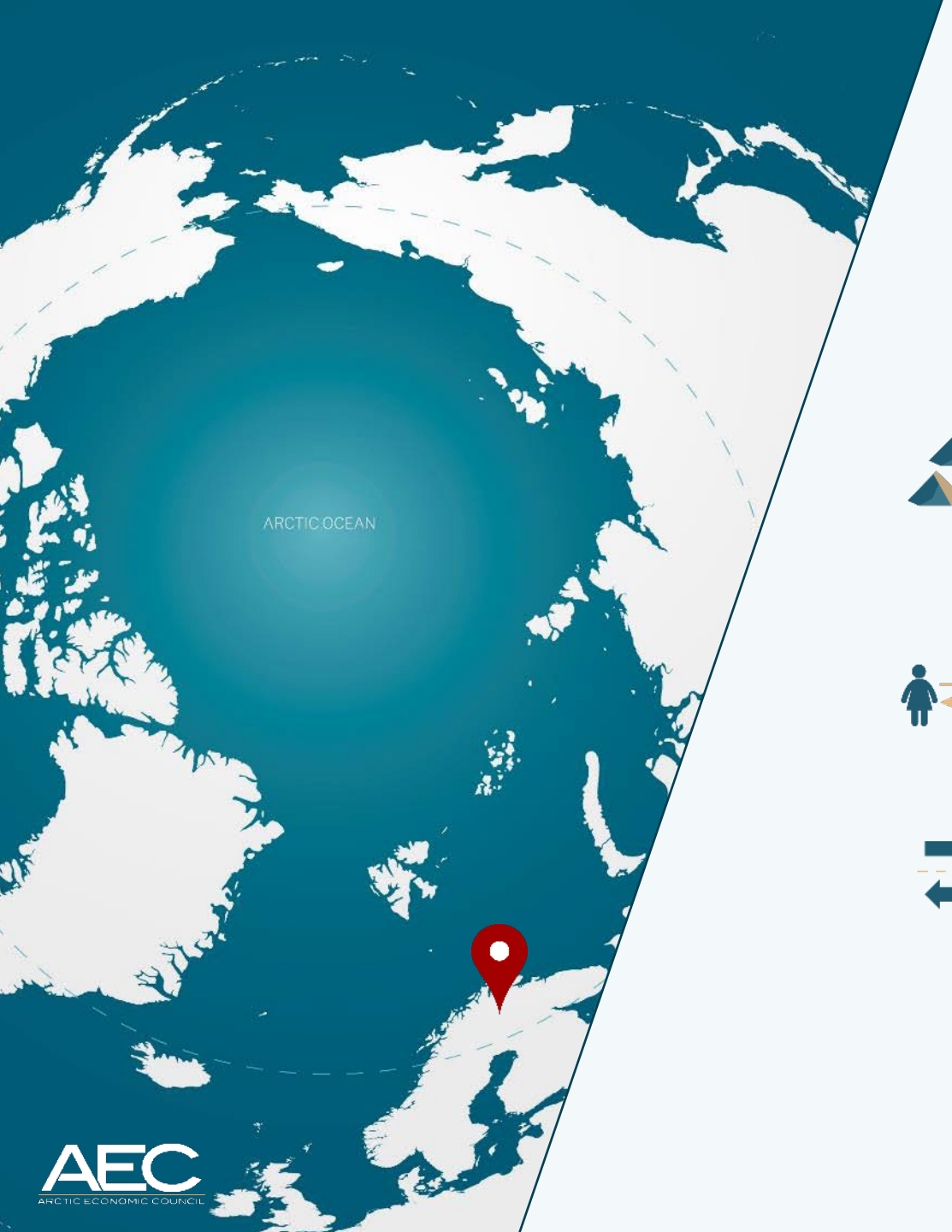
Currently Aurora Snowbox is **the only company in Europe offering testbed for connected autonomous driving** on public roads, proving grounds and providing authentic local winter data for early-stage simulation and virtual testing. One of the Snowbox partners has experience with winter vehicle and **cold testing for more than 40 years in the region**. Clients are mostly well-known car brands in Germany.

Muonio, Finnland

Technology - Road Testing

Public Private Partnership

SNOWBOX



KEY DATA

"Finnish company using their 'snow-how' and test facilities to fill a key market gap with an autonomous vehicle testing cluster in the Arctic"

PRODUCTION/OUTPUTS

- Cold weather road testing .
- Snowbox test environment is located 200 km above the Arctic Circle bordering Northern Norway and Sweden.

PERSONNEL

- Currently: 1
- After completion: 2 (minimum)

PROJECT TIMELINE

- Duration of 30 months.
- Completed by 02/2022.
- **Project status:** approved

Muonio, Finnland

Technology - Road Testing

Public Private Partnership

SNOWBOX

FINANCIALS

"Finnish company using their 'snow-how' and test facilities to fill a key market gap with an autonomous vehicle testing cluster in the Arctic"

$367K **TOTAL COST**

332K€ ($367k USD)

$63.8K **ANNUAL REVENUE**

Revenue 2020: US$63,862

$342K **TURNOVER**

Aim is to get 300K€ initially (US$342k)

INVESTMENT

- Annual needed: 250k € (US$285k)
- Annual received: 332k € (US$367k)

Muonio, Finnland

Technology - Road Testing

Public Private Partnership

SNOWBOX

SUSTAINABILITY

"Finnish company using their 'snow-how' and test facilities to fill a key market gap with an autonomous vehicle testing cluster in the Arctic"

The SDG's are fulfilled in numerous ways. These include but are not limited to:

Muonio, Finnland

Technology - Road Testing

Public Private Partnership

SNOWBOX

PROJECT PITCH

“Finnish company using their ‘snow-how’ and test facilities to fill a key market gap with an autonomous vehicle testing cluster in the Arctic"

AURORA INTELLIGENT TRANSPORT CLUSTER

Aurora Intelligent Transport Cluster has been **funded by Business Finland 2019** and is estimated for completion by February 2022. During the Project a service platform has been designed by combining partners’ expertise and extended Snowbox international network.

Aurora Snowbox is participating in the ISO standardization working group (ISO 34500) that is **carrying out standards for the test scenarios of autonomous driving systems**. Upon completion of the Cluster project, Aurora Snowbox is searching for funding to continue developing test facilities in the Arctic.

We have real-time information about the environment (weather and road weather), road condition, precise positioning down to 5 cm (validated by European Space Agency), winter data for simulation testing, Snowbox Digital Twin, and HD map.

The project aim has been to **facilitate a testing environment**, to design **one-stop-shop-basis services** and to utilize Arctic unique winter features for technology development work and enlarge current **well-known cold testing business into the new self-driving business sector**. We believe that supply creates demand.

Today no single vehicle drives without winter testing.

It has been part of the fundamental vehicle and component testing method for many decades and autonomous vehicles with embedded sensors won´t be an exception. As known, one of the biggest challenges for autonomous driving is bad weather causing troubles for designers of the self- driving developers. Weather-aware decision making is one of the main priorities from the technological point of view.

Not every kilometer nor environment is equal for testing.

Trying to achieve weather-resilient solutions is the base for commercialization; it is necessary to increase systematic testing in harsh weather. That is possible only, if there are winter test sites, which includes elements like cross-border area, proving ground and real-world environment for autonomous driving testing. Snowbox covers all these features. Furthermore, it has winter datasets that can be used for virtual testing.

Correlation and validation tests can be done in the original real-world domains after simulation. Unknown situations and residual risks can be found out via testing also only through the real-world testing. Winter testing needs long-lasting harsh conditions, and that is possible only in certain areas in Northern Europe.

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?
Aurora Snowbox's biggest positive contribution to the Arctic is that it strengthens the local and regional economy by creating employment and business opportunities for locals, SMEs, and communities. The need for Arctic winter testing for CAVs (connected autonomous vehicles) is becoming extremely important, and Aurora Snowbox is filling a gap in the market. We utilize our 'snow-how' and knowledge about extreme weather. In the short term, CAVs will be electric and shared to enable more environmentally friendly transport and mobility for people and goods.

Enabling appropriate winter testing for electric vehicles Aurora Snowbox fosters positive development work of green mobility and environmentally friendly electric vehicles.

How does your project integrate long-term sustainability, especially in the local community, into its design?

Our local municipalities – Muonio and Enontekiö – have been involved in our actions since we began in 2015. The members of the Aurora Advisory Board are also active participants. The first 3 years of local municipalities led the Snowbox initiative. All actions have aligned with community priorities. The Municipality of Muonio has a local strategy based on cold climate technology.

What is your fundraising strategy? What barriers or challenges have been greatest in securing funding for your project?
The most we need is to find early-stage end-users to utilize Snowbox services and test environment facilities. Self-driving winter testing is new but will become more common as technology matures.

Snowbox´s biggest challenge is being the pioneer in the sector. It is not easy to secure project funding for the Cluster partly because Finland is not an automotive industry-based country, but also because SME partners like to have revenue from the new business as soon as possible.

We can create a workable testing ecosystem with a strong business model with our partners. As soon as we have a client (OEM, Tier1), we can offer a subcontractor to put their knowledge into place. The initiative is promising but takes time and money to lead it into the business level. Covid-19 has not helped with international communication and marketing.

How does your project help develop human capital in the communities where it's located?

We would like to give communities work possibilities in the region where they live, giving local people employment opportunities that keep them in the area permanently.

Q&A

Snowbox provides local and national economic growth in many ways, if we can enlarge Finnish winter car testing to the self-driving industry. The direct and indirect output and demand for local services is remarkable e.g., accommodation, outdoor activities, transport services, catering. We work with the Aurora Advisory Board, holding meetings with representatives of the municipalities.

How have you partnered with the research community in measuring project processes and impacts?

Our partners hold meetings with the Aurora Advisory Board where regular discussions are held over processes, impacts and other questions as well. Research community is represented by Finnish National Land Survey /Finnish Geospatial Institute, University of Lapland Applied Sciences. They have done research and practical research projects with us.

What technical measures are in place to monitor for local impacts and hazards from your project?

We have not monitored or analyzed concrete local impacts, because we are not yet at this stage in our actions. Feedback from the local communities have been always positive and encouraging.

How have you entered into public/private partnerships with the local community and/or government?

Aurora Intelligent Project is a Public-Private Project that since 2015 has involved local, regional and national authorities and communities. The conceptual framework behind Aurora Snowbox came from the Finnish transport authorities, who liaised with local communities and partners to explore design possibilities and a testing ecosystem in Lapland.

Autonomous vehicles can be tested on Finnish public roads and the test vehicle can be remote controlled thanks to our legal framework for CAV testing and social license to test, since activities are supported by local municipalities.

How have you tried to set best practices for Arctic investment and what best practices have you followed from others?

The best practices have been business-related. Regarding Intelligent Infrastructure and Aurora Intelligent Road, the best knowledge has been gathered from private companies in Finland who have expertise in weather-related issues.

We have partnered with Catalonian Living Lab in Spain and learned a lot from them about the CAV business e.g., how to create test sections on open roads.

PolArctic LLC

ICE³ PROJECT

Lorton, VA, USA

Technology – Data Analytics

Private

PolArctic

"Alaskan data analytics company providing AI-driven modeling of sea ice to enable Arctic shipping and environmental protection."

PolArctic provides **advanced data analytic expertise in oceanographic modeling and research**. PolArctic has custom Artificial Intelligence and Machine Learning (AI/ML) tools that **provide solutions to increasingly complex maritime operations in the Arctic.**

Widespread summer sea ice melt and the anticipated **expansion of shipping and offshore resource exploration have highlighted a need for advanced technology** to support safe and sustainable maritime operations.

The accuracy of sea ice and bathymetry modeling is critical to the success of Arctic maritime operations. PolArctic's AI solutions have a demonstrated record of providing accurate, timely, adaptable, and **cost-effective solutions to meet the needs of evolving maritime operations**.

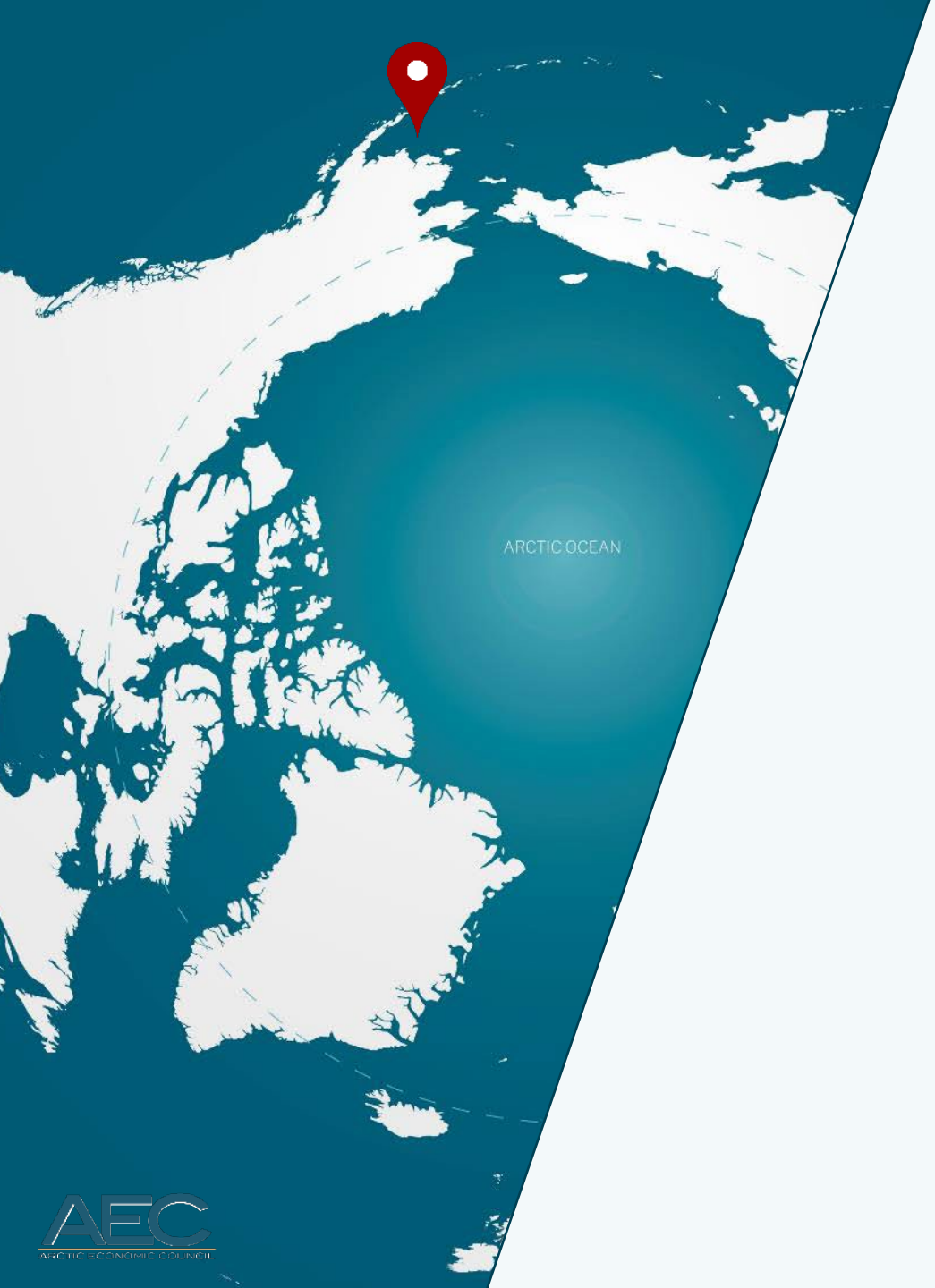
PolArctic LLC has worked with diverse industries including private, oil and gas, renewable energy, and various other United States federal government agencies.

Lorton, VA, USA

Technology – Data Analytics

Private

AEC
ARCTIC ECONOMIC COUNCIL



KEY DATA

"Alaskan data analytics company providing AI-driven modeling of sea ice to enable Arctic shipping and environmental protection."

PRODUCTION/OUTPUTS

- accurate forecasting of Arctic ice break-up and refreeze activities up to a year in advance.

PERSONNEL

- Currently 3

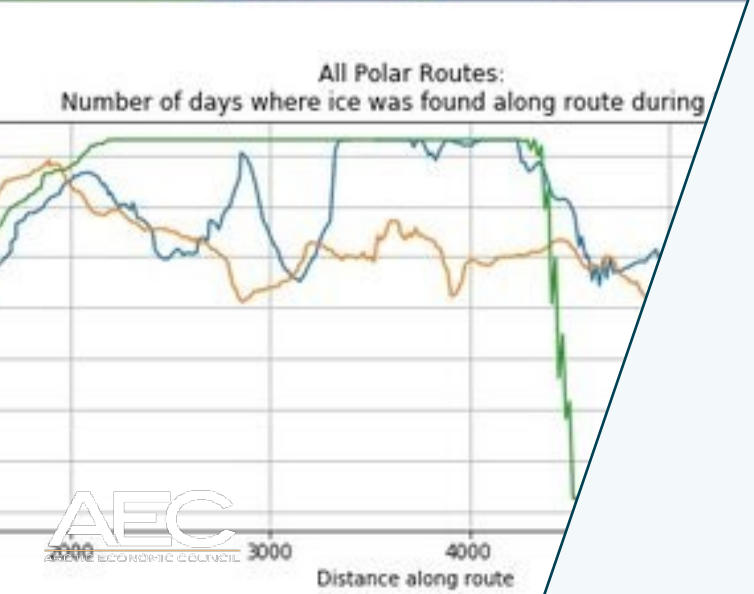
PROJECT TIMELINE

- **Project status:** ongoing

Lorton, VA, USA

Technology – Data Analytics

Private



FINANCIALS

"Alaskan data analytics company providing AI-driven modeling of sea ice to enable Arctic shipping and environmental protection."

$223.499 **ANNUAL REVENUE**
US$233,499 (2020)

$225K **INVESTMENT**
US$225K of federal grant awards since inception in 2018

FUNDING
Private Contracts and U.S. Government Grants

Lorton, VA, USA | Technology – Data Analytics | Private

SUSTAINABILITY

"Alaskan data analytics company providing AI-driven modeling of sea ice to enable Arctic shipping and environmental protection."

The SDG's are fulfilled in numerous ways. These include but are not limited to:

Lorton, VA, USA

Technology – Data Analytics

Private

PROJECT PITCH

"Alaskan data analytics company providing AI-driven modeling of sea ice to enable Arctic shipping and environmental protection."

ICE³ PROJECT

PolArctic Artificial Intelligence sea ice forecast product Ice³ is **a neural network leveraging a broad range of data sources** to generate accurate **forecasting of Arctic ice break-up and refreeze activities** up to a year in advance.

Ice³ advanced neural algorithm is the only market-capable solution with the demonstrated ability to identify industry-usable Arctic patterns through the **analysis of historical and real-time ice presence, ocean temperature, air temperature, and salt content**. Ice³ then tailors the results to meet the unique needs of each customer.

Ice³ works anywhere in the Arctic. The Sea Ice Prediction Network (SIPN) solicits pan-Arctic sea ice extent forecasts. In 2019, PolArctic estimated 4.3 million km2 for the average sea ice extent for September; the actual measured extent was 4.32 million km2.

PolArctic developed their AI classifier, useful in the rapidly changing coastal regions of Southern Alaska, to distinguish mudflats from muddy water.

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PolArctic has this unique advantage in the Arctic as traditional technology does not have the resolution to guarantee the safety of maritime operations. The economic benefits of procuring leading data on current tides and underwater obstacles is unmatched. 30cm of extra depth allows for 2,000 more tons of cargo

Ice³ provides the **probability of ice presence at any physical point at any time** and the result can be scaled from micro to macro, meeting the business needs from inlets to the entirety of the pan-Arctic. Among its predictions are **ice growth patterns, refreeze rates, ice on route, and probability and length of freeze durations.**

PolArctic's Ice³'s predictive modeling provides proven results that empower businesses and governments with the knowledge necessary to **maximize future operations while minimizing the unknown navigation risks.**

Machine damage or failure is the most frequent (47%) cause of incidents in the Arctic. There have been 520 incidents in the last decade and as the number of ships in the region increases, so will the number of incidents. PolArctic brings the power of **AI technology to the Arctic blue economy for responsible and sustainable development.**

Lorton, VA, USA | Technology – Data Analytics | Private

The partnership focused on development and application of artificial intelligence tools leveraging remote sensing data to determine if conditions were present for three species' habitats within an area around the community of Sanikiluaq. This partnership served to demonstrate the value of using data to enhance traditional fisheries management.

PolArctic

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

PolArctic's tools support local infrastructure development and maritime operations in a safe and ecologically sound manner. Ice information requirements vary depending on the scale of stakeholder operations. Cruise ships and other tour operators, fishing vessels, and indigenous subsistence hunters all stand to benefit from timely, accurate sea ice forecasts that enhance operational efficiencies and safety in the region.

For each of these user groups, PolArctic is able to provide precise and adaptable modelling, complete with spatial and temporal resolutions to best suit customer needs for safety, planning, and situational awareness. PolArctic's Ice^3 produces the probability of ice presence at any physical point at any time and the result can be scaled from micro to macro, meeting the needs of businesses spanning from inlets to the entirety of the pan-Arctic.

To protect ecological health, PolArctic's innovative modelling solutions provide increasing maritime traffic with the data necessary to reduce risk of colliding with ice and ensure the safe navigation of continually evolving coastlines, subsequently reducing the probability of causing catastrophic damage to the Arctic environment and ecosystem.

What is your fundraising strategy? What barriers or challenges have been greatest in securing funding for your project?

PolArctic has grown organically, leveraging funding streams through private business contracts to expand its artificial intelligence modelling portfolio. Through focusing on internal modelling development to meet our customer needs, while leveraging openly available data sources in new and innovative ways, PolArctic is able to minimize costs associated with business expansion.

As PolArctic continues to develop proven models that provide tangible benefits to maritime businesses, we will be seeking investment to scale.

The National Science Foundation is providing funding to PolArctic through the Small Business Innovative Research grant which will be used to develop AI and modelling technology at PolArctic – generating models equipped for more complicated analysis.

What resources or organizations have you relied on when crafting your project's sustainability strategy?

PolArctic predominantly adheres to the UN sustainable development goals and is a member of the UN Decade of Ocean Science Arctic working group. Additionally, PolArctic uses the Arctic Council's Protection of the Arctic Marine Environment resources to guide our sustainability practices.

Q&A

How does your project integrate long-term sustainability, especially in the local community, into its design?

PolArctic LLC is focused on supporting sustainable development in a changing Arctic through scientific data analysis, machine learning, and artificial intelligence. PolArctic is an Alaska Native-owned business and understands first-hand how Arctic communities, including indigenous populations, represent the front line of adaptation to climate change.

Coastal and river erosion due to a loss of sea ice, movement of terrestrial and marine subsistence food sources, and the impact of increasingly frequent and intense winter storms continue to impact

Arctic communities. PolArctic's ability to predict fall sea ice freeze-up is a high priority for coastal communities as the presence of sea ice constrains community re-supply and is vital for sustained subsistence activities. Against a background of limited funding for Arctic operations, sea-ice forecasting fills a critical infrastructure gap in reducing risk to maritime assets.

When interpreted within a context of dynamic uncertainty, sea-ice forecasts are a useful tool for identifying areas of critical concern for domain awareness and accident prevention, increasing the positive aspects and generating more sustainable investment in the region.

How does your project balance economic and social goals with environmental protection?

PolArctic Ice^3 provides predictive data of Arctic conditions for future months and years, enabling business and government the ability to plan logistics activity in the Arctic, and allows for informed decision-making for future operation plans and risk assessments. Sea ice melting has opened up previously nonexistent shipping lanes for navigation, driving new levels of activity involving established and new stakeholders. The use of trans-Arctic shipping routes and areas of interest for tourism is expected to increase with the longer open-water seasons.

The necessity of safe navigation for civilian ships not rated for ice operations, dynamic geographical needs, and transportation is driving the need for increased innovation in navigation tools. Sailors, crews, and marines alike require constantly evolving information for safe navigation through changing coastal hazards. Current government sea ice forecasting is not capable of providing solutions with the agility, quickness, and accuracy to suit modern needs.

PolArctic provides proven data-based solutions that empower businesses and governments with the knowledge necessary to maximize future operations, while minimizing the unknown navigation risks, therefore encouraging economic growth while protecting the marine environment.

The advantages of AI to Arctic business include sustainability and efficiency of operations. It is important to have access to the data and tools to support the logistics to do it right the first time, to completely prevent disaster in a fragile ecosystem of the maritime Arctic.

Q&A

How have you entered into public/private partnerships with the local community and/or government?

PolArctic worked with C-CORE on the commercial inshore fishery potential (CIFP) project for the community of Sanikiluaq, Nunavut, funded by the Government of Nunavut, the Nunavut Fishery Association, and the World Wildlife Foundation.

The partnership focused on development and application of artificial intelligence tools leveraging remote sensing data to determine if conditions were present for three species' habitats within an area around the community of Sanikiluaq. This partnership served to demonstrate the value of using data to enhance traditional fisheries management.

The co-founder and CEO of PolArctic participated in the development of the UN Decade of Ocean Science Arctic Action Plan and spoke on the Arctic

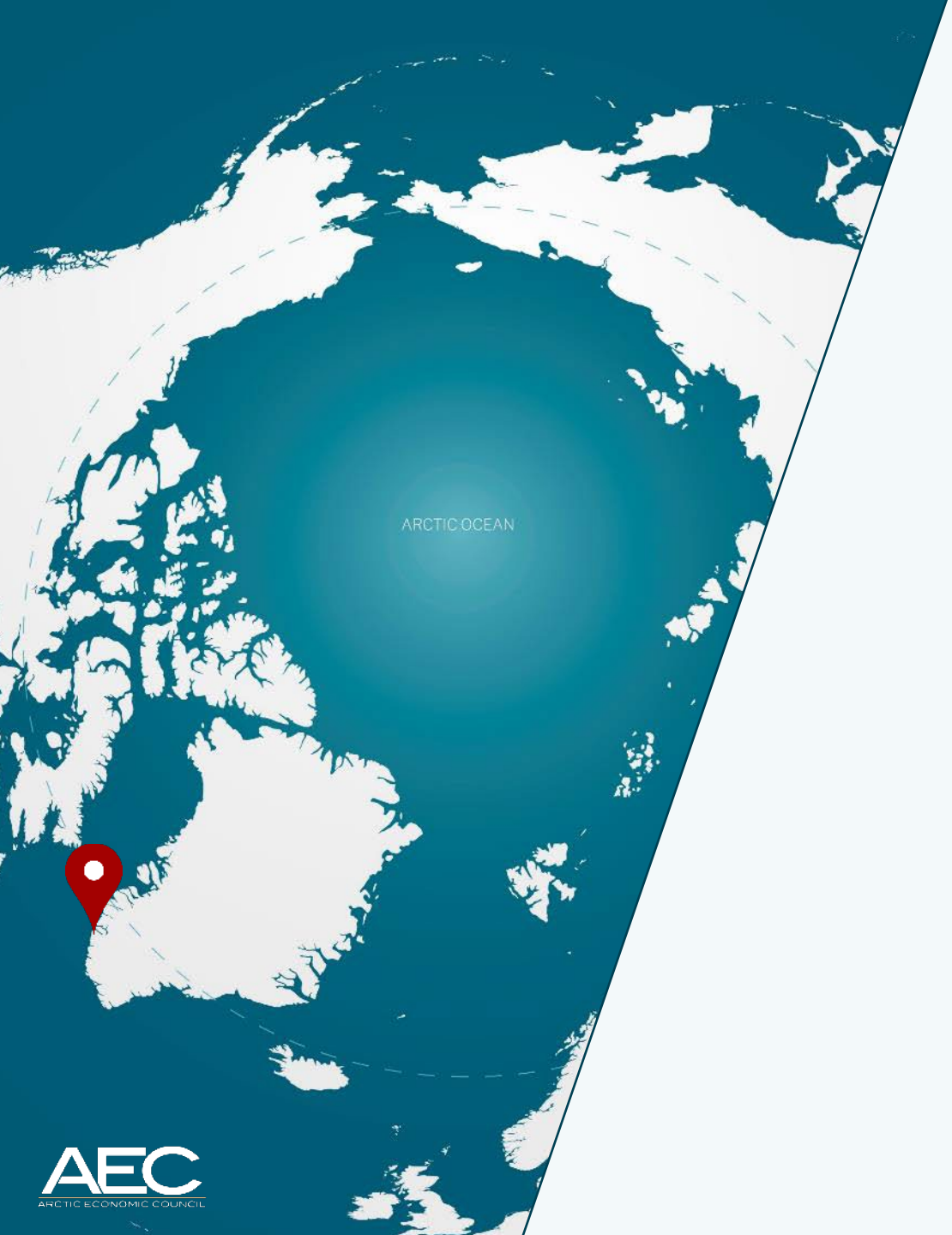
Domain Awareness Center Panel which seeks to explore the networks, resources and infrastructure to enable the commercial entrance of Arctic-related products and technologies into the Arctic domain.

How has your project integrated local/indigenous knowledge?

PolArctic's CIFP project pioneered the interweaving of Indigenous knowledge, satellite data, scientific research, and artificial intelligence into an adaptive co-management solution.

This involved creating a new framework for the way the Arctic Indigenous communities can adapt to new climate patterns and create sustainable aquaculture solutions through the merging of traditional knowledge and advanced technologies.

MINING



GREENLAND RUBY

AAPPALUTTOQ RUBY MINE

AEC
ARCTIC ECONOMIC COUNCIL

Fiskenæsset, Greenland

Mining – Ruby

Private

GREENLAND RUBY

GREENLAND RUBY

"Sustainably sourced and traceable ruby mining operation in Greenland, which facilitates the funding of local initiatives and climate research in the Arctic"

Greenland Ruby is **an active ruby and pink sapphire mining operation**, established in October 2016.

Greenland Ruby is part of LNS Group, a Norwegian, family-owned company.

Greenland Ruby is a member of the International Colored Gemstone Association (ICA) CIBJO (World Jewellery Confederation) and the AGTA (American Gem Trade Association). The company is also the first colored gemstone mining member of the Responsible Jewelry Council.

The **sales and marketing office is located in New York City, and Paris** respectively, with additional offices in **Miami, Bangkok, Copenhagen and Mo I Rana in Norway**.

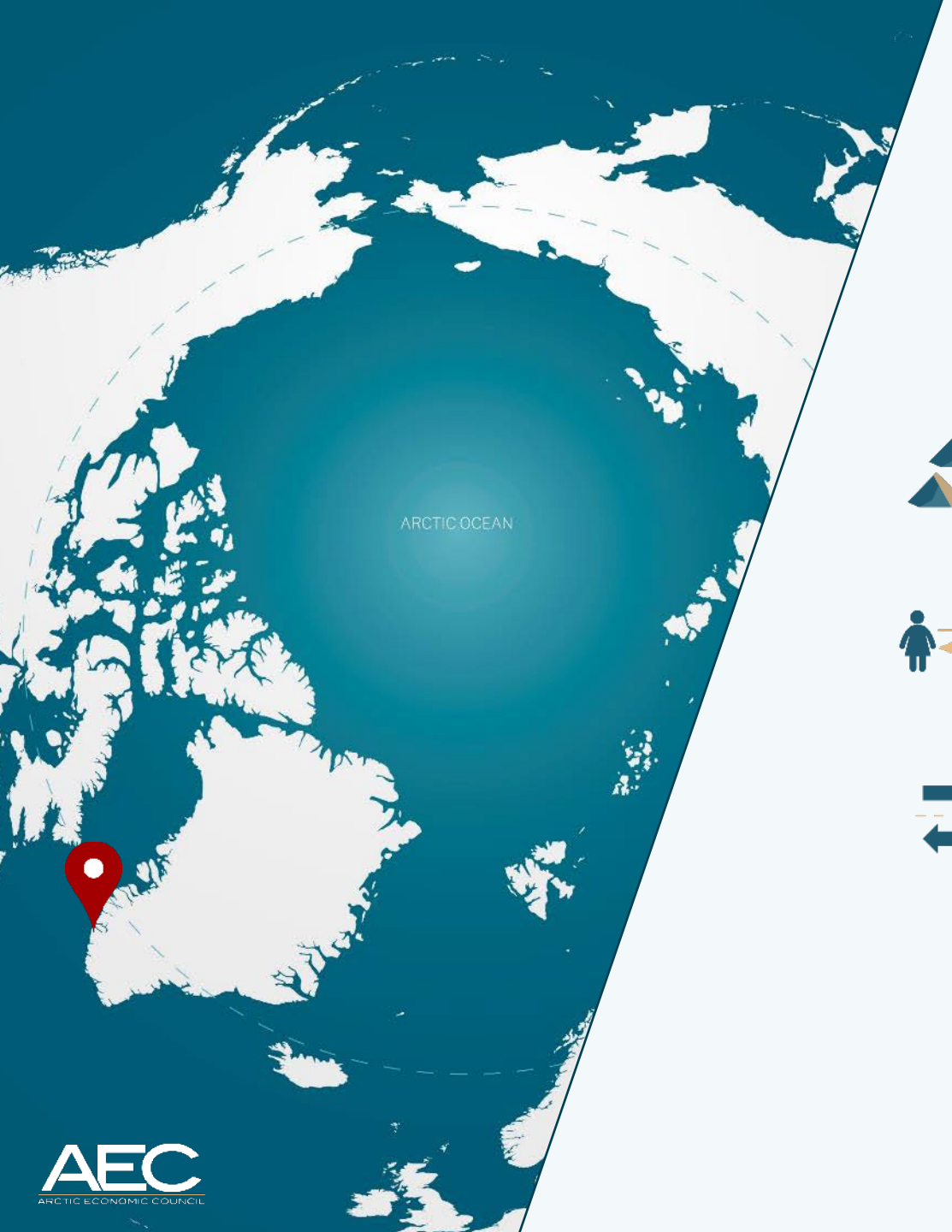
AEC
ARCTIC ECONOMIC COUNCIL

Fiskenæsset, Greenland

Mining – Ruby

Private

GREENLAND RUBY



KEY DATA

"Sustainably sourced and traceable ruby mining operation in Greenland, which facilitates the funding of local initiatives and climate research in the Arctic"

PRODUCTION/OUTPUTS

- 2,600kg annually of sorted rough, translating to almost 1 million carats of polished gemstones.

PERSONNEL

- 55 staff

PROJECT TIMELINE

- 2021-2031
- **Project status:** proposed

AEC ARCTIC ECONOMIC COUNCIL

Fiskenæsset, Greenland

Mining – Ruby

Private

GREENLAND RUBY

FINANCIALS

"Sustainably sourced and traceable ruby mining operation in Greenland, which facilitates the funding of local initiatives and climate research in the Arctic"

$15M

TOTAL COST

Approximately US$15 million per year to operate the ruby mine.

FUNDING

Debt and equity

INVESTMENT

Updated exploration reports, geological studies, confirmation drilling, pilot plant and starting production costs.

$100M

TOTAL ASSETS IN THE ARCTIC

AEC ARCTIC ECONOMIC COUNCIL

Fiskenæsset, Greenland

Mining – Ruby

Private

GREENLAND RUBY

SUSTAINABILITY

"Sustainably sourced and traceable ruby mining operation in Greenland, which facilitates the funding of local initiatives and climate research in the Arctic"

Sustainability strategy

- Partnered with the research community to measure project process and impacts.
- Partner with the International Polar Foundation in Brussels, the Greenland Institute of Natural Resources, and the Greenland Climate Research Center.
- Will to make a difference in the Greenlander's life through the PinkPolarBear Foundation, along with four other Founding Members.
- By driving large-scale change in the behavior of humans we can foster an improvement in the habitat of other species and other life-forms.

Neutral impact on the environment

- There is no residual, visual or environmental impact.
- The Ukkaata Qaava waterway will be refilled once the operation is closed.
- All equipment and buildings will be removed, and the site will be fully restored to its natural wilderness.
- The company is committed to achieving the 17 Sustainable Development Goals as set out by the United Nations

Fiskenæsset, Greenland | Mining – Ruby | Private | GREENLAND RUBY

PROJECT PITCH

"Sustainably sourced and traceable ruby mining operation in Greenland, which facilitates the funding of local initiatives and climate research in the Arctic"

AAPPALUTTOQ RUBY MINE

The current mine at Aappaluttoq is well-funded, but additional funding is sought for the exploitation of the adjacent anorthosite deposit (most probably the largest in the world) of which Greenland Ruby holds the license as well.

Mining will be done **with low-intensity blasting techniques** that are common in the diamond mining industry. The Aappaluttoq Project consists of **mining operations and the processing of ruby-bearing ore to ruby concentrate**.

Greenland Ruby's mining yield is processed at its **ultra-modern, state-of-the-art processing plant** adjacent to the mine. Sorting and cleaning of ruby concentrate is done in Nuuk.

Construction began in 2015 at a capital cost of US$25 million and the ruby mine officially opened in 2017.

The Greenland Ruby mine site is accessed via **a small port for equipment and a heliport** for employees and provisions.

AEC
ARCTIC ECONOMIC COUNCIL

Fiskenæsset, Greenland

Mining – Ruby

Private

GREENLAND RUBY

Greenland Ruby has partnered with the research community to measure project process and impacts, including the International Polar Foundation in Brussels, the Greenland Institute of Natural Resources, and the Greenland Climate Research Center.

Greenland Ruby

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

Greenland Ruby initiated the PinkPolarBear Foundation, whereby a percentage of proceeds from the sale of each gem goes to the Foundation. The foundation supports international polar research in all disciplines, particularly programs focused on understanding the mechanisms driving climate change in the arctic, as well as sponsoring research, cultural projects and education in Greenland. The PinkPolarBear Foundation's first project is to sponsor the Amitsialak Sewing Workshop in Nuuk.

What measures have you taken to increase transparency and guard against corruption in your project's financial and reporting activities?

Greenland Ruby has a state-of-the-art administration and reporting system. We are monitored by our parent company, Norwegian-owned LNS Group, and report to the Government of Greenland, as per our mining license. We are also proud to be the very first colored gem miner to join the Responsible Jewellery Council.

Greenland Ruby is currently undergoing a third-party, independent audit of the supply chain and of the responsible practices as required for its membership in RJC. Our mine-to-market tracking system also makes us unique. The PinkPolarbear Foundation has its own board and is monitored by Greenland Ruby.

How does your project balance economic and social goals with environmental protection?

The Aappaluttoq mining operation has a neutral impact on the climate. There is no residual, visual or environmental impact, and when we close the operation, the waterway (Ukkaata Qaava, which has been determined not to have any fish or other larger aquatic life). will be refilled, all equipment and buildings will be removed, and the site will be fully restored to its natural wilderness.

We also have a CO_2 neutral policy. Human rights, labor, environmental, mining, and product disclosure practices are respected at every project stage. The company is committed to achieving the 17 SDG's (Sustainable Development Goals) as set out by the United Nations.

How does your project integrate long-term sustainability, especially in the local community, into its design?

Greenland Ruby employs local Greenlandic staff, provides training and sponsors local projects, education and exchange programs. All resources are from local vendors. The company also pays royalties on the values extracted, which goes to Greenland's authorities.

Q&A

What resources or organization have you relied on when crafting your project's sustainability strategy?

Greenland Ruby has partnered with the research community to measure project process and impacts, including the International Polar Foundation in Brussels, the Greenland Institute of Natural Resources, and the Greenland Climate Research Center.

In addition, Greenland Ruby is dedicated to making a difference in the lives of Greenlandic people through the PinkPolarBear Foundation, along with four other Founding Members.

Ultimately, by driving large-scale change in the behaviour of humans we can foster an improvement in the habitat of other species and other life-forms. Greenland Ruby has, amongst others, signed an agreement with Greenland's self-rule authorities that constitutes a framework for how the company is to act, both towards authorities as well as the local population.

STAKEHOLDERS

"Sustainably sourced and traceable ruby mining operation in Greenland, which facilitates the funding of local initiatives and climate research in the Arctic"

Greenland Ruby received an US$18 million working capital injection from the Nebari Natural Resources Credit Fund.

Greenland Ruby is part of LNS Group, a Norwegian, family-owned company. LNS GROUP took over from True North Gems.

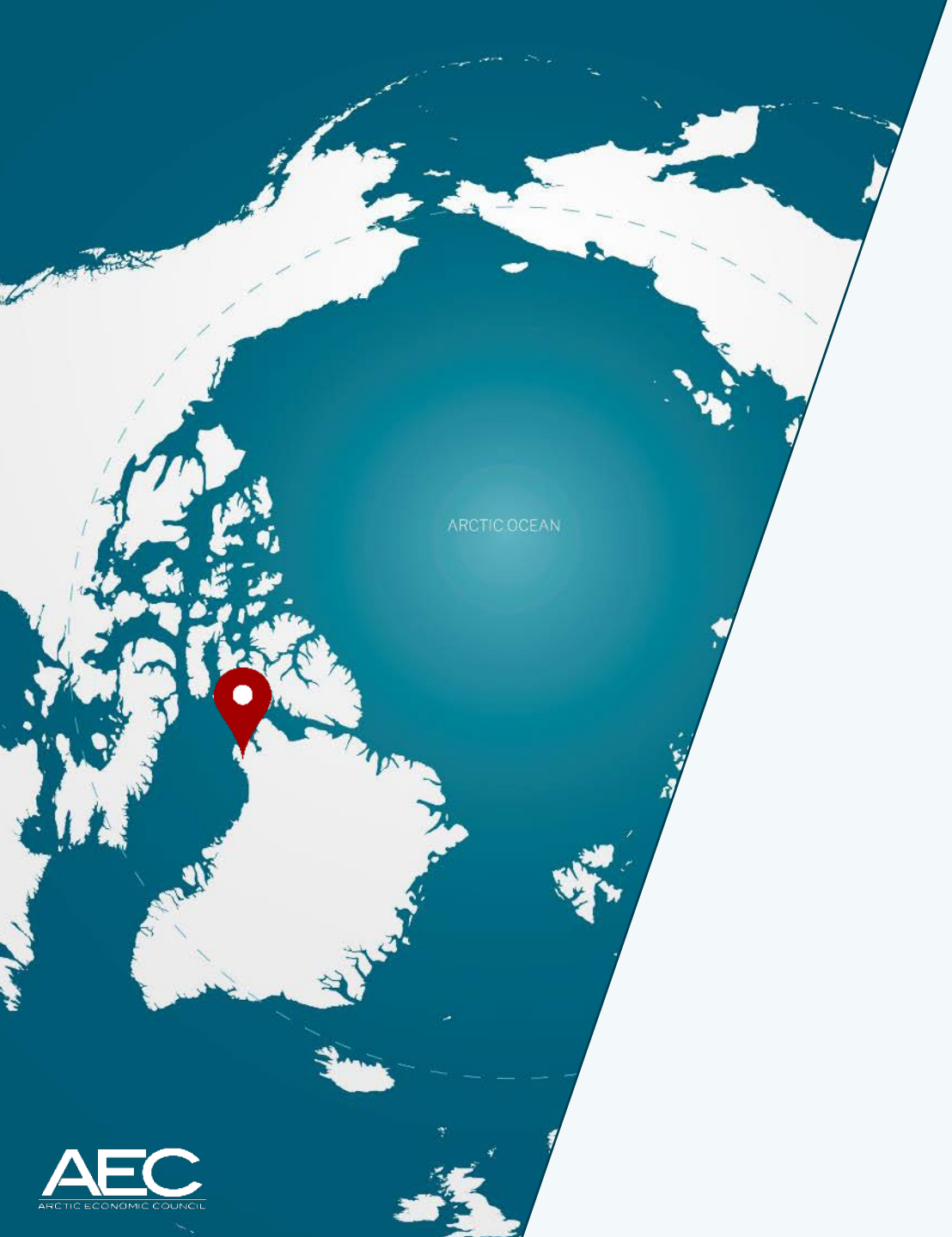
AEC
ARCTIC ECONOMIC COUNCIL

Fiskenæsset, Greenland

Mining – Ruby

Private

GREENLAND RUBY



BlueJay MINING LIMITED

DUNDAS TITANIUM

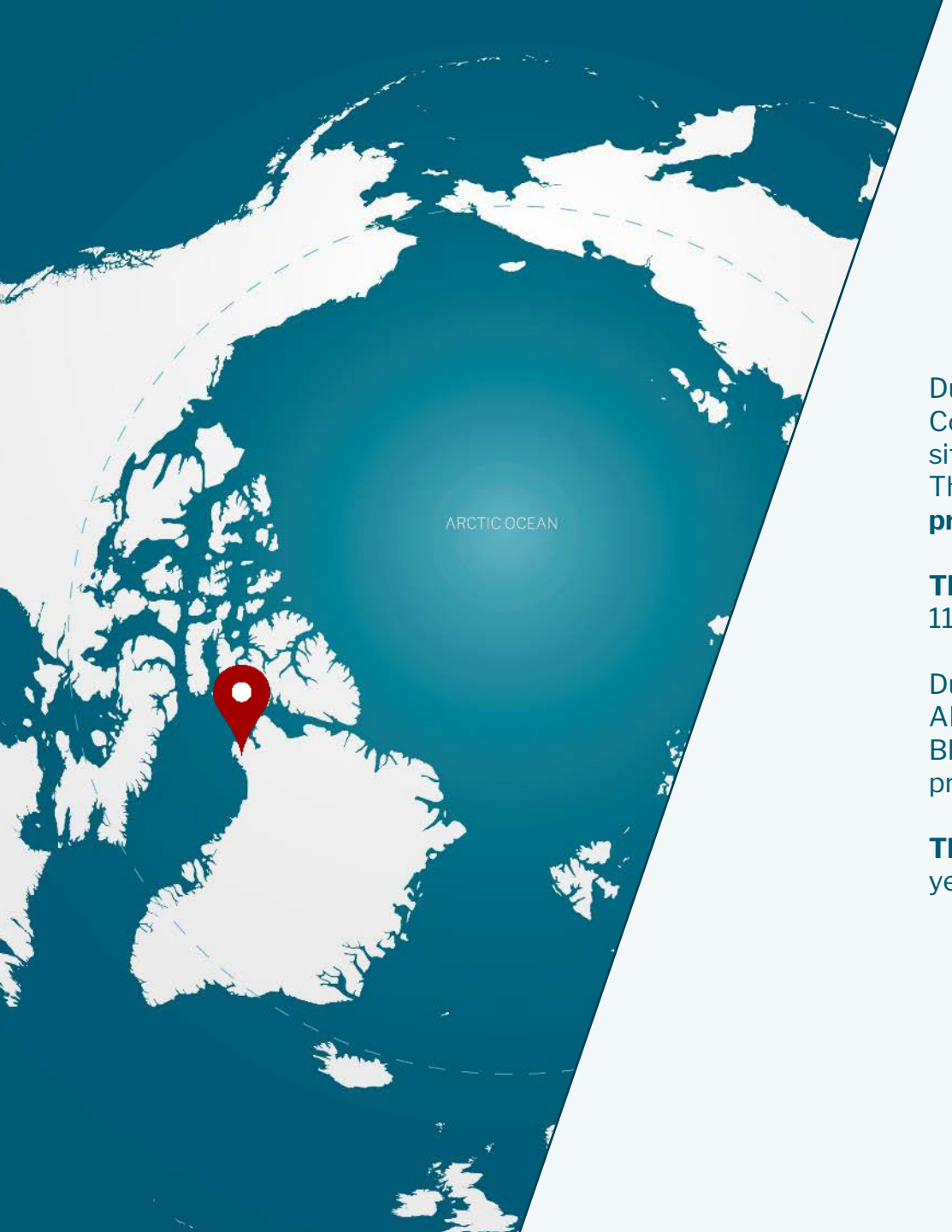
THE DUNDAS ILMENITE PROJECT

Qaanaaq, Greenland

Mining – Ilmenite/Titanium

Public listed company

AEC ARCTIC ECONOMIC COUNCIL



DUNDAS TITANIUM /BLUEJAY MINING

"An exceptionally low-cost / high-grade mineral sand mining project in Greenland "

Dundas Titanium A/S is a Greenland based mineral exploration and mining company. The Company is focused on developing it's 100% owned Dundas Ilmenite Project which is situated on the northern shore of the Wolstenholme fjord northwest coast of Greenland. The Project will **produce an ilmenite concentrate, a primary feed source for titanium metal production**.

The world's highest-grade mineral sands ilmenite project, with current total resources of 117 million tonnes at 6.1% ilmenite.

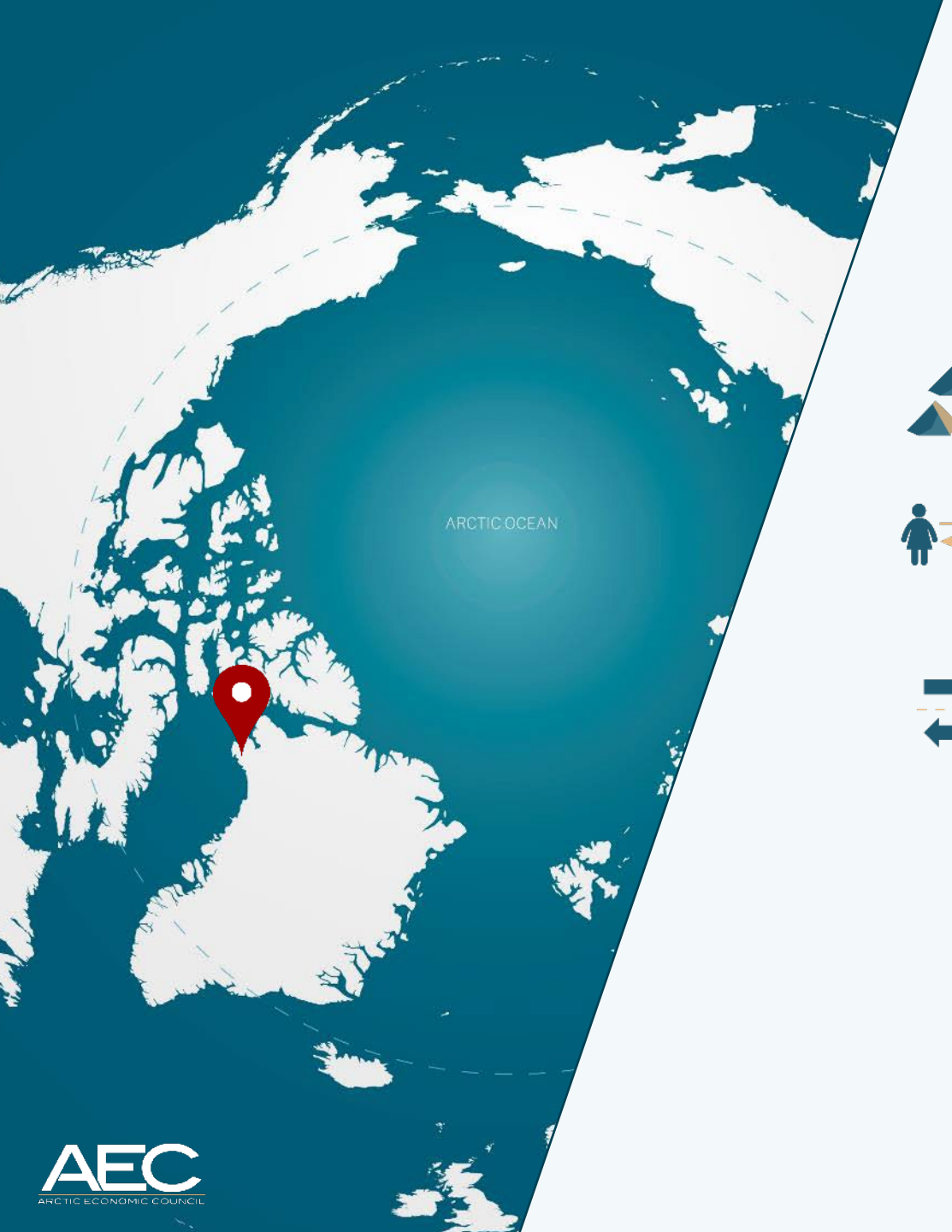
Dundas is 100% owned by Bluejay Mining Plc which is listed on the London Stock Exchange AIM market and Frankfurt Stock Exchange and traded also on the US OTCQB Market. Bluejay Mining Plc is a junior exploration and resource development company focusing on projects in Greenland and Finland.

The Dundas Ilmenite Project is its flagship project that it has advanced over the last 5 years.

Qaanaaq, Greenland

Mining – Ilmenite/Titanium

Public listed company



KEY DATA

"An exceptionally low-cost / high-grade mineral sand mining project in Greenland "

PRODUCTION/OUTPUTS

- Projected out being 440.000 tons of ilmenite concentrate per year.

PERSONNEL

- Projected 175 employees

PROJECT TIMELINE

- Construction period 18-24 months
- 10 years of mine-life
- 10-30 years of anticipated additional mine-life
- In 2020, the Greenland government granted Bluejay Mining an exploitation licence for its Dundas Ilmenite Project. According to the current PFS, the project has a mine life of 11 years.
- Bluejay plans to begin mining no later than the end of 2025, subject to approvals.
- **Project status:** Ready to commence construction. Currently ongoing discussion on CAPEX funding opportunities with financial institutions, export credit agencies and commercial banks.

Qaanaaq, Greenland

Mining – Ilmenite/Titanium

Public listed company

AEC ARCTIC ECONOMIC COUNCIL

FINANCIALS

"An exceptionally low-cost / high-grade mineral sand mining project in Greenland "

$245 M — **TOTAL COST**

$247.2 M — **ANNUAL REVENUE**

Undiscounted net profit of USD $247.2M

$342K — **TURNOVER**

$245 M — **INVESTMENT**

- $24,360,000 for mining
- $57,695,044 for processing
- $60,975,382 for infrastructure

FUNDING

Debt funding
Private, commercial banks, financial institutions, export credit agencies.

Qaanaaq, Greenland

Mining – Ilmenite/Titanium

Public listed company

BlueJay Mining Limited

SUSTAINABILITY

"An exceptionally low-cost / high-grade mineral sand mining project in Greenland "

Sustainable project

- Provides activities, developments and opportunities absent in Northwest Greenland.
- Simple operations appropriate to the local skill-base, workforce.
- Acts as a stepping-stone for the community.
- Supports the development of infrastructure, education and local business creation.

Master distribution agreement

- At the end of 2020, Dundas signed a Master Distribution Agreement.
- Off-take amount of up to 350.000 tons of annual production (minimum off-take 250.000 tons).
- With a large global industry and commodity trading conglomerate with representation and a network in Europe, US, Pacific and Southeast Asia.
- Testifies to the quality of both the Project and the ilmenite extracted at Dundas.

Low environmental impact

- More like a gravel-sand pit operation than true mining.
- No crushing, no chemicals, no blasting, no tailings involved.
- 93% of the excavated material is returned to the pits.

Qaanaaq, Greenland

Mining – Ilmenite/Titanium

Public listed company

The Dundas Ilmenite Mine provides activities, developments and new opportunities previously absent in Northwest Greenland. The simple mining operation and mineral sand processing is appropriate to the local skill-base, workforce and acts as a stepping-stone for the community as the mining sector emerges in Greenland.

Bluejay Mining

PROJECT PITCH

"An exceptionally low-cost / high-grade mineral sand mining project in Greenland "

THE DUNDAS ILMENITE PROJECT

Mining operation with **very high ESG standards** and a s**trong relationship to local Arctic communities**. It will provide **beneficial opportunities, developments, and activities** to Greenland and the high Arctic

mining of the ilmenite-bearing sand is done via **simple excavation of onshore mineral sand** whereafter the ilmenite is extracted by proven wet gravity and dry magnetic separation. It is a very simple, proven and efficient operation in which **7% of the ilmenite is extracted** from the sand volume

Ilmenite is widely **considered to be the most important ore of titanium** – a metal used in everything from jewelry, to prosthetics, surgical tools and mobile phones

Qaanaaq, Greenland

Mining – Ilmenite/Titanium

Public listed company

BlueJay MINING LIMITED

PROJECT PITCH

"An exceptionally low-cost / high-grade mineral sand mining project in Greenland "

THE DUNDAS ILMENITE PROJECT

The Dundas Ilmenite Project ('Dundas' or 'Project') is an onshore mineral sand mining project in North-West Greenland, 80 km south of the Greenlandic town Qaanaaq and 40 km east of the major US Thule Air Base. Ilmenite is a titanium-iron-oxide mineral used by consumers world-wide to produce titanium dioxide and titanium metal. Independently proven to be the highest- grade mineral sand ilmenite project globally.

Since 2015, the Project has been progressed by Bluejay Mining Plc, a junior exploration and resource development company through its 100% owned subsidiary Dundas Titanium A/S (Greenland registered company), through its initial exploration phase; resource definition and advanced mineralogical study; certified pre-feasibility study, environmental and social impact assessments studies; and subsequently at the end of 2020 with the granting of an Exploitation License from the Government of Greenland for 30 years (with possibility for extension).

In June 2021, the 'Exploitation and Closure Plan' permit for the operation was granted by the Government of Greenland. This is the last political permit therefore the project is fully permitted and ready to commence construction (18-24 months) with subsequent production of ilmenite concentrate.

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The European Union and US define titanium as a critical metal. The ilmenite produced at Dundas will secure a supply of ilmenite from a northern-hemisphere, western-world mining operation for customers producing titanium dioxide and titanium metals. The market for ilmenite/titanium is strong – with a very positive price outlook.

Currently Bluejay Mining plc is working on securing CAPEX for constructing the mine at the Dundas Ilmenite Project.

The Project represents a simple, environmental low impact mining operation with very high ESG standards and a strong relationship to local Arctic communities. It will provide beneficial opportunities, developments, and activities to Greenland and the high Arctic.

The granting of the Exploitation License from the Government of Greenland has been based on an advanced pre-feasibility study, an Environmental Impact Assessment (EIA) and a Social Impact Assessment (SIA). All studies and investigations have been carried out with and certified by leading European, Danish/Greenlandic, Canadian, and Australian international consulting houses.

Qaanaaq, Greenland

Mining – Ilmenite/Titanium

Public listed company

BlueJay MINING LIMITED

PROJECT PITCH

"An exceptionally low-cost / high-grade mineral sand mining project in Greenland "

THE DUNDAS ILMENITE PROJECT

In the process of granting the Exploitation License, the EIA and SIA were found to be compliant with the very high ESG standards set out by the Government of Greenland (standards that are based on Canadian and Scandinavian defined standards for ESG) and were subsequently approved by the Government.

The Exploitation License process constituted a transparent public consultation on the project with the public, stakeholders and NGOs. Successful Public Consultations meetings were held during the pandemic, which were finalized in September 2020.

In full production, the planned operation will produce 440.000tons of ilmenite concentrate per year. The mining of the ilmenite-bearing sand is done via simple excavation of onshore mineral sand whereafter the ilmenite is extracted by proven wet gravity and dry magnetic separation. It is a very simple, proven and efficient operation in which 7% of the ilmenite is extracted from the sand volume.

The excavations will be fully remediated after production since the rejected non- valuable sand (93% of sand volume) will be returned to fill up the excavations. The planned production will be shipped from Northwest Greenland to the international market during the four-month long ice-free window via 11 bulk-carriers.

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The planned operation will need 175 employees; 120 of which are on-site due to rotations all year-around in a 24/7 operation. The workforce will constitute 50% unskilled and 40% skilled workers which means the project utilizes both available existing and upgradable locally-sourced labor. In a cooperation between Greenlandic educational institutions, the Government of Greenland and Dundas Titanium A/S, training programs with Greenlandic educational institutions have already begun.

The pre-feasibility study (PFS) was conducted at an advanced level and based on a very conservative approach for such studies. It was important to scrutinize the project to ensure it would hold up technically, operationally, environmentally, and economically in line with the harsh conditions of operating remotely in the Arctic.

An advanced, comprehensive feasibility study has been developed for the project and a JORC Mineral Resource base of 117.3Mt at 2.9% in-situ TiO2 (6.1% ilmenite). Of these, a JORC compliant Mineral Reserve of 67.1Mt has been certified by an independent certifying consultancy house. The JORC Mineral Reserve justified a 10-year mining operation at a yearly production rate of 440.000 tons of ilmenite concentrate.

PROJECT PITCH

"An exceptionally low-cost / high-grade mineral sand mining project in Greenland "

THE DUNDAS ILMENITE PROJECT

The remaining c. 50Mt JORC Mineral Resource represents further potential for mine production and an opportunity to extend the mine's life. Furthermore, additional ilmenite mineral-sand exploration targets exist onshore adjacent to the current planned mining area.

An assessment of the shallow marine area underway where potential for additional resources is being evaluated. These offshore resources that exist outside the planned onshore mine area pose an additional resource and a JORC compliant Exploration Target of 300Mt to 530Mt at an average grade of 0.4%-4.8% ilmenite in-situ. A license for exploitation of the offshore resources means a separate license and subsequently, a related application process in addition to the secured Exploitation License for the onshore resources.

Bluejay Mining have for some years made environmental base-line studies off-shore to ensure a foundation of data and validate an environmentally sustainable resource extraction offshore. The offshore resources pose another possible extension or up-scale production scenario for a future operation at Dundas. The additional resources could provide additional 10-30 years of mine-life at the current planned production and can also be used to upscale the production if desired.

The estimated CAPEX in the PFS for the project is USD $245M for all mining, processing, and supportive infrastructure to the mine.

An Optimization Study for the Project in which all process and infrastructure components of the PFS are being undertaken to assess if 'leaner and/or greener' solutions exist for the project.

The highly conservative PFS identifies and considers reductions on infrastructure components and implementation of alternative power and mining methods.

Dundas Ilmenite offtake secured

The ilmenite concentrate produced at Dundas will be marketed internationally. Ilmenite is widely considered to be the most important ore of titanium – a metal used in everything from jewellery, to prosthetics, surgical tools and mobile phones.

At the end of 2020, Dundas signed a Master Distribution Agreement – an off-take amount of up to 350.000 tons of annual production (minimum off-take 250.000 tons) – with a large global industry and commodity trading conglomerate with representation and a network in Europe, US, Pacific and Southeast Asia. The Master Distribution

Agreement is an important milestone for the Dundas Ilmenite Project because it testifies to the quality of both the Project and the ilmenite extracted at Dundas. It furthermore provides a very high degree of security for the Project when in production. In addition to the 350.000 tons of ilmenite already secured, Bluejay is in dialogue with potential additional off-takers regarding the last c. 90.000 tons of ilmenite concentrate.

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

The Dundas Ilmenite Mine provides activities, developments and new opportunities previously absent in Northwest Greenland. The simple mining operation and mineral sand processing is appropriate to the local skill-base, workforce and acts as a stepping-stone for the community as the mining sector emerges in Greenland.
Furthermore, the Project offers many indirect advantages for Northwest Greenland. The Project supports the development of infrastructure, education and local business creation in an Arctic region where tourism and fishery are dominant.

An extensive Impact Benefit Agreement between the municipality of North-West Greenland, the Government of Greenland and Dundas Titanium A/S corroborate that mining activities are sustainable, viable and provide maximal opportunities to the local community and Greenland population. The nature of the Project – as more like a gravel-sand pit operation than true mining – reduces the environmental impact on the area.
There is no crushing, no chemicals, no blasting, no tailings involved in the operation and 93% of the excavated material is returned to the pits where it was excavated from. There is minimal disruption to local wildlife and restoration of fauna and landscape has been integrated as part of the project.

What resources or organizations have you relied on when crafting your project's sustainability strategy?

The Environmental and Social Impact Assessment studies (EIA and SIA) have all been carried out and certified by international well-recognized consultancy houses. The EIA have been developed and certified by WSP|Orbicon and the SIA have been developed and certified by NIRAS.

Both the EIA and SIA are developed according to the highest Environmental, Social and Governance (ESG) standards required by Greenland law and authorities. The Greenland ESG standards and regulatory framework (the Mineral Resource Act) builds on Danish, Scandinavian and Canadian practice.

The Greenland Mineral Resource and Environmental Authorities & Agencies, as well as their independent subcontracted consultants, have reviewed and approved the EIA and SIA and the Technical, Operational & Economical Pre-Feasibility Study for the project.

Do you have anything else to add about your project? What are your next steps?

The Greenland Government named the Dundas Ilmenite Project one of the most well- advanced mineral projects in the autonomous territory in its 2018 economic report and named Bluejay Mining plc Prospector and Developer of the year for 2017.

Q&A

How does your project integrate long-term sustainability, especially in the local community, into its design?

An extensive Impact Benefit Agreement between the municipality of North-West Greenland, the Government of Greenland and Dundas Titanium A/S ensures that the mine activities are carried out in a sustainable and viable way with maximal beneficial impact and opportunities for the local communities, the region and the Greenland population.

A strong and continuous relationship has been built with the Avannaata Kommunia, its elected politicians and the administration. Dundas Titanium A/S has its head office in Ilulissat, Greenland where it hosts the Avannaata Kommunia municipality administration center.

How does your project help develop human capital in the communities where it's located?

The Impact Benefit Agreement for the project ensures that the mine activities are carried out in a sustainable and viable way with maximum beneficial opportunities for local communities, the region and the Greenland population. In order to upskill the local workforce, training activities with educational institutions in Greenland have been established.

How have you ensured inclusive and equitable consultations with local/ indigenous communities?

The procedure to obtain an Exploitation License (mining permit) in Greenland stipulates that the mining project and its associated Environmental and Social Impact Assessments studies must be presented to the public through a public consultation period. As part of the consultation, public meetings were arranged in the Greenlandic settlements and neighboring towns most impacted by the mining project.

This included specific stakeholder groups and organizations. All incoming responses, comments and questions about the project and the EIA and SIA are documented and summarized in a WhiteBook which forms the basis for a final review of the project. Prior to the public consultation period, interview and group meetings were held with local representatives of the communities, both locally and regionally.

How does your project balance economic and social goals with environmental protection?

The aforementioned extensive Impact Benefit Agreement (IBA) certifies that mining activities are sustainable and beneficial to local communities, the region and the Greenland population. The IBA is based on the Social Impact Assessment study for the project. The IBA is coherent with the Environmental Impact Assessment and the extensive Environmental Monitoring Program which were formulated, executed and approved with Greenland authorities during the construction and production phases of the project. No major environmental impacts have been identified by the assessments realized.

Q&A

What specific mitigation measures, technological or otherwise, has your project put in place to safeguard the local environment?

Studies conducted to explore options e.g. ore transport in the mine, electrifying parts of the processing that currently are diesel-fired (de-icing and drying). In addition, option studies are being conducted to explore replacing diesel-generated electricity with solar- or wind-generated electricity.

The design of the project focuses on solutions that safeguard the local environment. This includes optimal solutions for waste management, water management, modularized and sustainable infrastructure with high insulation and climate-shield solutions. NIRAS, an internationally renowned development consultant, has concluded the sand mine will have a significantly positive effect on the livelihoods of the Greenland population.

What measures have you taken to increase transparency and guard against corruption in your project's financial and reporting activities?

The Government of Greenland granted the Exploitation License and approved the Exploitation and Closure Plans. This demonstrates our commitment to financial transparency and guarding against corruption and stipulates clearly how we must report to the Greenlandic authorities. We are held to high ESG standards and the existing legal framework in Greenland.

How has your project integrated local/indigenous knowledge?

The IBA is based on the Social Impact Assessment study for the project. As a basis for interviews and public consultation on the project, local communities and businesses were asked to contribute knowledge, ideas and aspirations for the project, includeing how the project could enhance its anchoring with the local community.

What technical measures are in place to monitor for local impacts and hazards from your project?

A full environmental monitoring program will be implemented during construction and production. Furthermore, a monitoring program will be in place during and after the closure of the mine. The simple process flow sheet at Dundas includes both wet gravity separation plant and a dry magnetic separation plant. No liberation, grinding, chemicals etc are needed in the processing.

Q&A

How have you tried to set best practices for Arctic investment and what best practices have you followed from others?

The government-backed financial institution – Greenland Venture and Danish Growth Fund – are investors in Bluejay Mining PLC. Also, the Greenland Workers Pension Fund is an investor. Greenland Venture has a board member in the board of Dundas Titanium A/S. The above setup ensures best practices and local control with the project.

How have you worked to uphold and strengthen regulatory measures that contribute to healthy Arctic communities and environments?

Our Managing Director of Dundas Titanium A/S has been elected as chairman of the mineral resource branch under the Greenland Business Association. This is testimonial to our continued involvement and high standards towards securing and contributing to the healthy, sustainable development of the emerging mining sector in Greenland.

AGNICO EAGLE

NUNAVUT OPERATIONS
A GOLD MINING SITE

AEC
ARCTIC ECONOMIC COUNCIL

Nunavut, Canada

Mining – Gold

Publicly traded

AGNICO EAGLE

AGNICO EAGLE

"Gold mining company in Canada with international reach and an exemplary record of environmental and social practices"

Senior Canadian gold mining company, producing precious metals from operations in Canada, Finland and Mexico.

Pipeline of high-quality exploration and development projects in these countries as well as in the United States and Colombia.

Recognized globally for its **leading environmental, social and governance practices**.

Founded in 1957 and has consistently created value for its shareholders, declaring a cash dividend every year since 1983.

AEC
ARCTIC ECONOMIC COUNCIL

Nunavut, Canada

Mining – Gold

Publicly traded

AGNICO EAGLE

KEY DATA

"Gold mining company in Canada with international reach and an exemplary record of environmental and social practices"

PRODUCTION/OUTPUTS

- Payable gold production in the full year 2020 was 1,736,568 ounces
- Production details per operation (Meliadine, Meadowbank)
- Details on the Company's four-year production guidance

PERSONNEL

- 4,000 people
- including ~410 Inuit employees

PROJECT TIMELINE

- Meadowbank 2010-2019,
- Amaruq satellite deposit 2019-2026
- Meliadine mine 2019-2032
- Hope Bay mine 2017-under review
- **Project status:** funded and in operation

AEC ARCTIC ECONOMIC COUNCIL

Nunavut, Canada | Mining – Gold | Publicly traded | AGNICO EAGLE

FINANCIALS

"Gold mining company in Canada with international reach and an exemplary record of environmental and social practices"

ANNUAL REVENUE

Current:

- Meliadine: US$ 569,063
- Meadowbank: US$ 366,743
- Also see p. 59 of the 2020 Annual audited consolidated financial statements
- excluding Hope bay: (unaudited: US$67,295)
- Also see p.54 of the Second Quarter Report 2021

TURNOVER

In 2020:

- Global turnover rate: 7.6%
- Meadowbank: 9.9%
- Meliadine : 6.4%
- Also see details on 2020 workforce metrics see 2020 GRI Data Table

Nunavut, Canada

Mining – Gold

Publicly traded

AGNICO EAGLE

AEC ARCTIC ECONOMIC COUNCIL

FINANCIALS

"Gold mining company in Canada with international reach and an exemplary record of environmental and social practices"

$288 294

INVESTMENT

- Meadowbank US$162,339.
- Meliadine: US$125,955
- Also see p. 62 of the 2020 Annual audited consolidated financial statements

FUNDING

Cash flow generated from existing operations,
use of its existing unsecured revolving bank credit facility and through access to capital markets.

$3.2M

ASSESTS IN THE ARCTIC

2020 Annual audited consolidated financial statements

Second Quarter Report 2021

Interactive analyst center

Nunavut, Canada

Mining – Gold

Publicly traded

AGNICO EAGLE

AEC ARCTIC ECONOMIC COUNCIL

SUSTAINABILITY

"Gold mining company in Canada with international reach and an exemplary record of environmental and social practices"

Agnico Eagle believes that responsibly undertaken, gold mining can play an important and positive role in supporting sustainable development.
For all sustainability performance metrics, consult 2020 GRI Data Table.

UN SDGs

GRI and SASB index

4 QUALITY EDUCATION

On-site educators in Nunavut

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Infrastructure development for hydroelectricity in Kivalliq region, Nunavut

8 DECENT WORK AND ECONOMIC GROWTH

Provided investments to support 7 community investment projects in Nunavut

15 LIFE ON LAND

Terrestrial Advisory Committee in Nunavut to contribute to the preservation of the biodiversity and minimizing ecological footprint of mines

Nunavut, Canada

Mining – Gold

Publicly traded

AGNICO EAGLE

PROJECT PITCH

"Gold mining company in Canada with international reach and an exemplary record of environmental and social practices"

AGNICO EAGLE NUNAVUT OPERATIONS

Responsibly developing Canadian mineral resources in Nunavut for more than 12 years.

Currently operate the Meliadine mine and Meadowbank Complex (including the Amaruq satellite deposit at Meadowbank) in Nunavut's Kivalliq region. As of February 2, 2021, have added the Hope Bay mine in the Kitikmeot region, which was acquired from TMAC Resources Inc.

Project ownership
100% owned, directly or indirectly, by Agnico Eagle Mines Limited

Nunavut, Canada

Mining - Gold

Publicly traded

AGNICO EAGLE

PROJECT PITCH

"Gold mining company in Canada with international reach and an exemplary record of environmental and social practices"

Helping to build social and economic development

- 4 000 employees, more than 410 Inuit employees
- Annual payroll of US$17.6M to Inuit employees
- Work with communities to assess potential opportunities to enhance local economic benefits and create economic prosperity
- Goal of obtaining 50 % Inuit employees for all our Nunavut operations

Leading environmental practices

- Strategy guided by the World Gold Council's Responsible Gold Mining Principles and the United Nations Sustainable Development goals
- Identify potential effects of the mining operations to wildlife and wildlife habitat and measures to mitig
- Terrestrial Environment Monitoring and Management Plans

Local governance

- Mandated consultations related to any permitting processes
- Consultation initiatives : Inuit Qaujimajatuqangit (IQ), Wildlife Coordinator and the Kivalliq Inuit Elders' A Committee
- Terrestrial Advisory Group : to provide Inuit traditional knowledge
- TSM protocols to measure and publicly report our performance

Nunavut, Canada

Mining - Gold

Publicly traded

AGNICO EAGLE

AEC
ARCTIC ECONOMIC COUNCIL

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

Agnico Eagle first began investing in the Canadian Territory of Nunavut in 2007. Our Nunavut mining operations at Meliadine and Meadowbank are helping to build social and economic infrastructure vital to the Arctic's future.

In 2021, we acquired a third mining operation in northwestern Nunavut – the Hope Bay property. As the largest private sector employer in Nunavut, we now directly and indirectly employ more than 4,000 people (with Hope Bay), including ~410 Inuit employees.

Our annual payroll is ~CA$200M (US$159.9M), with ~CA$25M (US$17.6M) paid to Inuit employees. We annually invest an average of CA$7M to CA$9M (US$5.6M-7.2M) per year to provide training for our Nunavut workforce.

We have three Inuit Impact Benefit Agreements (IIBAs) (including Hope Bay) and a Memorandum Of Understanding (MOU) with the Government of Nunavut (GN), and since 2007, have paid over CA$109M (US$87.1M) in royalties and fees to the Nunavut Tunngavik Inc (NTI) and Kivalliq Inuit Association (KivIA).

In 2020, we contributed CA$38M (US$30.4M) in taxes, royalties, fees and compensation payments in Nunavut and CA$2.4M (US$1.92M) in community contributions and we spent CA$612M (US$489.2M) with Indigenous suppliers, which represents 68 % of our procurement spending in the region.

Since 2007, we have invested over CA$7 billion (US$5.6bn) in Nunavut and are helping to contribute to the development of a middle class in the region. local export value of wild fishing and salmon farming.

What resources or organizations have you relied on when crafting your project's sustainability strategy?

Our primary resource has been the Mining Association of Canada's Towards Sustainable Mining® (TSM®) initiative – a globally recognized sustainability program that supports mining companies in managing key environmental and social risks.
Our strategy has also been guided by the World Gold Council's Responsible Gold Mining Principles and the United Nations Sustainable Development goals. We also rely on traditional knowledge to guide us in developing conservation and environmental protection programs.

How does your project integrate long-term sustainability, especially in the local community, into its design?

From the outset, we work with communities to assess potential opportunities to enhance local economic benefits and create economic prosperity beyond the life of our mines. We continue to build capacity through our procurement partnerships with Indigenous businesses with more than 80 registered Inuit suppliers – a key element of our IIBAs – providing workshops and assistance to Inuit firms in addition to entrepreneurial training.

Q&A

We also offer local Inuit a Pre-Trade/Apprenticeship Program which combines on-the-job learning and in-school technical training to enhance employment readiness, allowing Inuit apprentices to eventually take their Certificate of Qualification Journeyman and Red Seal exams. In consultation with Kivalliq communities, we develop careful land use plans to monitor, study, protect and support critical habitat and wildlife species that are vital to the region's social, cultural and economic prosperity.

How does your project help develop human capital in the communities where it's located?

We focus on creating sustainable and high-quality jobs and careers in mining with a goal of obtaining 50 % Inuit employees for all our Nunavut operations. We have developed extensive Work and Site Readiness programs to prepare candidates from the Kivalliq region to work with us.

We provide training, summer employment for students and individual career development; employees who lack literacy, numeracy skills or the confidence to take on senior roles are provided with adult education support.

We have established initiatives in schools designed to inspire students to further their education, including a trades awareness week, mine site visits, and career information days. We also provide financial support for Nunavut-based organizations that provide literacy and skills training.

How does your project strengthen local/indigenous communities and traditional livelihoods?

We focus on creating sustainable and high-quality jobs and careers in mining with a goal of obtaining 50 % Inuit employees for all our Nunavut operations. We have developed extensive Work and Site Readiness programs to prepare candidates from the Kivalliq region to work with us. We provide training, summer employment for students and individual career development; employees who lack literacy, numeracy skills or the confidence to take on senior roles are provided with adult education support. We have established initiatives in schools designed to inspire students to further their education, including a trades awareness week, mine site visits, and career information days. We also provide financial support for Nunavut-based organizations that provide literacy and skills training.

How have you ensured inclusive and equitable consultations with local/indigenous communities?

In addition to mandated consultations related to any permitting processes, we work to ensure inclusive and equitable consultations with local Indigenous communities through various initiatives. The Terrestrial Advisory Group (TAG) – which provides Inuit traditional knowledge to protect caribou herds that cross our site, and to inform environmental monitoring, mitigation and management of the terrestrial environment impacted by our Nunavut mining activities – includes representatives from Agnico Eagle, the GN, KivIA and the local Hunters and Trappers Organization.

We have established initiatives in schools designed to inspire students to further their education, including a trades awareness week, mine site visits, and career information days. We also provide financial support for Nunavut-based organizations that provide literacy and skills training.

Agnico Eagle

Q&A

In 2018-2019, Agnico Eagle undertook an independent health study to better understand the wellness impacts of our Meadowbank operations on the community of Baker Lake. The community then self-identified four priority initiatives to improve community wellness, which culminated in a CA$1M (US$745k) Agnico Eagle investment in these initiatives to provide lasting economic, social, educational and health benefits for local residents as part of the official opening of our nearby Amaruq Whale Tail project.

Other consultation initiatives include our Inuit Qaujimajatuqangit (IQ) and Wildlife Coordinator and the Kivalliq Inuit Elders' Advisory Committee (see Q 14); our Community Liaisons and Digital Ambassador Program; and our Good Deeds Brigade, launched during COVID-19 to encourage Nunavummiut employees to make a difference in their communities while continuing to receive 100 % of their base salary.

What specific mitigation measures, technological or otherwise, has your project put in place to safeguard the local environment?

We adhere to the TSM protocols to measure and publicly report our performance, including protocols related to biodiversity, climate change, Indigenous and community relations, water stewardship and tailings management. TSM requires site-level assessments and is mandatory for all companies that are MAC members – 8 critical aspects of social and environmental performance are evaluated and independently validated. We are also guided by the Responsible Gold Mining Principles and by our own Terrestrial Environment Monitoring and Management Plans (TEMMP).

What channels have you set up to effectively communicate with local communities, including addressing grievances and requests for information?

Our channels include a regional Nunavut website, with the latest news and information about our activities and Tusaajugut, our formal Nunavut Community Complaints System to address local concerns about environmental issues, tendering and hiring processes, or any other aspects of our operations. We also have three Facebook pages: for Meadowbank, Meliadine and Hope Bay.

We have established Community Liaison Officers in the seven Kivalliq communities, who provide job information, maintain contact with employees, and identify ways to support their families. We also have four joint committees with the KivIA to ensure we are fulfilling our IIBA commitments and resolving any outstanding community issues.

As a result of the restrictions put in place during the COVID-19 pandemic, all in-person activities were suspended. Agnico Eagle turned to conventional community radio stations to host community programs to consult on projects going through a permitting process with the regulator.

Q&A

How has your project integrated local/indigenous knowledge?

We are integrating traditional Inuit knowledge into our operations and engagement activities through our IQ and Wildlife Coordinator. Under his leadership, we have established the Kivalliq Inuit Elders' Advisory Committee to provide advice on how to incorporate traditional Inuit knowledge into community engagement activities; collaborated with Hunters and Trappers' organizations on road management practices during caribou migration; and introduced naming protocols and community mapping initiatives.

What technical measures are in place to monitor for local impacts and hazards from your project?

Measures include Terrestrial Ecosystem Management and Monitoring Plans (TEMMP) to monitor land use issues, such as habitat loss and caribou interactions with our Nunavut operations. TEMMP identify potential effects of the mining operations to wildlife and wildlife habitat and measures to mitigate those effects i.e., giving caribou the right-of-way on all roads, protocols for suspending operations when caribou are in proximity to the operation, and wildlife surveys. They also provide the guidelines for reporting.

Additionally, Agnico Eagle has recently committed to the development of community-based monitoring programs for fish and shellfish as well as water quality of water bodies near its Meliadine operation (Meliadine Lake and Melvin Bay). These programs are to be developed through consultations with interested community members and interveners.

AMBLER METALS

A COPPER MINING PROJECT DEVELOPING THE INFRASTRUCTURES

Brooks Range, AK, USA

Mining – Copper

Private

AMBLER METALS

AEC
ARCTIC ECONOMIC COUNCIL

AMBLER METALS

"A proposed copper mine and access road in Alaska, undertaken in full consultation with local communities and with an emphasis on supporting traditional livelihoods."

Ambler Metals is independently owned and operated as a 50/50 joint venture between Trilogy Metals and South32. Ambler Metals is an Alaskan company with offices in both Anchorage and Fairbanks.

The company is working to advance **the development of high-grade copper deposits** in the Ambler Mining District in the southern Brooks Range, in northwest Alaska.

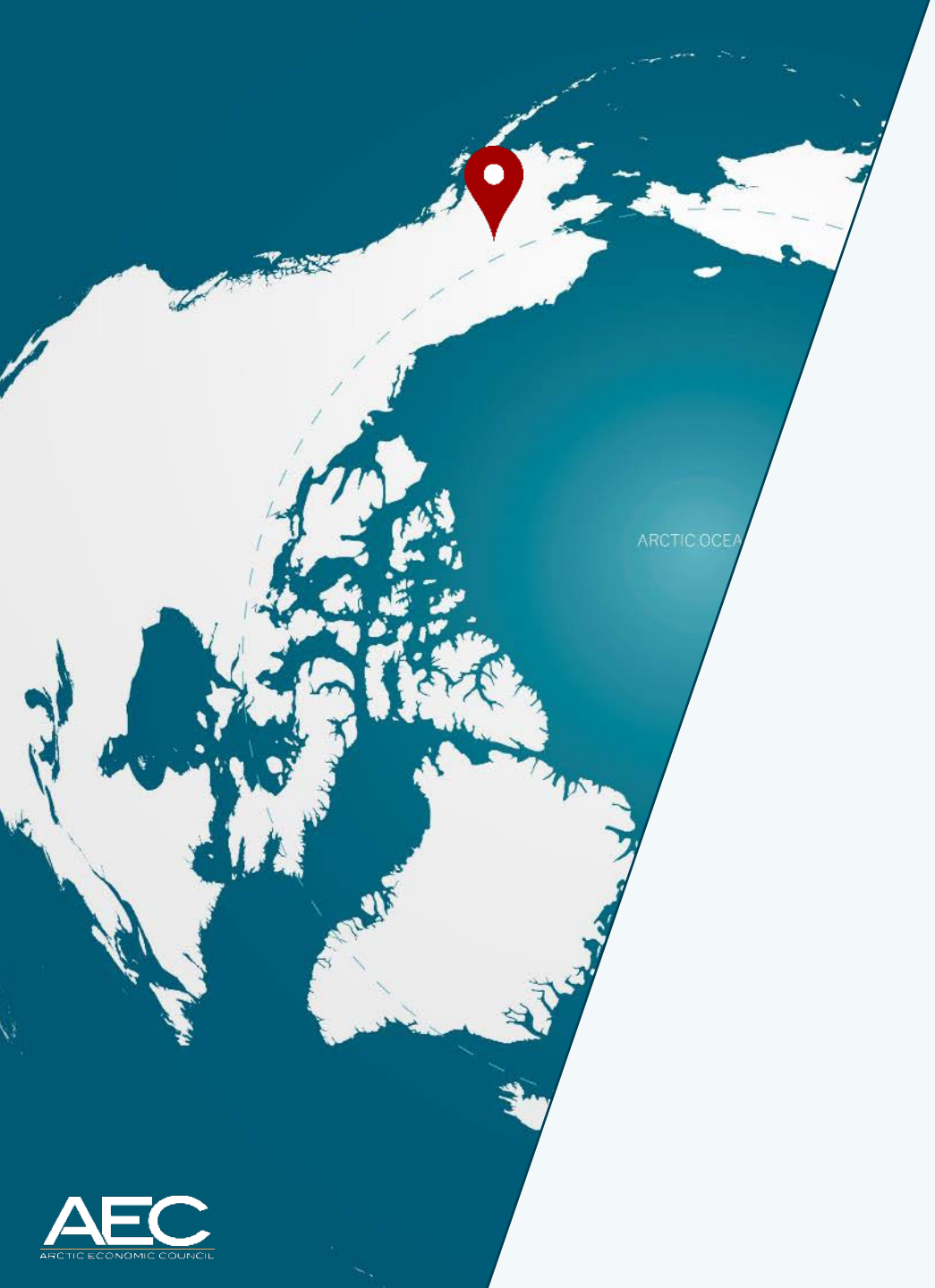
AEC
ARCTIC ECONOMIC COUNCIL

Brooks Range, AK, USA

Mining – Copper

Private

AMBLER METALS



KEY DATA

"A proposed copper mine and access road in Alaska, undertaken in full consultation with local communities and with an emphasis on supporting traditional livelihoods."

PRODUCTION/OUTPUTS

- 43,443 kt or approx.
- 10,000t/day of high grade Copper ~2.24%, with Cu Equivalent at ~4.2% when other metals (Zn, Pb, Au, and Ag) are included.

PERSONNEL

- for operations – 450 employees
- for construction – 600 employees

PROJECT TIMELINE

- 12 years
- **Project status:** currently in the pre-feasibility stage. The predevelopment phases of the Arctic Project as well as the related access road are funded.

Brooks Range, AK, USA

Mining – Copper

Private

AMBLER METALS

AEC ARCTIC ECONOMIC COUNCIL

FINANCIALS

"A proposed copper mine and access road in Alaska, undertaken in full consultation with local communities and with an emphasis on supporting traditional livelihoods."

TOTAL COST

- Projected +/- 15% accuracy
- US$906M Initial Capital
- US$114M Sustaining Capital
- US$205M Closure / Reclamation
- US$4,756M Operating costs over life of mine

INVESTMENT

- $906M Initial Capital
- $114M Sustaining Capital
- $205M Closure / Reclamation
- $4,756M Operating costs over life of mine
- Ambler access road: US$35M reserved

FUNDING

Private

$906M

ASSETS IN THE ARCTIC

US$906M - cost of mine construction

Brooks Range, AK, USA

Mining – Copper

Private

AMBLER METALS

PROJECT PITCH

"A proposed copper mine and access road in Alaska, undertaken in full consultation with local communities and with an emphasis on supporting traditional livelihoods."

The Arctic deposit is located in the Ambler Mining District in the southern Brooks Range, in the Northwest Arctic Borough of Alaska.

The Property is geographically isolated with no current road access or nearby power infrastructure.

The Property is located 168 miles (270 kilometers) east of the town of Kotzebue, 22 miles (36 kilometers) northeast of the village of Kobuk, and 162 miles (260 kilometers) west of the Dalton Highway, an all-weather state- maintained highway.)

Arctic Design Assumptions

- Integrated tailings, waste rock and water management, and water treatment.
- Minimized environmental footprint
- Three concentrate products (Cu, Zn, and Pb)
- Concentrate will be shipped to the Port of Anchorage via the Ambler Access Road and Dalton Highway by truck to Fairbanks and then by rail to Anchorage.

Brooks Range, AK, USA

Mining – Copper

Private

AMBLER METALS

AEC
ARCTIC ECONOMIC COUNCIL

PROJECT PITCH

"A proposed copper mine and access road in Alaska, undertaken in full consultation with local communities and with an emphasis on supporting traditional livelihoods."

Including local populations

- Works closely with the NANA Regional Corporation and sharehokders (who constitute the local/indigenous communities around our future mine site)
- Robust workforce development plans
- Oversight committee, composed of NANA board members from the upper Kobuk villages, the president of NANA, and board members and the president of Ambler Metals.

Preserving the environment

- High quality equipment with safeguards and redundancy
- Fuel transfer and storage systems use a dry lock system to prevent spills, as well as secondary containment for the unlikely event of the failure of the dry locking system
- Task training for each employee on site

Brooks Range, AK, USA

Mining – Copper

Private

AMBLER METALS

Q&A

How does your project help develop human capital in the communities where it's located?

Ambler Metals works closely with the NANA Regional Corporation to ensure, inter alia, that we have robust workforce development plans to train and maximize job participation of NANA shareholders (who constitute the local/indigenous communities around our future mine site).

The NANA/Ambler Metals relationship is managed through an oversight committee, composed of NANA board members from the upper Kobuk villages, the president of NANA, and board members and the president of Ambler Metals.

How does your project strengthen local/indigenous communities and traditional livelihoods?

Ambler Metals is committed to working with all NANA shareholders to understand the traditional lifestyle that needs to be preserved or enhanced. Ambler Metals and NANA co-facilitate a subsistence advisory committee for the region representing the neighboring communities, and which advises Ambler Metals on subsistence matters that may influence the mine design, ongoing exploration activities, and future operations.

Caribou hunting, for example, is an essential part of the community's subsistence living and as such, when caribou herds are seen around our operations, Ambler Metals have standing instructions in place to stop work until such time the herds have safely passed.

What measures have you taken to increase transparency and guard against corruption in your project's financial and reporting activities?

Ambler Metals operates in accordance with established policies, procedures, practices and standards. This includes both a Code of Conduct standard and an Anti-Bribery and Corruption standard. Annual anti-bribery and corruption compliance training is required of key employees each year and certification of compliance to the Code of Conduct standard is required of all employees.

Part of Ambler Metals procedures include a set of internal controls to safeguard its assets, ensure accuracy and reliability of accounting records and information, promote operating efficiency, and measure compliance with management's prescribed policies and procedures.
Ambler Metals has appointed an external auditor, Price Waterhouse-Coopers, to audit the company's financial statements on an annual basis as well as provide a special purpose audit for our international control

Q&A

What specific mitigation measures, technological or otherwise, has your project put in place to safeguard the local environment?

Technologically, Ambler Metals utilizes high quality equipment with safeguards and redundancy. For example, Ambler Metals' fuel transfer and storage systems use a dry lock system to prevent spills, as well as secondary containment for the unlikely event of the failure of the dry locking system. This prevents fuel from ever hitting the ground.

Tanks are double walled, and in many cases, have tertiary containment beneath them. Technology and equipment are essential in safeguarding the local environment, but proper operation of the systems is equally important.

Ambler Metals requires task training for each employee on site. For example, Operators receive training in draining secondary containments, fuel handling, spill prevention and response, waste handling, and wildlife interaction.

A 130-year-old LKAB invests 30-40 billion euro in Arctic innovations to transform global steelmaking into a carbon-free industry

With initiative emerging from LKAB the HYBRID project and also H_2 green steel there is a revolution in steel production with zero CO_2 emissions in the making. This will be largest industrial investment ever in Sweden.

Ann Linde, Swedish Minister of Foreign Affairs

LKAB is Europe's largest iron-ore producer with production facilities in Northern Sweden. It specialises in extracting iron ore and processing it into pellets using coal and oil-powered pellet plants.

In 2021, LKAB transformed the world industry standards with autonomous, digitalized, electrified and carbon dioxide free mining. It produces sponge iron using hydrogen and extracts essential minerals from mining waste. This strategy is the biggest transformation in the company's 130-year history and is the largest industrial investment ever made in Sweden.

LKAB aims to eliminate carbon dioxide emissions from the steelmaking process by using only fossil-free feedstock and energy in all parts of the value chain.

In 2021 after five years of feasibility studies LKAB in partnership with Vattenfall and SSAB has produced the world's first hydrogen-reduced sponge iron, used as a raw material in steelmaking. The breakthrough demonstrates the viability of using hydrogen to process iron ore, instead of conventional fuel.

The steel market is forecasted to grow by 50% by 2050. LKAB pushes global iron and steelmaking responsible for 7% of total greenhouse gas emissions towards fundamental green transformation.

Now LKAB is moving from the pilot project to the next phase. By 2026, it will begin full industrial scale production of fossil-free sponge iron at a demonstration plant. LKAB aims to pioneer a fossil-free value chain "from mine to steel" in the market.

They have committed to invest between 30 and 40 billion EUR to convert its coal and oil-powered pellet production for coal powered blast furnaces to sponge iron for electric arc furnaces powered by renewable electricity at the processing facilities in Sweden and Finland. Potentially reducing emissions by 10% in Sweden and 7% in Finland.

When LKAB transforms its operations from pellets to sponge iron it will save 35 million tons in own and clients operation emissions corresponding to two thirds of Sweden's territorial emissions

It is estimated that technological transition will stimulate labour market and directly create up to 3000 workplaces in the European Arctic.

BIOECONOMY

OCEAN RAINFOREST

SUSTAINABLE NORDIC SEAWEED

OFFSHORE SEAWEED CULTIVATION

AEC
ARCTIC ECONOMIC COUNCIL

Kaldbak, Faroe Islands

Biotechnology – Seaweed

Private

OCEAN RAINFOREST
SUSTAINABLE NORDIC SEAWEED

By farming 1 million tons wet weight on < 1% of the Continental Shelf, the Faroe Islands would offset all of its CO 2 emissions and remediate all nitrogen and phosphorus emissions related to salmon farming – the country's main export

Ocean Rainforest

OCEAN RAINFOREST

"A sustainable seaweed harvesting company in the Faroe Islands offsetting the country's CO_2 emissions"

Ocean Rainforest, Sp/F brings nearly ten years of experience in **offshore cultivation of kelp and other seaweed species.** By applying science, innovation and expertise in growing premium quality seaweed for sale and research.

Ocean Rainforest is internationally recognized as a key pioneer in the developing industry.

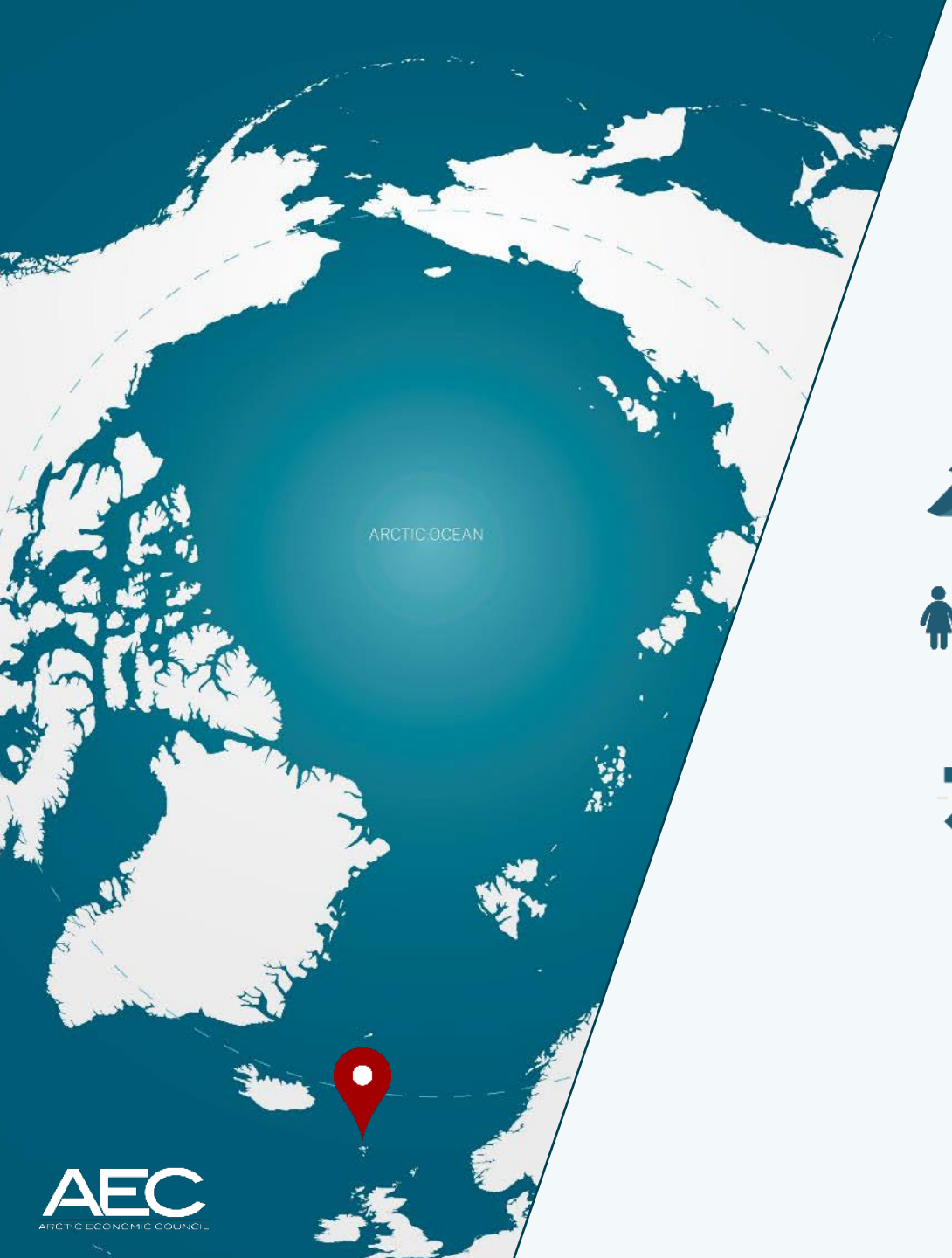
Ocean Rainforest has developed a seaweed cultivation system for offshore and nearshore locations. It also **operates a supply chain from seedling production to end-user products.**

Ideally, the company's vision is a worldwide local ocean rainforest. Essentially, the company's inbuilt **focus on research and innovation** enables it to further develop world-class cultivation methods.

AEC
ARCTIC ECONOMIC COUNCIL

Kaldbak, Faroe Islands | Biotechnology – Seaweed | Private

OCEAN RAINFOREST
SUSTAINABLE NORDIC SEAWEED



KEY DATA

"A sustainable seaweed harvesting company in the Faroe Islands offsetting the country's CO_2 emissions"

PRODUCTION/OUTPUTS

- Seaweed cultivation and harvesting

PERSONNEL

- Current - 9 employees
- Anticipated -30 employees

PROJECT TIMELINE

- 2021 – 2024
- **Project status:** partially funded

AEC
ARCTIC ECONOMIC COUNCIL

FINANCIALS

"A sustainable seaweed harvesting company in the Faroe Islands offsetting the country's CO_2 emissions"

$25M **TOTAL COST**

Total CAPEX of €22 million (25m USD)

$14.1M **ANNUAL REVENUE**

Current: 0.7M EUR (798K USD)
Anticipated in 2024: 12,4M EUR (14.1M USD)

$14.1M **TURNOVER**

Currently: €0,7 million (798K USD)
In 2024: €12,4 million (14.1m USD)

$6.8M **INVESTMENT**

€6.000.000 (6.8m USD) received

AEC ARCTIC ECONOMIC COUNCIL

Kaldbak, Faroe Islands | Biotechnology – Seaweed | Private | OCEAN RAINFOREST SUSTAINABLE NORDIC SEAWEED

FINANCIALS

"A sustainable seaweed harvesting company in the Faroe Islands offsetting the country's CO_2 emissions"

FUNDING

Partially funded through private and non-dilutive grant or loan funding

$28.5M

ASSETS IN THE ARCTIC

Current: 1.2M EUR (1.4M USD)
Anticipated in 2024: 25M EUR (28.5M USD)

Kaldbak, Faroe Islands

Biotechnology – Seaweed

Private

OCEAN RAINFOREST
SUSTAINABLE NORDIC SEAWEED

AEC
ARCTIC ECONOMIC COUNCIL

PROJECT PITCH

"A sustainable seaweed harvesting company in the Faroe Islands offsetting the country's CO_2 emissions"

OFFSHORE CULTIVATION OF KELP AND OTHER SEAWEED SPECIES

By farming 1 million tons of wet weight of kelp on < 1% of the Continental Shelf, the Faroe Islands would **offset all of its CO 2 emissions and remediate all nitrogen and phosphorus emissions** related to salmon farming – the country's main export.

By farming 7.2 million tons of seaweed on < 5% of the continental shelf, can offset all CO 2 emissions of the whole nation.

7.2 million tons of seaweed production will also support the development of **a large-scale bioeconomy with projected revenue of more than €2 billion** per year – effectively surpassing the local export value of wild fishing and salmon farming.

AEC ARCTIC ECONOMIC COUNCIL

Kaldbak, Faroe Islands

Biotechnology – Seaweed

Private

OCEAN RAINFOREST SUSTAINABLE NORDIC SEAWEED

PROJECT PITCH

"A sustainable seaweed harvesting company in the Faroe Islands offsetting the country's CO_2 emissions"

Improving the health of the marine environment
- Seaweed farming requires no arable land or fresh water
- No need for additional fertilizers
- Seaweed cultivation provides habitat for marine wildlife
- Kelps are widely recognized as critical carbon sinks

Securing licenses to operate
- Communication with local communities through public meetings
- Discussions on the proposed scope of work, challenges and opportunities
- Q&A with the community members
- Invitation to engage in the environmental and social aspects of regenerative farming.

Research & Development
- EU Horizon 2020 grant (2018)
- Partnership with in the Danish Technological Institute (2019)
- Technology transfer contract with a US federally-funded MacroSystems (2017)
- Prime contractor for demonstration project with $4M, the ARPA-E Mariner program (2019)
- Demonstration project in the Santa Barbara Channel (2020)

AEC ARCTIC ECONOMIC COUNCIL

Kaldbak, Faroe Islands | Biotechnology – Seaweed | Private | OCEAN RAINFOREST SUSTAINABLE NORDIC SEAWEED

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

Offshore seaweed cultivation presents a unique opportunity to improve the health of the environment while supporting economic development in the Arctic.

By farming 1 million tons wet weight on < 1% of the Continental Shelf, the Faroe Islands would offset all of its CO 2 emissions and remediate all nitrogen and phosphorus emissions related to salmon farming – the country's main export.

By farming 7.2 million tons of seaweed on < 5% of the continental shelf, seaweed cultivation can offset all CO 2 emissions of the whole nation. 7.2 million tons of seaweed production will also support the development of a large-scale bioeconomy with a projected revenue of more than €2 billion per year – effectively surpassing the local export value of wild fishing and salmon farming.

How does your project balance economic and social goals with environmental protection?

Seaweed cultivation is uniquely positioned to support economic and social goals while improving the health of the marine environment.

Widely recognized as among the most sustainable and environmentally responsible forms of biomass production, seaweed farming uses no arable land or fresh water and, in most cases, requires no additional fertilizers.

Seaweed cultivation also provides a number of ecosystem services and supports marine biodiversity by providing habitat for marine wildlife.

Furthermore, kelps are widely recognized as critical carbon sinks given that they are among the dominant primary producers in marine environments.

Given the array of environmental benefits inherent to seaweed aquaculture, seaweed cultivation must be considered among the most economically sustainable, socially responsible and environmentally regenerative industries on the planet.

How have you partnered with the research community in measuring project processes and impacts?

Ocean Rainforest has participated in an array of research and development projects throughout Europe and the U.S. geared towards ensuring the sustainable development of the seaweed industry.

In December 2018, AquaVitae was awarded a grant from the EU Horizon 2020 program.

AquaVitae intends to increase sustainable aquaculture production in and around the Atlantic Ocean by developing new and emerging low trophic species and optimizing production in existing aquaculture value chains.

In November 2019, Ocean Rainforest became a partner in the Danish Technological Institute-led project "Climate Feed."

The research project will run from 2019-2023 and intends to develop methods for cultivating, harvesting, processing, and drying seaweed into finished goods, such as powder or pellets, that could be used as an animal feed supplement.

Q&A

What channels have you set up to effectively communicate with local communi-ties, including addressing grievances and requests for information?

Securing licenses to operate is among the largest barriers to scaling the seaweed industry. In parallel to expediting the regulatory review processes, engaging the local community is critical to the success of the regenerative biomass production strategy.

On April 18, 2018, the Faroese Parliament unanimously approved reformed aquaculture legislation that allowed companies like Ocean Rainforest to apply for individual seaweed licenses.

In June 2020, Ocean Rainforest was granted its first 12-year license in Funnings-fjørður – in addition to applications in Gøtuvík and in Skálafjørður. As part of the company's application efforts, Ocean Rainforest conducted five public meetings at which company representatives discussed the proposed scope of work and answered questions from community members.

Due to this, Ocean Rainforest was able to better educate the community on the opportunities and challenges of seaweed cultivation, as well as invite residents to engage in the environmental and social aspects of the company's regenerative farming strategy.

Do you have anything else to add about your project? What are your next steps?

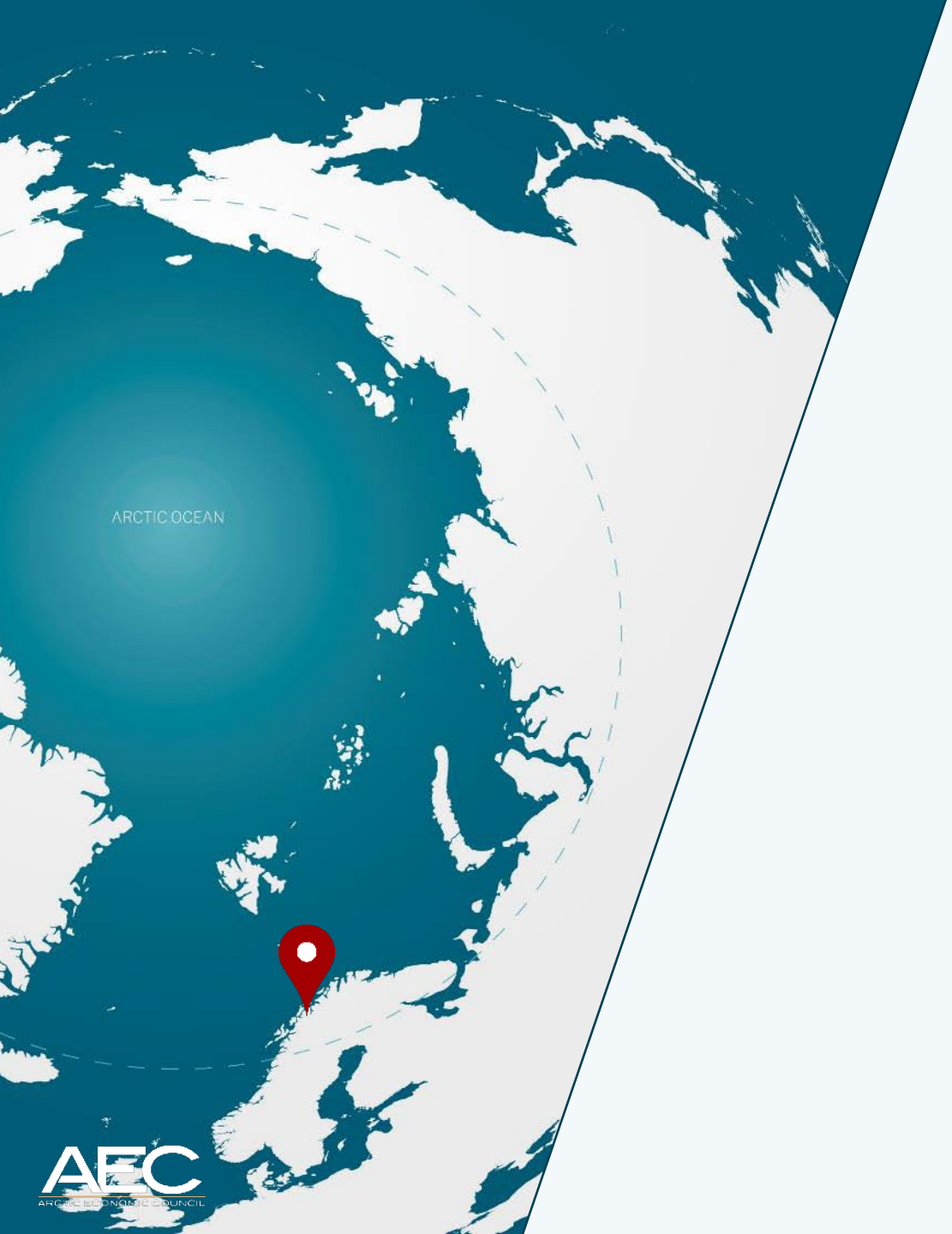
In September 2017, Ocean Rainforest was awarded a Phase 1 technology transfer contract in a US federally-funded project called MacroSystems.

During Phase 1 of the cooperative agreement (April 2018 – July 2019), the MacroSystems team designed a state-of-the-art cultivation structure that ecosystem services.

Ocean Rainforest was subsequently recognized as the prime contractor for the Phase 2 demonstration project with $4M from the ARPA-E Mariner program in September 2019.

The goal for Phase 2 is to develop and upscale the necessary technology and machinery to de-risk the full chain from propagation to planting, cultivation and harvesting.

In June 2020, Ocean Rainforest launched a three-year demonstration project in the Santa Barbara Channel to test the capabilities of the design, as well as to optimize the aspects and factors that significantly affect the economics and scaling up of operations.



Marealis

SUSTAINABLE BLUE VALUE CREATION

Kårvikhamn, Troms, Norway

Bioeconomy – Supplements

Private

Marealis

MAREALIS

"Locally-operated biotech company in Tromsø, Norway, partnering with multiple research institutions to utilize by-products from the marine industry, and providing high-skilled jobs"

Marealis AS is a **B-Corp certified Norwegian biotech company** committed to developing, producing, and commercializing sustainable, high quality products from marine by-products.
Marealis converts cold-water prawn shells (Pandalus borealis), historically a waste by-product, into a **clinically proven bioactive marine peptide concentrate** with significant blood pressure-lowering attributes.

Building on parent company Stella Polaris' industrial competence and after more than 50 years of industrial experience, Marealis will leverage its unique competence within marine **by-product R&D and innovation** by creating new products from various marine species and establishing an Innovation Centre for Marine by-products.

The bioprocess facility will contain **production lines for marine byproducts** like shrimp shells and fish skin/heads into refined bioactive peptide concentrates, and high quality collagen and flavor ingredients.

The facility aims to operate in **close cooperation with educational institutions** and other industries to share knowledge and increase value creation.

Kårvikhamn, Troms, Norway

Bioeconomy – Supplements

Private

Marealis

The facility will also create jobs, growth, contribute to responsible and sustainable fishing practices and consumption, and provide internship and research partnership opportunities for students.

Marealis

KEY DATA

"Locally-operated biotech company in Tromsø, Norway, partnering with multiple research institutions to utilize by-products from the marine industry, and providing high-skilled jobs"

PRODUCTION/OUTPUTS

- Current production of bioactive marine peptide concentrate: 3500 kg
- Current production of shrimp meal: 200,000 kg
- Projected production output from hydrolysis process: 200,000 kg
- Projected output from other production: 400,000 kg

PERSONNEL

- Current staff: 4
- Projected staff: 20-25

PROJECT TIMELINE

- 5 years
- **Project status**: proposed

Kårvikhamn, Troms, Norway

Bioeconomy – Supplements

Private

Marealis

FINANCIALS

"Locally-operated biotech company in Tromsø, Norway, partnering with multiple research institutions to utilize by-products from the marine industry, and providing high-skilled jobs"

$25 - 40M **TOTAL COST**

$10M **ANNUAL PROJECT REVENUE**

- Projected 2021: US$500K
- Anticipated 2026: US$5 -10M

FUNDING

- Private and public

Kårvikhamn, Troms, Norway

Bioeconomy – Supplements

Private

Marealis

AEC ARCTIC ECONOMIC COUNCIL

FINANCIALS

"Locally-operated biotech company in Tromsø, Norway, partnering with multiple research institutions to utilize by-products from the marine industry, and providing high-skilled jobs"

$20 - 30M INVESTMENT

- US$20-30m
- Commercialization of our product and brand PreCardix® in North America (US$5-10m)
- Market expansion of PreCardix® in Europe, Asia and Africa (US$5-10m)
- New product innovation (US$3-5m)
- Establishment of a state-of-the-art innovation park and bio-processing production facility in the Arctic region (US$10-15m)

$500K TOTAL ASSETS IN THE ARCTIC

- Current assets: US$500k
- Projected: US$15m

Kårvikhamn, Troms, Norway

Bioeconomy – Supplements

Private

Marealis

SUSTAINABILITY

"Locally-operated biotech company in Tromsø, Norway, partnering with multiple research institutions to utilize by-products from the marine industry, and providing high-skilled jobs"

Marealis AS seeks funding to support sustainable marine biotechnology innovation in the Arctic region.
Over the next five years, four Marealis projects will contribute to the UN's sustainable development goals and growth in the Arctic region. These include:

- commercialization of our product and brand PreCardix® in North America;
- market expansion of PreCardix® in Europe, Asia and Africa;
- new product innovation;
- and the establishment of a state-of-the-art innovation park and bio-processing production facility in the Arctic region.

Kårvikhamn, Troms, Norway | Bioeconomy – Supplements | Private | Marealis

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

Marealis will contribute to achieving several UN sustainable development goals in the arctic region, specifically quality education, decent work, economic growth, industry, innovation and infrastructure, sustainable cities and communities, responsible consumption and production, and life below water. Marealis diverts 100% of its marine by-products from prawn production into commercially viable ingredients and products.

The establishment of a state-of-the-art innovation park and bio-processing production facility allows Marealis to scale and evolve its innovation and efficiency.

The facility will also create jobs, growth, contribute to responsible and sustainable fishing practices and consumption, and provide internship and research partnership opportunities for students.

Investment in PreCardix® will help Marealis grow revenue and contribute to the viability of the new production facility.

How does your project help develop human capital in the communities where it's located?

Marealis AS intends to establish an Arctic-based state-of-the-art facility for bioprocessing to support its business strategy. This will help to develop human capital as the facility will attract highly-educated professionals across many disciplines including R&D and biotechnology.

The facility will, therefore, contribute to significant innovation, technology, and job opportunities. Individuals would then have an environment where they can acquire new competencies, develop skills and apply innovative ideas.

The facility will be the first industrial facility for bio-processing in the Arctic region of Norway .

How does your project balance economic and social goals with environmental protection?

The foundation of the Marealis AS business strategy is to leverage underutilized resources (marine by-products) from the seafood industry to create high-value products and brands with specific health benefits. Marealis is already a leader in sustainable marine by-product sourcing and helps solve global health issues such as hypertension through its products. Marealis is one of only 4,000 certified B-Corporations globally.

B-corporations must pass a rigorous certification process based on the world's highest social and environmental performance standards and accountability standards. The Stella Polaris Group (including Marealis) has been working with UN Global Compact in a program to optimize sustainability, and has initiated a collaboration with Seacirc to pilot a reporting system for sustainability and environmental optimization.

Marealis also plans to partner with the Arctic University of Norway and governmental institutions to support students and research projects within fishery, science and biotech in Norway.

Q&A

Marealis will continue to leverage its unique knowledge and expertise gained through the development and commercialization of PreCardix® to become a leading innovator in unique, groundbreaking products and brands utilizing marine by-products in the Arctic region of Norway.

How have you entered into public/private partnerships with the local community and/or government?

Marealis partnered with governmental research institutions and local universities to develop its unique and groundbreaking blood pressure-lowering peptide concentrate.

Both the Arctic University of Norway, which has played an advisory role throughout the development of the peptide concentrate, and the Norwegian Institution of Fishery and Science, who presented the scientific idea to help us recreate the findings, ensure reproducibility, and scale it to production, hold strong academic and professional competence within the marine industry and R&D.

These relationships played a significant role for Marealis historically and will remain important in the future. Marealis continues to leverage its unique competence within R&D gained from the development of PreCardix® to support future R&D and product development with other marine species.

Marealis and parent company Stella Polaris AS have formed close and valuable collaborations with other local companies in the seafood industry, such as Brødrene Karlsen AS and Wilsgård AS, which hold large quantities of products from cod fish and salmon.

PURE NATURA

SKAGAFJÖRÐUR, ICELAND

HEALTHCARE AND CONSUMER GOODS

Saudarkrokur, Iceland

Bioeconomy – Supplements

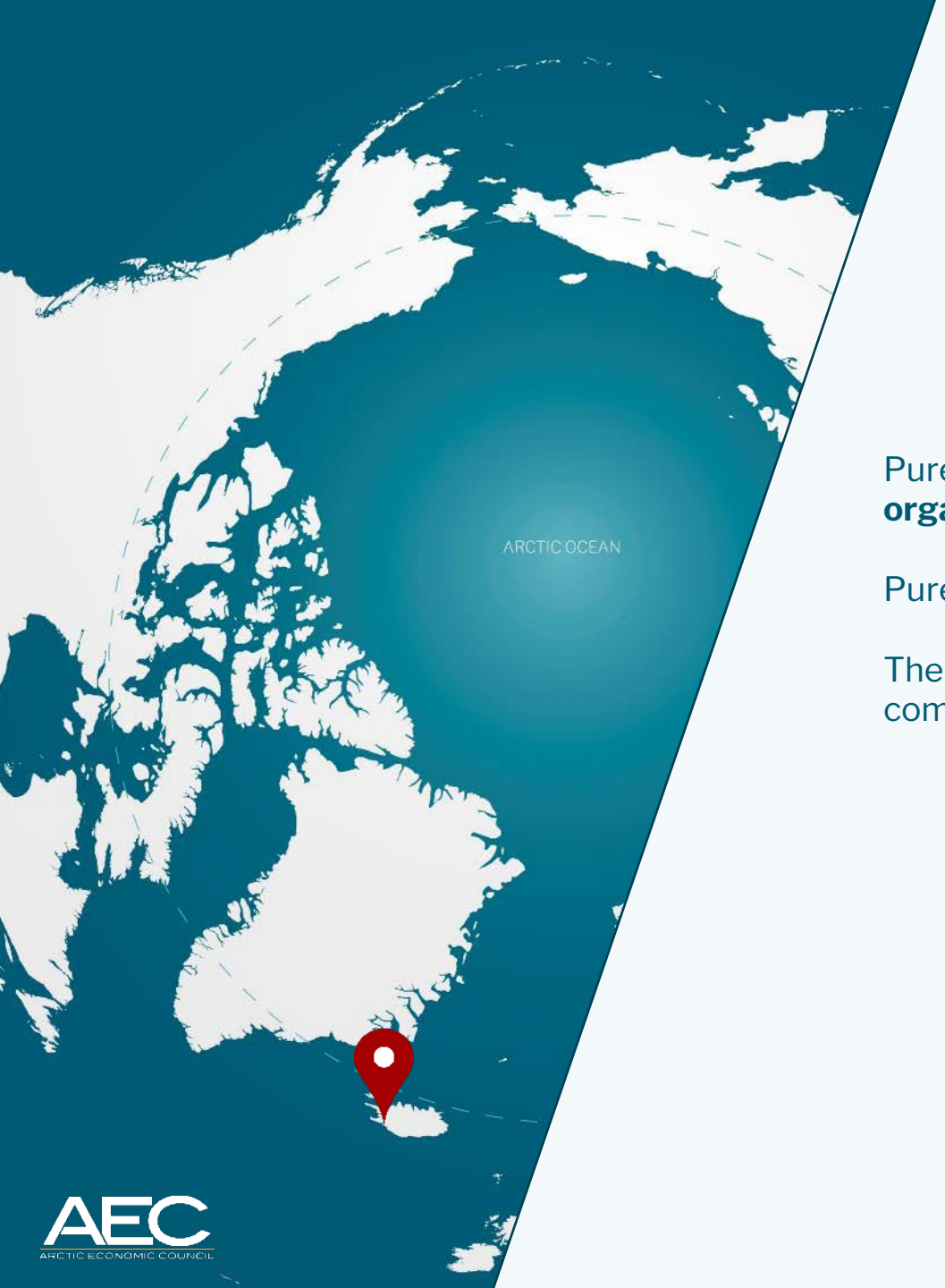
Private

PURE NATURA

AEC
ARCTIC ECONOMIC COUNCIL

Making side products, like organ meats and value-added products allows Pure Natura to contribute to a more sustainable future for farmers. This process also benefits the manufacturing industry in supplements, sales and operations in rural areas of Iceland. Pure Natura´s products are produced with energy derived from Iceland's renewable sources – both hydropower and geothermal heat.

Pure Natura



PURE NATURA

“High-quality food supplement supplier derived from byproducts of free-range Icelandic lambs and sustainably-picked, wild Icelandic herbs..”

Pure Natura makes whole food, high-quality **dietary supplements from Icelandic lamb organ meats and herbs** to support customer’s journey to improved energy and health.

Pure Natura is the first company in the world to use lamb offal as a dietary supplement.

The company values are the purity of products, **quality of the natural superfoods** and company integrity.

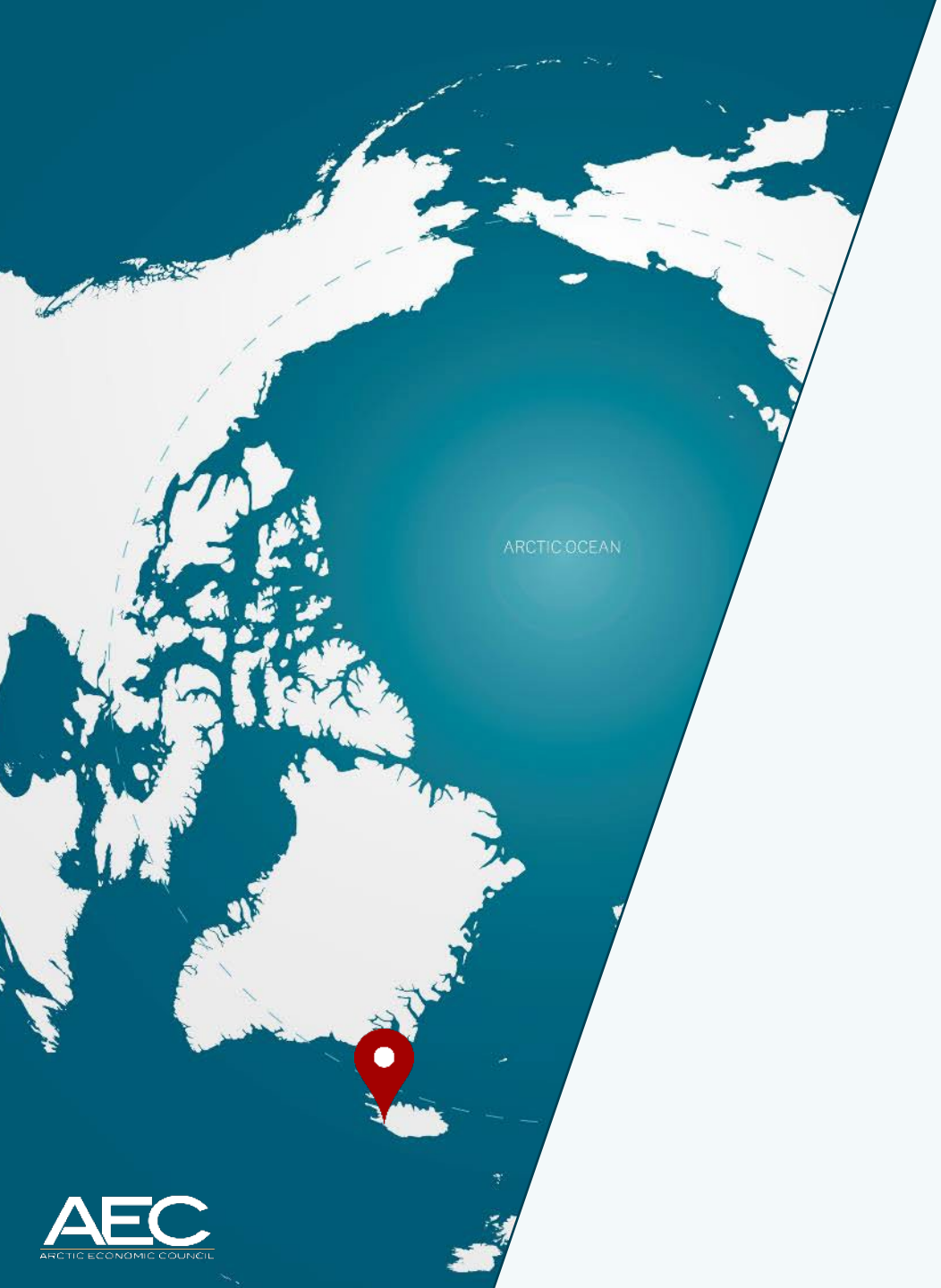
AEC
ARCTIC ECONOMIC COUNCIL

Saudarkrokur, Iceland

Bioeconomy – Supplements

Private

PURE NATURA



PROJECT PITCH

"High-quality food supplement supplier derived from byproducts of free-range Icelandic lambs and sustainably-picked, wild Icelandic herbs.."

PRODUCTION/OUTPUTS

- 240 tons of freeze-dried powder from Nordic whole foods per year.

PERSONNEL

- Approximately 6 people

PROJECT TIMELINE

- December 2022
- **Project status:** approved and fully funded

Saudarkrokur, Iceland

Bioeconomy – Supplements

Private

PURE NATURA

AEC
ARCTIC ECONOMIC COUNCIL

FINANCIALS

"High-quality food supplement supplier derived from byproducts of free-range Icelandic lambs and sustainably-picked, wild Icelandic herbs.."

$3.56M **TOTAL COST**

3M EUR (US$3.54M)

$4.73M **ANNUAL REVENUE**

Current: 200K EUR (US$236.3K)
Anticipated: 4M EUR (US$4.73M)

FUNDING

Both debt and equity

$3.56M **INVESTMENT**

3M EUR (US$3.54M)

Saudarkrokur, Iceland

Bioeconomy – Supplements

Private

PURE NATURA

PROJECT PITCH

“High-quality food supplement supplier derived from byproducts of free-range Icelandic lambs and sustainably-picked, wild Icelandic herbs..”

Looking to expand the business. **Waste into value-** the most nutrient-dense Nordic superfoods. Pure Natura manufactures whole food supplements from Icelandic lamb organ meats and herbs. We need to invest in a plant freeze drier and set it up in Iceland to help with the expansion of the company.

Our values are to improve health by clean, nutrient-dense, original superfoods like organ meats and wild herbs. Pure Natura has four **flagship whole-food, freeze-dried supplements** (Liver, Balance, Power, Detox).

Saudarkrokur, Iceland

Bioeconomy – Supplements

Private

PURE NATURA

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

Pure Natura creates local employment in rural Northwest Iceland and also utilizes raw material from animals that would either be thrown away or used as animal feed.

Organ meat, which is considered to be waste, is, in fact, one of the most nutrient-dense foods available. In addition, Pure Natura believes it is more respectful to the animal slaughtered for meat to use the whole animal. Less waste is good for the planet, builds a strong economy in the area, and improves global health.

Ultimately, Pure Natura ensures the welfare of the animals the company works with, supports Icelandic farmers, increases the utilization of Icelandic products, and minimizes environmental pollution

What resources or organizations have you relied on when crafting your project sustainability strategy?

The founders have always considered sustainable thinking key to the company. Three female entrepreneurs founded Pure Natura to promote sustainable decision-making towards a better world.

How does your project integrate long-term sustainability, especially in the local community, into its design?

Northwest Iceland is predominantly farmland and sheep are the most common farm animal there. For years, farmers have been paid consistently less than the cost of manufacturing lamb meat.

Making side products, like organ meats and value-added products allows Pure Natura to contribute to a more sustainable future for farmers. This process also benefits the manufacturing industry in supplements, sales and operations in rural areas of Iceland. Pure Natura´s products are produced with energy derived from Iceland's renewable sources – both hydropower and geothermal heat.

This means that its production process leaves a minimum environmental impact and allows the company to stay true to its ideas of sustainability at all stages of production. This essentially leaves behind a small environmental footprint of the company's production and fits its Win-Win concept perfectly. Additionally, production still occurs in the small town where Pure Natura was founded.

Q&A

How does your project balance economic and social goals with environmental protection?

Pure Natura's top priority is environmental awareness. The company is passionate about limiting waste and using the whole of its manufacturing products. It does not use harmful chemicals in the process.

Every year, for instance, the founders plant approximately 10 thousand trees to ensure that the company participates in making the earth a healthier planet.

Pure Natura also allows Icelandic lambs to roam freely in nature all their lives, live only on grass and what nature has to offer and receive no antibiotics, growth hormones, or other undesirable substances.

Furthermore, the herbs Pure Natura uses are mostly found in the wild in Icelandic nature, far from the pollution of cities and towns.

What measures have you taken to increase transparency and guard against corruption in your project's financial and reporting activities?

Over the last 3 years, Pure Natura has partnered with the largest research institute for food in Iceland. This partnership allows the company to be confident that all of its products are of the highest quality and meet safety checks.

What channels have you set up to effectively communicate with local communities, including addressing grievances and requests for information?

Pure Natura draws from the wisdom of its ancestors and incorporates the herbal blends that have been used by local people for hundreds of years.

STAKEHOLDERS

"High-quality food supplement supplier derived from byproducts of free-range Icelandic lambs and sustainably-picked, wild Icelandic herbs.."

All production still takes place today in Sauðárkrókur. After the Efficient Collaborative Retail Marketing, Pure Natura met with 50 retail buyers. Walmart is now selling Pure Natura's products. It is also available on Amazon for purchase.

Currently, Pure Natura manufactures supplements for its own brand and for brands in the UK. The company is also taking on new clients in the USA. Therefore, expansion of production capacity is needed.

Saudarkrokur, Iceland

Bioeconomy – Supplements

Private

PURE NATURA

INFRASTRUCTURE

Northwest Territories

THE TŁICHǪ HIGHWAY: A SUSTAINABLE INFRASTRUCTURE PROJECT

AEC ARCTIC ECONOMIC COUNCIL

NWT, Canada

Infrastructure – Roads

Public Private Partnership

Northwest Territories

KEY DATA

"Indigenous-operated highway project providing access from Highway 3 to the community of Whatì in the Northwest Territories"

OUTPUT

- Two-lane all-season, gravel highway between NWT Highway 3 and the Community of Whatì storage.

PERSONNEL

- At peak construction, 276 workers
- Currently 115 employees
- Post construction Operation and Maintenance 8 to 11 NWT/Tłı̨chǫ employees

PROJECT TIMELINE

- Substantial Completion date– 30/11/2021
- Final completion date – 30/11/2022
- Operation and Maintenance through to 2047
- **Project status:** Status: Funded, Under Construction.

NWT, Canada

Infrastructure – Roads

Public Private Partnership

AEC ARCTIC ECONOMIC COUNCIL

FINANCIALS

"Indigenous-operated highway project providing access from Highway 3 to the community of Whatì in the Northwest Territories"

$307M

TOTAL COST

CA$411.8M (appx. US$307m)

FUNDING

25% from PPP Canada
75% from Government of NWT

INVESTMENT SPENDING BREAKDOWN

- GNWT Substantial Completion payment: CA$110.4M
- Service Payment – Capital Portion: CA$148.5M
- Service Payment – OMR Portion: $152.9M

NWT, Canada

Infrastructure – Roads

Public Private Partnership

Northwest Territories

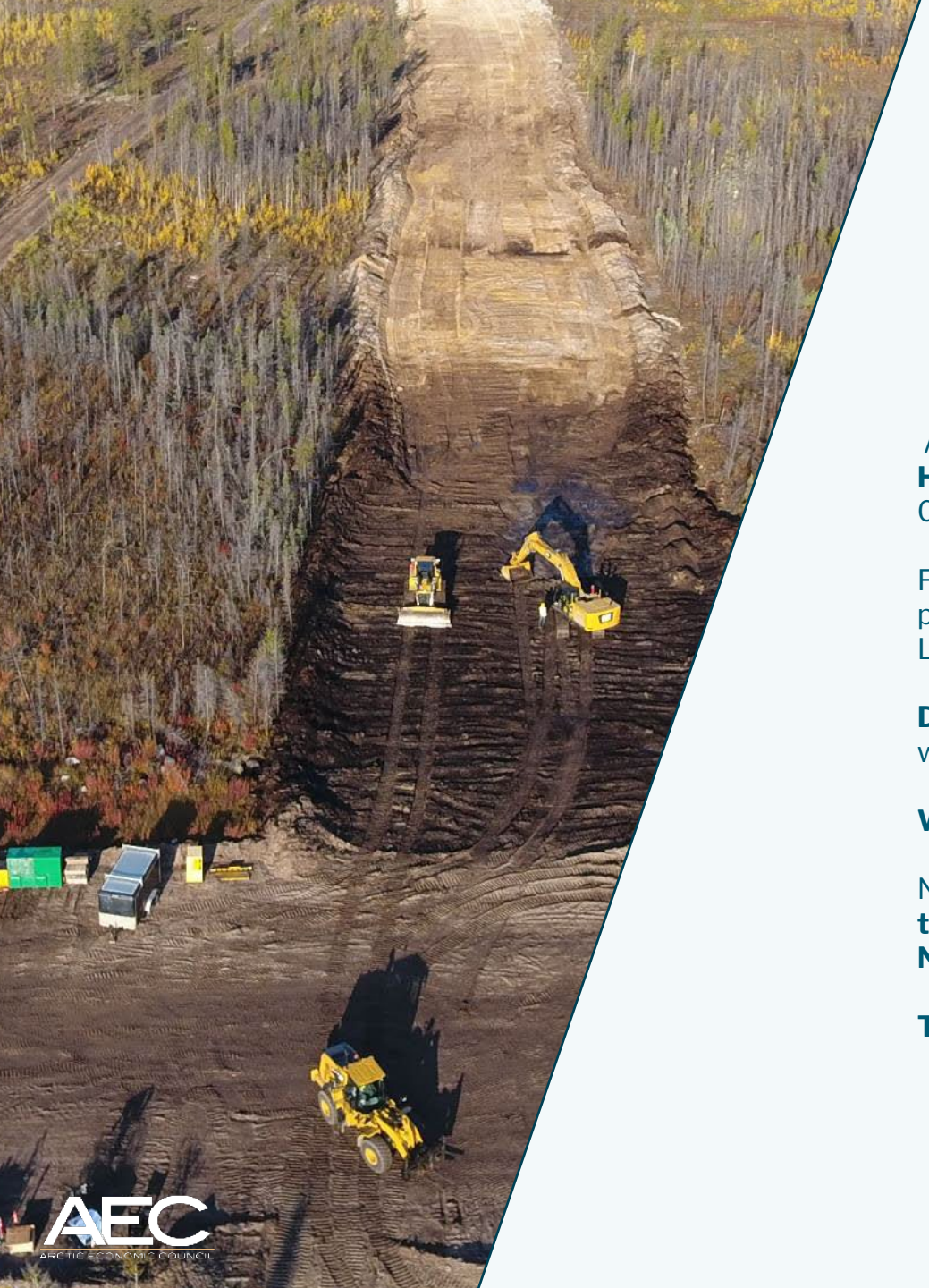
SUSTAINABILITY

The SDG's are fulfilled in numerous ways. These include but are not limited to:

NWT, Canada

Infrastructure – Roads

Public Private Partnership



PROJECT PITCH

"Indigenous-operated highway project providing access from Highway 3 to the community of Whatì in the Northwest Territories"

THE TŁICHǪ HIGHWAY

A two-lane, 97-kilometre gravel all-season road, providing a **year-round connection from Whatìto Highway 3.** The road top width is 8.5 metres including each lane of 3.75 metres width and another 0.5 metres width of shoulders on either side.

Four major structural bridges, two major structural culverts and more than one hundred drainage pipe culverts. This road is designed to RLU80 standards with a design speed of 80km/h for Rural Local undivided (Low Volume) and a posted speed limit of 70 km/h.

Design standard is for year-round use by commercial and private vehicles according to the size and weight limitations outlined by NWT regulations

Will increase access for the winter roads to the communities of Gamètì and Wekweètì.

North Star Infrastructure GP has signed up to a **detailed training plan** requirement to **employ and train Tłı̨chǫ Citizens.** North Star Infrastructure GP is contractually **obligated to ensure Tłı̨chǫ, Northern and Local Businesses deliver a meaningful proportion of the project.**

The Tłı̨chǫ Investment Corporation has had an equity share in the project.

NWT, Canada

Infrastructure – Roads

Public Private Partnership

AEC ARCTIC ECONOMIC COUNCIL

PROJECT PITCH

"Indigenous-operated highway project providing access from Highway 3 to the community of Whatì in the Northwest Territories"

An infrastructure project improving the local community's life

- Important role in the longevity and health of local communities
- Will essentially improve the ease of access to various health care services for local residents
- Will be improved access to goods and services which will reduce the cost of living
- The project brings support concerning new social and employment opportunities
- Will attract further interest from industry in the exploration and development of natural resources

Ensuring the involvement of the populations

- The project ensures inclusive and equitable consultations with the local communities through various collaborations
- North Star Infrastructure has set up a Community Coordination Lead who works directly with the local communities
- The Government of the Northwest Territories has been working collaboratively with the Tłı̨chǫ Government to advance the project, through the environmental assessment process, procurement and now construction

NWT, Canada

Infrastructure – Roads

Public Private Partnership

STAKEHOLDERS

"Indigenous-operated highway project providing access from Highway 3 to the community of Whatì in the Northwest Territories"

The project owner is the Government of the Northwest Territories.

The primary stakeholders:

- PPP Canada
- GNWT
- Tłı̨chǫ Investment Corporation (TIC)
- North Star Infrastructure (NSI)
- Kiewit

NWT, Canada

Infrastructure – Roads

Public Private Partnership

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

The project's biggest contribution to the Arctic is its Infrastructure development. This has a very important role in the longevity and health of local communities.

Firstly, the Tłı̨chǫ Highway project will essentially improve the ease of access to various health care services for local residents.

Secondly, there will be improved access to goods and services that will reduce the cost of living in the region.

And thirdly, the project brings support concerning new social and employment opportunities while helping attract further interest from industry in the exploration and development of natural resources.

How does your project balance economic and social goals with environmental protection?

The Tłı̨chǫ Highway project has undergone an environmental assessment which was required under the Mackenzie Valley Resource Management Act (MVRMA). This assessment determined if the project was likely to have significant adverse impacts on the environment or be of public concern.

The project was approved by the board and the Tłı̨chǫ Government has separately concurred with the board's report. The report, conclusively, shows that the project balances economic and social goals while ensuring that the environment remains protected

How does your project help develop human capital in the communities where it's located?

Providing employment and economic development opportunities ensures communities remain healthy and vibrant.

North Star Infrastructure GP has signed up to a detailed training plan that requires them to employ and train Tłı̨chǫ Citizens into various roles through the construction, operations, and maintenance periods – with particular attention towards creating opportunities for women and youth.

This will ensure that significant knowledge and capacity transfer occurs, building on the skills that already exist within the Tłı̨chǫ Communities. North Star Infrastructure GP is contractually obligated to ensure Tłı̨chǫ, Northern and Local Businesses deliver a meaningful proportion of the project, and achievement of these obligations will be carefully monitored by the GNWT.

The employment and training opportunities associated with the project allows residents to better support themselves and supports the development of a strong northern workforce.

The employment and training opportunities associated with the project allows residents to better support themselves and supports the development of a strong northern workforce

Tłı̨chǫ Highway

Q&A

What specific mitigation measures, technological or otherwise, has your project put in place to safeguard the local environment?

The Tłı̨chǫ Highway project has put in place significant measures to ensure environmental protection and restrict potential future hazards.

The current mitigation measures associated with the project to safeguard the environment include plans associated with permafrost, wildlife, caribou habitats, fish habitats and sediment erosion.

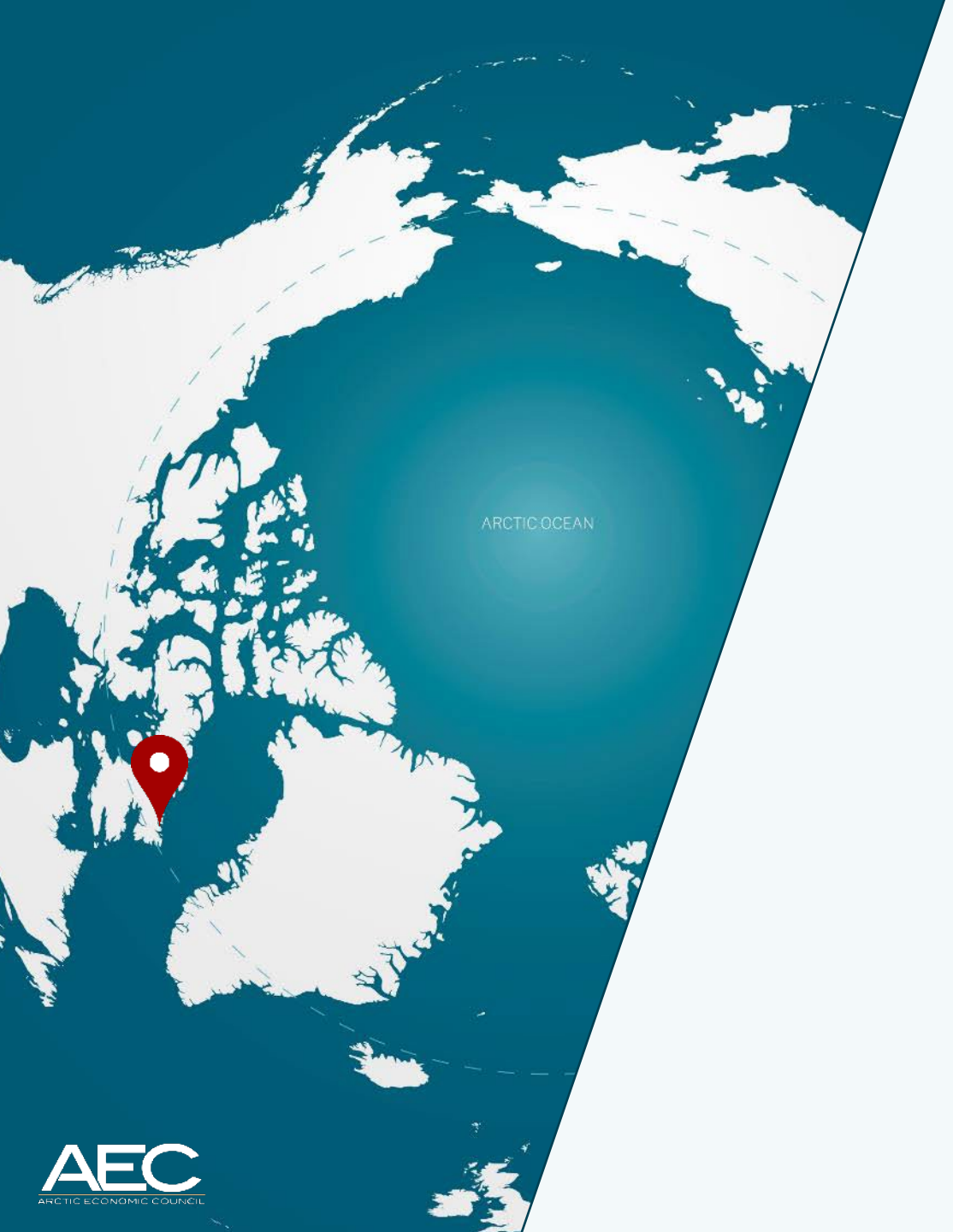
How have you ensured inclusive and equitable consultations with local/indigenous communities?

The Tłı̨chǫ Highway project ensures inclusive and equitable consultations with the local communities through various collaborations. For example, as part of the project, North Star Infrastructure (NSI) has set up a Community Coordination Lead (CCL) who works directly with the local communities to solicit their inputs and needs while addressing grievances.

Furthermore, the CCL's responsibility includes coordinating workshops and training to develop the necessary skills of residents to get them ready for working life.

The Government of the Northwest Territories has been working collaboratively with the Tłı̨chǫ Government (TG) to advance the Tłı̨chǫ All-Season Road project, through the environmental assessment process, procurement and now construction.

Since 2012, the Tłı̨chǫ Investment Corporation (TIC), the business wing of TG, has had an equity share in the project.

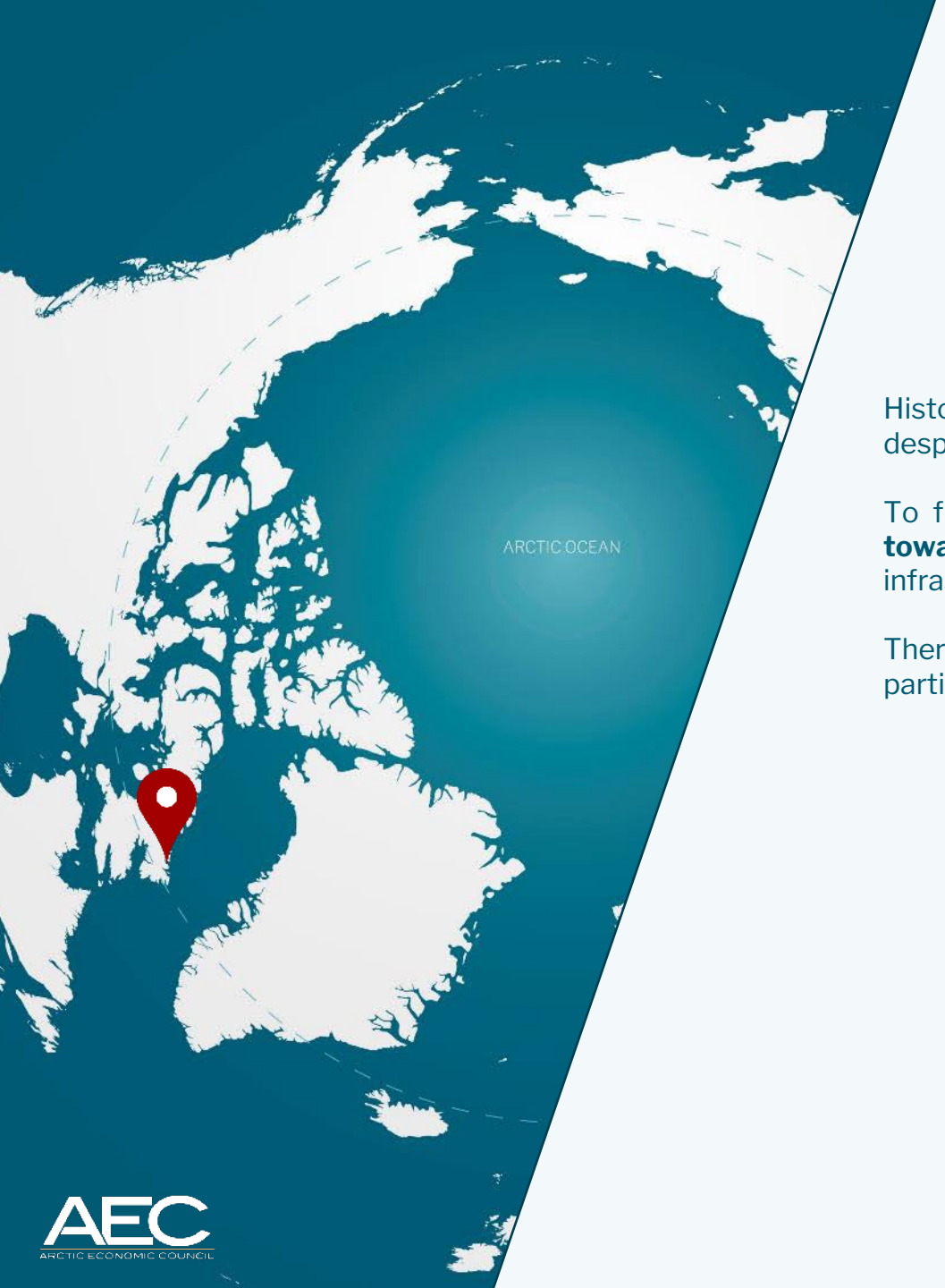


QIKIQTARJUAQ DEEP SEA PORT

Qikiqtarjuaq, NU, Canada

Infrastructure – Maritime port

Public



GOVERNMENT OF NUNAVUT

"A publicly-funded deep sea port in Nunavut, representing the largest infrastructure investment in the area and serving as a basis for further development."

Historically, Nunavut has not received many investments in infrastructure or sustainable opportunities, despite **holding 42% of Canada's Arctic marine waters and coastline** within the jurisdiction.

To further add, Nunavut has significant unemployment rates and needs meaningful **investments toward sustainable economic opportunities.** Typically the first step of this is an investment in infrastructure.

Therefore, The Department of Economic Development and Transportation's role is to support the participation of Nunavummiut in the development and growth of the Nunavut Economy.

AEC
ARCTIC ECONOMIC COUNCIL

Qikiqtarjuaq, NU, Canada

Infrastructure – Maritime port

Public

KEY DATA

"A publicly-funded deep sea port in Nunavut, representing the largest infrastructure investment in the area and serving as a basis for further development."

PRODUCTION/OUTPUTS

- Port infrastructure for marine sector and industries that support it.

PERSONNEL

- Current: 5 (Government workers)
- Projected: between 25-150, (depending on the season and which economic spin-offs develop).

PROJECT TIMELINE

- 2022-2027

STAKEHOLDERS

- Government of Nunavut
- Qikiqtani Inuit Association

Qikiqtarjuaq, NU, Canada

Infrastructure – Maritime port

Public

FINANCIALS

"A publicly-funded deep sea port in Nunavut, representing the largest infrastructure investment in the area and serving as a basis for further development."

$42.4M TOTAL COST

CDN53.5M (US$42.4M)

$23.8M ANNUAL REVENUE

Anticipated in the short term: CDN12M (US$9.5) annually
Long-term - CDN30M (US$23.8M) annually

INVESTMENT

Received investment for the port structure itself. More investment is needed to support industries for port operations and any spin-off economic opportunities.

FUNDING

- Government of Canada
- Government of Nunavut

Qikiqtarjuaq, NU, Canada

Infrastructure – Maritime port

Public

AEC ARCTIC ECONOMIC COUNCIL

SUSTAINABILITY

"A publicly-funded deep sea port in Nunavut, representing the largest infrastructure investment in the area and serving as a basis for further development."

The port proposal addresses community initiatives and factors in environmental impacts and infrastructure resilience to climate change and harsh climate.

The SDG's are fulfilled in numerous ways. These include but are not limited to:

Qikiqtarjuaq, NU, Canada

Infrastructure – Maritime port

Public

PROJECT PITCH

"A publicly-funded deep sea port in Nunavut, representing the largest infrastructure investment in the area and serving as a basis for further development."

QIKIQTARJUAQ DEEP SEA PORT

A deep seaport in Qikiqtarjuaq, Nunavut has been approved for federal funding up to $40M CDN ($31.7M USD) and will be the first marine economic infrastructure investment for Nunavut of this size.

This infrastructure will allow Nunavummiut to be more active in the significant offshore fisheries that take place between Baffin Island and Greenland. Large offshore factory freezer fishing vessels will be able to land their catch in Nunavut, reducing the amount of economic leakage from the territory.

Additionally, there will be more opportunities for employment in the marine sector and industries that support it. Nunavut needs more investment in infrastructure like this, including investment into support infrastructure (e.g. accommodations, runways) to be able to undertake economic opportunities, especially within its marine sector. So far the investment received and those in the process of being agreed to is only for the construction of the port.

Additional funding is needed to build infrastructure for support services such as hotels, extra fuel tank reserves, larger fish processing plants, and more.

Qikiqtarjuaq, NU, Canada

Infrastructure – Maritime port

Public

In Nunavut, there is a need to balance economic opportunity and environmental protection, and this is met with the construction of infrastructure and the successful operation of the port which will provide economic opportunities.

Qikiqtarjuaq Deep Sea Port

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

This project will be the first infrastructure of its type in Nunavut, granting Nunavummiut access to economic development and minimizing economic leakage. Ideally, the project will support the needs of northern marine trade corridors as the Northwest passage opens and Arctic marine traffic increases. The port will also increase northern vessel safety and services while supporting the growing northern fisheries, tourism and trade industries.

What is your fundraising strategy? What barriers or challenges have been greatest in securing funding for your project?

The greatest barrier is applying for federal funding. Most people outside of Nunavut don't understand the realities and are not in touch with what is available in Nunavut and what is needed to bring the territory up to current standards found in southern Canadian or other Arctic jurisdictions.

How does your project help develop human capital in the communities where it's located?

This project helps to develop human capital by bringing direct economic opportunities and employment to a community with few employment options. As a result, workers will be equipped with the necessary skills and knowledge needed for jobs.

How does your project balance economic and social goals with environmental protection?

In Nunavut, there is a need to balance economic opportunity and environmental protection, and this is met with the construction of infrastructure and the successful operation of the port which will provide economic opportunities. However, in order to ensure this, the port needs to be constructed with adequate care in a timely manner as to factor in and minimize environmental impacts.

What measures have you taken to increase transparency and guard against corruption in your project's financial and reporting activities?

This project will be administered by the Government of Nunavut through its transparent procurement processes and all funding is closely monitored by the finance teams, including the review of applicant reports on construction projects. Due to these measures being in place, the risk of corruption is low.

IC ALASKA

A MEMBER OF THE C CHANGE GROUP

ANCORAGE AIR CARGO CAMPUS

Anchorage, AK, USA

Infrastructure – Airport

Private

AEC
ARCTIC ECONOMIC COUNCIL

IC ALASKA

"Dedicated to developing sustainable world-class infrastructure at the world's 4th busiest air cargo hub."

THE INVESTMENT COMPANY OF ALASKA LLC

IC Alaska is committed to developing sustainable infrastructure initiatives across the State of Alaska with an impact for the increasingly efficient utilization of natural resources across the Arctic region and beyond.

AEC
ARCTIC ECONOMIC COUNCIL

Anchorage, AK, USA

Infrastructure – Airport

Private

PROJECT PITCH

"Dedicated to developing sustainable world-class infrastructure at the world's 4th busiest air cargo hub."

ANCORAGE AIR CARGO CAMPUS

PRODUCTION/OUTPUTS

- cargo handling and warehousing
- maintenance and repair hanger for large Class 6 aircraft

PERSONNEL

- Target 400-500 FTEs by 2025

PROJECT TIMELINE

- 5 years

Anchorage, AK, USA

Infrastructure – Airport

Private

FINANCIALS

"Dedicated to developing sustainable world-class infrastructure at the world's 4th busiest air cargo hub."

$250M ***TOTAL COST***

$50M ***ANNUAL REVENUE***

Target Future Revenues of $50M USD/year by 2025

$20-40B ***TURNOVER***

Target Future Annual Turnover of 20,000 flights/year, each with an average of cargo value of $1-2MUSD, equating to $20-40 billion USD of cargo annually

INVESTMENT BREAKDOWN

$112M for 13 hardstands,
$26M for a 90,000 square foot warehouse,
$49M for a 180,000 square foot 2-bay MRO Hanger

Including for community/environmental initiatives:
$5-10M for creating a sound berm, raised greenbelt, and paid-for but not utilized lease space

Anchorage, AK, USA

Infrastructure – Airport

Private

FINANCIALS

"Dedicated to developing sustainable world-class infrastructure at the world's 4th busiest air cargo hub."

FUNDING

Private infrastructure equity and private and/or municipal deb:
$125M USD equity
$125M USD debt

$250M

TOTAL ASSETS IN ARCTIC

Target of $250M USD

STAKEHOLDERS

Owned by the IC Alaska LLC (the Developer) and its investors, comprised of infrastructure funds and other institutional investors.

Anchorage, AK, USA

Infrastructure – Airport

Private

SUSTAINABILITY

"Dedicated to developing sustainable world-class infrastructure at the world's 4th busiest air cargo hub."

Improving the shipment of PPE and vaccines between North America and East Asia

Sustainable technologies such as glycol recapture and recycling improve the environment compared with prevailing practices;

Critical and large-scale employment in a chronically underemployed state with a large indigenous population;

Improves the pollution emissions associated with air cargo;

World-class infrastructure for what has become the world's 4th largest air cargo hub and the fastest-growing of the top 10 air cargo airports;

Establishes key partnerships for sustainable and low-footprint operations across dozens of air cargo carriers;

Anchorage, AK, USA

Infrastructure – Airport

Private

PROJECT PITCH

"Dedicated to developing sustainable world-class infrastructure at the world's 4th busiest air cargo hub."

ANCORAGE AIR CARGO CAMPUS

The Anchorage airport has seen significant traffic growth during the pandemic especially coming from Asia. The airport saw a 15% increase in cargo, which has bumped the airport two spots higher on the list of busiest cargo airports.

However, despite the significant growth the airport lacks the services its competitors occupy. Thus, an expansion was warranted.

The Anchorage (ANC) South Air Cargo Campus will provide:

- world-class and maximally sustainable hardstands for large air cargo aircraft,
- efficient cargo handling and warehousing to minimize the number of flights that are needed for air cargo between continents, and
- a maintenance and repair hanger for large Class 6 aircraft which eliminates the costs and inefficiencies for repairing such aircraft through remote ad-hoc methods.

Anchorage, AK, USA

Infrastructure – Airport

Private

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

By creating a world-class and environmentally-efficient air cargo campus in Anchorage, the utilization of natural resources including fuel and glycol for de-icing become materially improved with commensurate improvements to the natural environment across the Arctic and for air cargo infrastructure between East Asia and North America which has become the world's busiest international air cargo corridor.

With the new campus, we hope to strengthen the airport's facilities, services and overall functioning, anchoring it as a key global and Arctic transport hub.

What is your fundraising strategy? What barriers or challenges have been greatest in securing funding for your project?

The fundraising strategy is to develop the project and create shovel-ready conditions which can appeal to equity investment from long-term infrastructure funds and other institutional investors.

A parallel amount of debt is targeted to match the equity investment through a combination of private and municipal bond sources.

How does your project integrate long-term sustainability, especially in the local community, into its design?

The community was engaged from the outset and continues through the development and operations of the initiative. This led to a combination of more efficient environmental design, including the recycling of glycol used in de-icing operations as well as establishing an optimally irregular sound berm, leveraging off of the experience at Amsterdam Airport to minimize the combination of noise and air pollution in the community.

How does your project help develop human capital in the communities where it's located?

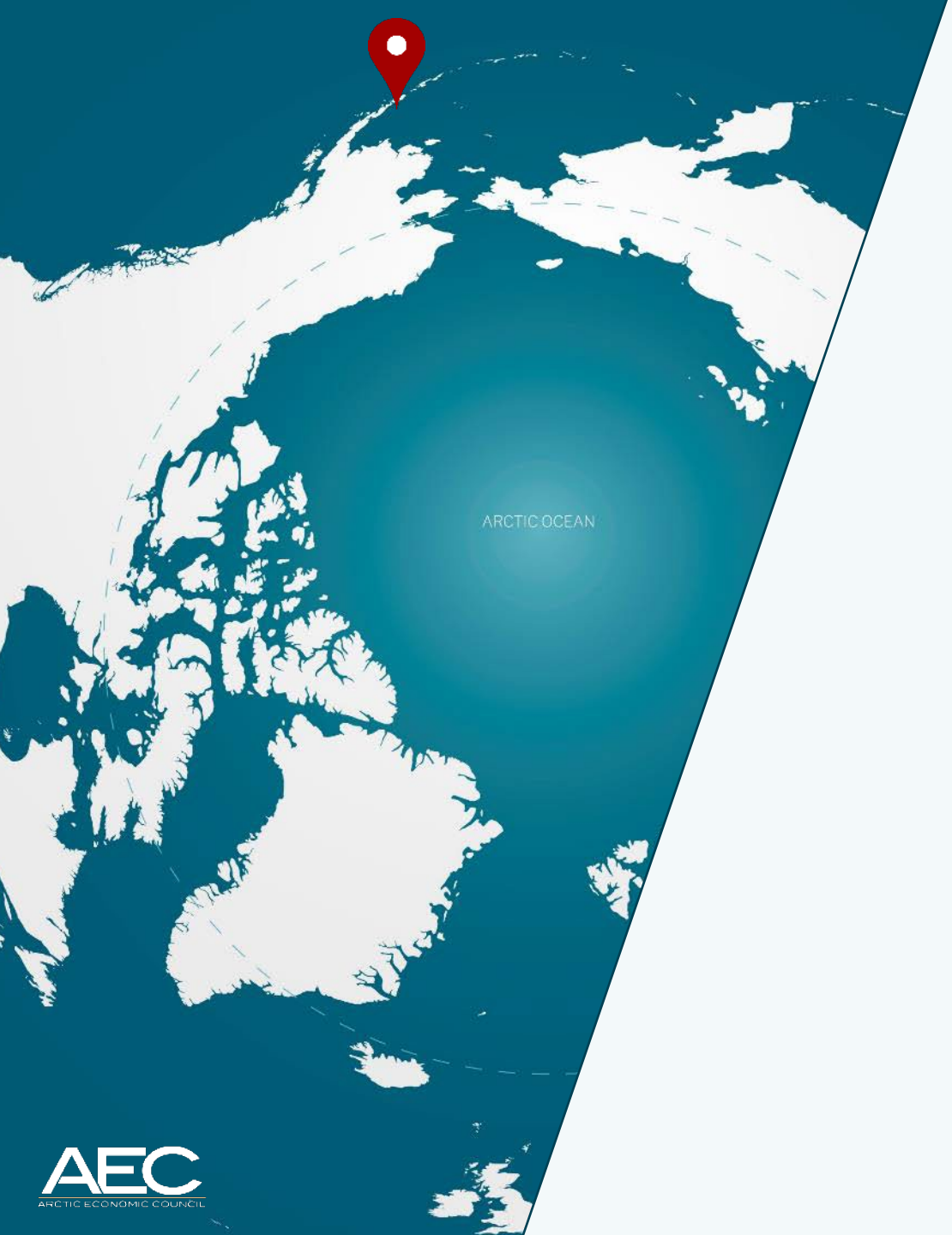
The project will become a significant source of employment for the local community at an airport which is already employing 1 out of every 9 jobs in the Anchorage area, which is Alaska's largest community. There is a special focus on the employment of veterans (VIPER Program), indigenous Native Alaskans, and union labor.

How does your project balance economic and social goals with environmental protection?

The final design and plan reflects the shared objectives of the Airport Authority, the local residents, the local job market, the US Federal Aviation Authority (FAA), and the air cargo carriers. The resulting design and project plan reflects what has become a more efficient and improved initiative compared to alternatives in which any one group's concerns and objectives were not fully considered.

With the new campus, we hope to strengthen the airport's facilities, services and overall functioning, anchoring it as a key global and Arctic transport hub.

IC Alaska

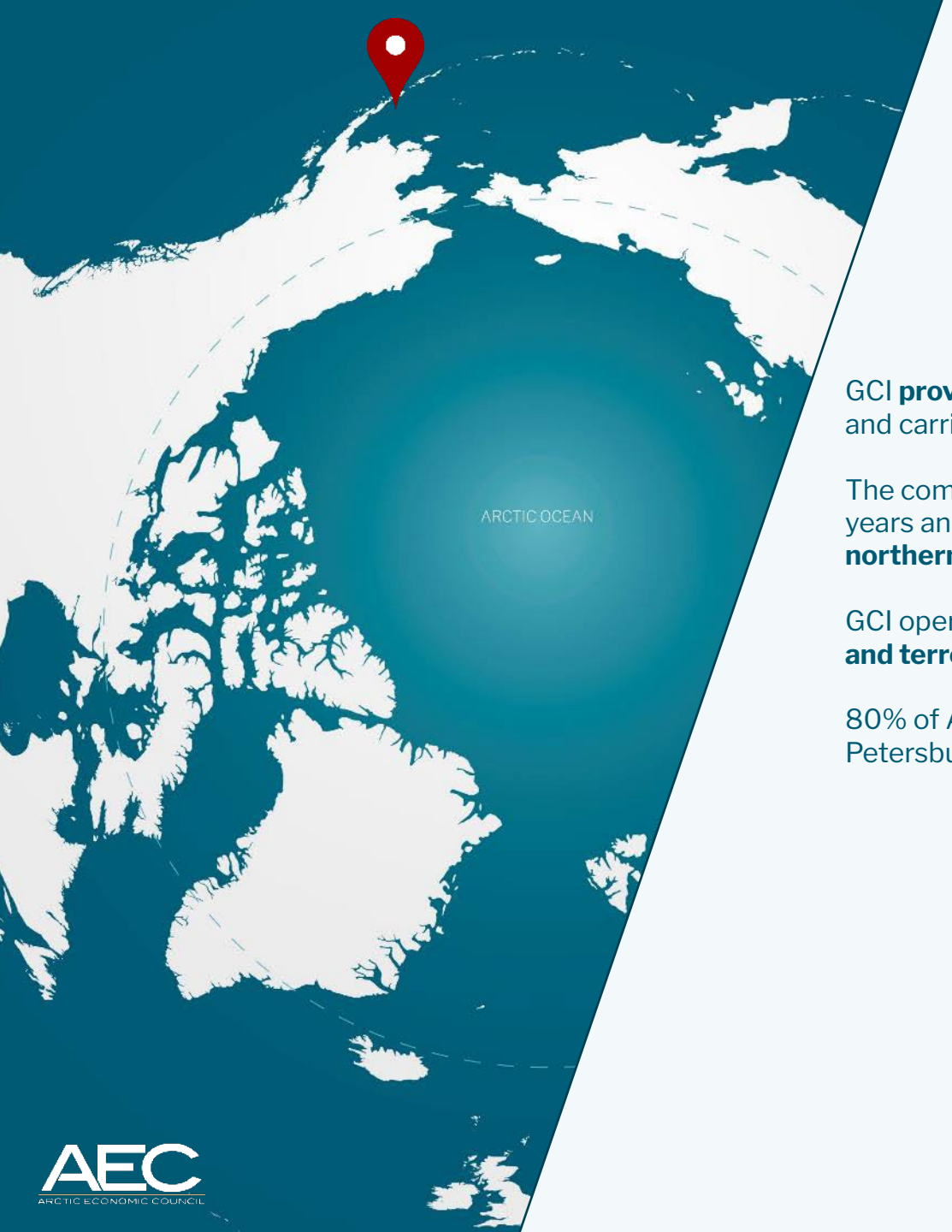


AU-ALEUTIANS FIBER PROJECT

Anchorage, AK, USA

Infrastructure - Telecommunications

Private



GCI COMMUNICATION CORP

"High-speed broadband access to communities across the Aleutians."

GCI **provides data, mobile, video, voice and managed services** to consumer, business, government, and carrier customers throughout Alaska, serving more than **200 communities**.

The company **has invested more than $3 billion** in its Alaska network and facilities over the past 40 years and recently launched true standards-based 5G NR service in Anchorage, now the nation's **northernmost 5G service area**.

GCI operates the largest network in the state including more than **5,500 miles of far-reaching subsea and terrestrial fiber network.**

80% of Alaskans—including those living in small, isolated communities like Ketchikan, Wrangell and Petersburg—have access to 2 GIG gig internet speeds.

AEC
ARCTIC ECONOMIC COUNCIL

Anchorage, AK, USA

Infrastructure - Telecommunications

Private

GCI

KEY DATA

"High-speed broadband access to communities across the Aleutians."

THE AU-ALEUTIANS FIBER PROJECT

PRODUCTION/OUTPUTS

- High-speed broadband access

PERSONNEL

- GCI employs nearly 2,000 Alaskans

PROJECT TIMELINE

- In 2017, planning began.
- In 2020, a grant sparked the development phase of the project.
- By the end of 2021, project design, planning and permitting will be finalized, groundbreaking work will begin in communities and a marine survey conducted.
- Laying fiber is scheduled for Spring 2022.
- Initial service in Unalaska to be activated by the end of 2022.
- **Project status**: in progress

Anchorage, AK, USA

Infrastructure - Telecommunications

Private

AEC ARCTIC ECONOMIC COUNCIL

FINANCIALS

"High-speed broadband access to communities across the Aleutians."

$58M TOTAL COST

US$58M including a US$25 million federal grant from the U.S. Department of Agriculture's ReConnect program in 2020.

$222,581 ANNUAL REVENUE

In 2020, total company revenue was US$222,581.

FUNDING

Public/Private Partnership

INVESTMENT

Funding is used to execute a plan to deploy an 800+ mile subsea fiber an launch urban level speeds in six Aleutian communities.

$3B TOTAL ASSETS IN ARCTIC

GCI has invested more than $3 billion in its Alaska network and facilities over the past 40 years.

Anchorage, AK, USA

Infrastructure - Telecommunications

Private

GCI

SUSTAINABILITY

"High-speed broadband access to communities across the Aleutians."

The SDG's are fulfilled in numerous ways. These include but are not limited to:

Anchorage, AK, USA

Infrastructure - Telecommunications

Private

PROJECT PITCH

"High-speed broadband access to communities across the Aleutians."

THE AU-ALEUTIANS FIBER PROJECT

The AU-Aleutians Fiber Project is a $58 million project that will deliver **urban-level speed, service and reliability** for the first time over an 800+ mile subsea fiber to the Aleutians communities of **Unalaska, King Cove, Sand Point, Akutan, Chignik Bay, and Larsen Bay.**

Over the next two years, GCI will deploy an **860-mile subsea fiber system** to some of the nation's most remote communities.

The Project will enable GCI to **deliver 2 gig internet access to 80% of Alaskans** in 2022 and provide 10 gig speeds in the next five years. The fiber will make landings in six communities with a combined year-round population of 8,000.

The subsea fiber is a non-powered, 12-count fiber optic cable. It's provisioned with 2-100G channels with 8-100G channels capable per fiber pair.

AEC
ARCTIC ECONOMIC COUNCIL

Anchorage, AK, USA

Infrastructure - Telecommunications

Private

GCI

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

GCI works to bridge the digital divide between urban and remote areas, dramatically improving the delivery of a wide range of critically-important services to Alaskans. Creating fast, reliable service in the Aleutians will bring life-changing opportunities to the people who live there.

The Aleutians are also home to a healthy maritime industry with plenty of room to grow. GCI's AU-Aleutians Fiber Project will enable that growth by delivering urban-level connectivity that will open the doors to economic and technological expansion of existing industries and, perhaps, the introduction of new ones, greatly expanding economic opportunities in the region.

The network will provide connectivity possibilities for local businesses, consumers, students, teachers and health care providers. And, if residents are able to take advantage of remote work, distance education, and ecommerce capabilities made possible by fast, reliable connectivity, they're apt to remain in these communities, maintaining and strengthening the culture of the region, which stretches back thousands of years.

GCI, like the U.S. government, also recognizes the strategic importance of connectivity along the Aleutian chain, including Dutch Harbor, one of the nation's largest fishing ports.

How does your project help develop human capital in the communities where it's located?

As the global pandemic has demonstrated, access to connectivity is more important than ever. With urban levels of connectivity, residents of the Aleutians will soon have an incredible amount of online professional opportunities at their fingertips. Working from home for a company that has embraced the distributed workforce model will soon be a viable possibility.

Consumers living in the most remote communities in the nation will have access to urban-level 2 gigabits (2GIG) speeds in their home. And with easier access to things like online training resources and distance learning classrooms, personal and professional development opportunities are exponentially greater.

Equally important as professional growth will be for residents of these communities will be the ability for them to remain in these communities without sacrificing economic stability. In turn, communities will be nurtured, and the long-standing culture of the Aleutians will be strengthened.

GCI is committed to efforts across Alaska, donating $2 million in cash, products, scholarships, and grants to Alaska organizations each year. GCI regularly donates to causes including suicide prevention, over 150 AK nonprofit organizations and $6 million in scholarships over the last two decades.

In 2019, nearly 500 GCI employees volunteered more than 5,300 hours. The Emergency Broadband Benefit (EBB) Program offers temporary free entry level internet to qualifying households by providing a $75 monthly credit. This new program means once qualified you can get GCI's entry-level internet plan for free.

Q&A

How does your project strengthen local/indigenous communities and traditional livelihoods?

GCI has taken special care to protect the history and livelihoods of the indigenous communities that have called the region home for millennia.

Throughout the project's marine survey, marine biologists are aboard the vessel, monitoring animal activities, including migration patterns, fishing grounds, and mammal groups, helping ensure the project doesn't impede on marine wildlife or harm traditional and modern fisheries in the region.

Our team also consults with marine archaeologists and cultural monitors to ensure the project does not affect any historical resources.

Additionally, GCI has partnered with the Museum of the Aleutians in Unalaska to help make its collection available to a wider community by developing additional web content to aid teachers, parents and visitors in teaching and learning Aleutian history and culture – a project that will only be more impactful as connectivity is improved.

What specific mitigation measures, technological or otherwise, has your project put in place to safeguard the local environment?

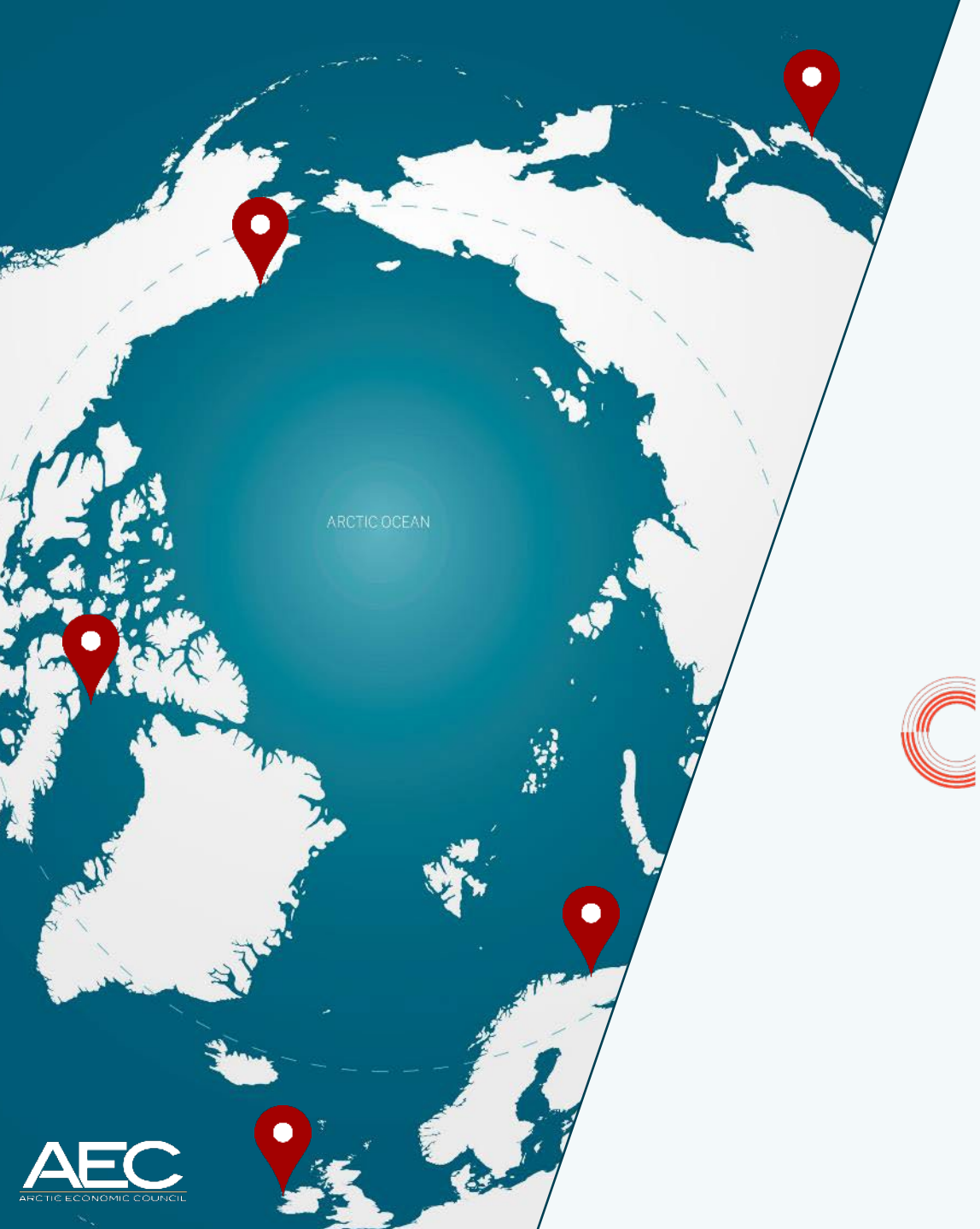
The results of our marine survey are currently being reviewed by marine archaeologists to ensure the project does not affect any historical resources. From the earliest planning stages, GCI has continually taken special precautions to ensure the safety and maintain the integrity of Alaska's ecosystem and cultural resources.

During the marine survey processes, crewmen act as observers and abide by strict guidelines to not impede on marine wildlife. And throughout the fiber laying process, onboard marine biologists monitor animal activities including migration patterns, fishing grounds and mammal groups.

What channels have you set up to effectively communicate with local communities, including addressing grievances and requests for information?

In a sense, the AU-Aleutians Fiber Project has been built on communication. It's a project that could not have hap pened without extensive and vocal support from residents, businesses, tribal organizations, lawmakers, Alaska Native Corporations, and so many more. We've worked hard to strengthen those relationships and build a high level of trust – and we intend to keep doing so.

Through a combination of community town halls, individual outreach, legislative relations, and, of course, through GCI's frontline staff, we have made an extensive effort to communicate with local communities and have several well-established channels to address grievances and requests for information.



Far North Fiber

Cinia

Far North Digital LLC

ARTERIA

Anchorage, AK, USA

Infrastructure – Fiber optic cable

Private

Far North Digital LLC

AEC
ARCTIC ECONOMIC COUNCIL

A Pan-Arctic Submarine Fiber Optic Cable linking Asia, North America and Europe, providing unrivalled speed, security, route diversity, and research capabilities to global partners

Far North Fiber, Inc.

"An Uncommon Effort for the Common Good: Partners Connecting Three Continents"

Far North Fiber, Inc. is a Joint Development Corporation created to deliver the first long-haul submarine fibre system through the Northwest Passage. The partners are:

- **Far North Digital, LLC** an Alaskan limited liability company, initiated the Far North Fiber project. FND and its affiliate, True North Global Networks, a Canadian Limited Partnership, are focused on development of the Far North Fiber backbone project and the extension of fiber-based telecom services into Northern communities. http://fn-digital.com
- **Cinia**, a Finnish company, provides secure high-availability data network and software solutions offering communications solutions to the Nordics, Central Europe and to markets in Asia and Eastern Europe. Cinia owns and operates a ~1200 kilometer fibre optic network. https://www.cinia.fi/en/company
- **Arteria Networks Corporation**, a Japanese company and a subsidiary of Marubeni Corporation, provides corporate services over its own high-capacity fibre backbone and leased circuits network. Its condominium internet service has the No. 1 market share in Japan. https://www.arteria-net.com/en/
- **Alcatel Submarine Networks** (ASN) is the principal supplier for the Far North Fiber project. ASN has over 160 years' experience in developing, designing, and manufacturing submarine cable systems, with more than 650,000 km of optical submarine systems deployed worldwide. It is the most experienced supplier of Arctic submarine cable installations. ASN provides all elements of turnkey global undersea transmission systems, along with marine and maintenance operations performed by its wholly-owned fleet of cable ships. https://web.asn.com/en/

Anchorage, AK, USA

Infrastructure – Fiber optic cable

Private

Far North Digital LLC

SUSTAINABILITY

"Secure, high-capacity fiber optic Gateway to Communities of the Far North"

	SUSTAINABLE DEVELOPMENT GOALS
7 AFFORDABLE AND CLEAN ENERGY	Far North Fibre will enable robust, fiber optic broadband connections to data centers powered by efficient, green energy in northern climates.
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	Far North Fibre builds resilient infrastructure that will promote inclusive and sustainable industrialization and foster innovation with advanced telecommunications services bridging remote northern communities.
10 REDUCED INEQUALITIES	As the Covid Pandemic has shown, having access to communications infrastructure allows communities to thrive. Far North Fibre will offer historically underserved communities the means for mainstream commercial, education and health services. .
11 SUSTAINABLE CITIES AND COMMUNITIES	Stable, reliable, world-class communications is foundational to successful and sustainable communities. Far North Fibre will have "Branching Units" inserted into the backbone cable to permit shore landings at strategically located Arctic "gateway" communities.
13 CLIMATE ACTION	Science Monitoring And Reliable Telecommunications (SMART) cable technologies will give academic institutions and science agencies advanced tools to study the oceanography of the most rapidly changing oceans on earth.

Anchorage, AK, USA

Infrastructure – Fiber optic cable

Private

Far North Digital LLC

PROJECT PITCH

“Shortest, Fastest, Most Secure.“

Far North Fiber is a 14,500 km route greatly reducing the optical distance between Japan and Western Europe relative to all other combinations of terrestrial and oceanic fibre plant available today. The route minimizes signal latency to an unrivaled 142 millisecond Round-Trip Delay (RTD).

The high-fibre count cable offers unprecedented transmission capacity, route diversity, and geopolitical stability to the global fibre network.

Far North Fiber will connect hubs of the hyperscale data centre industry, cloud networks, and Low Earth Orbit (LEO) satellite systems in Asia, North America, and Europe to the low-energy-cost Arctic.

Branching units are located to support a buildout to Arctic and Subarctic communities, providing critical infrastructure and system redundancy.

The Far North Fiber system aims to integrate SMART cable technologies, giving advanced new tools to study the oceanography of the most rapidly changing oceans on earth.

Exclusive agreement with supplier Alcatel for turnkey project; system ready-for-service 2026. Agreements in place with Japanese, Icelandic, Finnish and Irish partners for landing rights, backhaul, and permitting services.

AEC
ARCTIC ECONOMIC COUNCIL

Anchorage, AK, USA

Infrastructure – Fiber optic cable

Private

Far North Digital LLC

PROJECT PITCH

“Unique world class, state of the art, upgradeable.”

PRODUCTION/OUTPUTS

- 240Tbps of broadband capacity connecting Asia, North America, and Europe through the Arctic.

PERSONNEL

- Far North Fiber, Inc. is backed by the combined international staff of partner corporations, approx. 1200.

PROJECT TIMELINE

- Approximately 48 months
- 2022 Supply Contract-in-Force (CIF)
- 2023 – 2024 Marine Route Survey
- 2023 – 2025 Cable Manufacturing & Installation
- 2026 Ready-for-Service

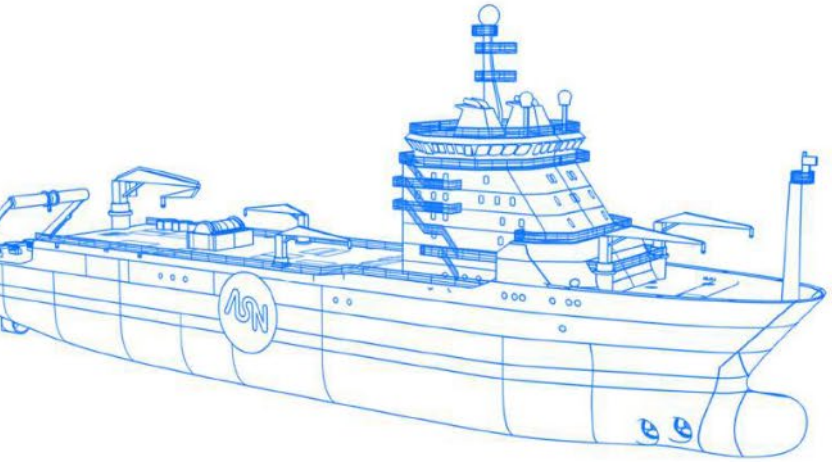
Anchorage, AK, USA

Infrastructure – Fiber optic cable

Private

Far North Digital LLC

AEC ARCTIC ECONOMIC COUNCIL



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FINANCIALS

Far North Fiber, Inc.

Sources and Uses (000's USD)

Sources	Totals	%
Debt	685,689	60%
Equity	445,131	40%
Total sources	1,130,820	

Uses	Totals	%
Working Cap	17,993	1.59%
Landings	36,743	3.25%
Wet Plant Install	1,076,084	95.16%
Total Uses	1,130,820	

NOTES:

Assumes 60:40 Debt : Equity allocation

Landings and wet plant figures include engineering, permitting, licensing, installation, testing, and commissioning

Anchorage, AK, USA

Infrastructure – Fiber optic cable

Private

Far North Digital LLC

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

The FNF project is aligned with Canada's Indigenous Community Infrastructure Initiative (ICII) and other regional interests along the cable route in that it provides benefits to Indigenous and rural communities to help close the infrastructure gap. Broadband availability will have ripple-effect benefits to other sectors by, for example, enabling advanced, remote 'supervisory control and data acquisition' (SCADA) system architecture for clean power generation, transmission and storage, green infrastructure projects such as 'smart' buildings, and agriculture-related infrastructure. Submarine cable construction will generate local jobs and business opportunities including follow-on terrestrial fiber, microwave, wi-fi and related broadband facilities build-out.

How does your project help develop human capital in the communities where it's located?

Far North Fiber will provide a bridge to communities on the wrong side of the digital divide. That means access to telemedicine, distance education, governmental services and broad new opportunities in the developing digital economy.

How does your project balance economic and social goals with environmental protection?

The planned route will cross culturally and environmentally sensitive areas. Far North is seeking input from interested communities and regulatory agencies and will follow best practices in the project design and installation to protect the interests and ecological values associated with these areas. Far North is working closely with its supplier Alcatel, one of the leading fibre installers in the world with experience working in sensitive Arctic environments, to develop appropriate strategies for work in these areas.

"Global digital connectivity is essential to drive future economic growth and coherence between continents. Fast and reliable internet is vital for all parts of modern society, from private use to businesses, governments, and research and education (R&E) institutions—and will be even more so going forward, as digital transformations in society require more robust, more resilient, more performant, and more digital capacity, while also having to reduce the carbon footprint."

Copenhagen Economics: The Economic Value of Submarine Cables in the Arctic, May 2022

AEC ARCTIC ECONOMIC COUNCIL

AEC ARCTIC ECONOMIC COUNCIL

Q&A

What channels have you set up to effectively communicate with local communities, including addressing grievances and requests for information?

As an Alaska-based company, we know that ongoing communication with local communities and Arctic organizations is essential. We have a network of informal personal relationships and business ties, and a policy of ongoing engagement. Far North Fiber will continue its outreach in community meetings and public hearings throughout route planning, marine survey, the permitting process, and installation phases of the project.

Do you have anything else to add about your project?

SMART cable - Science Monitoring And Reliable Telecommunications (SMART) cables will be a major new element in the Global Ocean Observing System, integrating temperature, pressure, and three-axis seismic accelerator sensors into the fiber system to obtain long-term measurements of ocean environmental conditions.

What are your next steps?

- Contract coming into force.
- Assemble the SMART cable team and secure ownership/governing body and financing.
- Marine survey and cable route engineering.

Far North Fibre is seeking to work with communities and agencies across the Arctic to deliver a world class project with significant benefits for all stakeholders.

Far North Fiber with SMART cable technology will give researchers advanced new tools to study the mechanisms of climate change and the oceanography of the most rapidly changing ocean and region of earth.

AEC
ARCTIC ECONOMIC COUNCIL

PORT OF ADAK

Arctic shipping opens up economic opportunities for the Aleut Islands.

Thomas Mack, Aleut International Association

PORT OF ADAK. ECONOMIC OPPORTUNITIES FOR THE ALEUT ISLANDS

The Aleutians to benefit as the Arctic maritime transportation intensifies

The Aleutian Archipelago is a 1,200-mile island chain sitting on the border of the North Pacific Ocean and the Bering Sea. Even though the Aleutian Islands might seem like a very remote area at first glance, they are strategically intersecting the North Pacific Great Circle Route. This shipping lane is one of the shortest between North America and Eastern Asia, where the world's busiest seaports are located. During summer, ship traffic navigates South of the archipelago, while in stormy winter months, the vessels go North of the islands

Port infrastructure

"We are fortunate in the Aleutian Island Region to have the infrastructure already in place due to a vibrant commercial fishing industry, past military activities, and the current shipment on the Great Circle Route," says Thomas Mack from the Aleut International Association (AIA). Unalaska/Dutch Harbour is one of the largest seafood processing areas and the largest fishing port in the United States. Before the pandemic, cruise ship tourism played a significant role in several communities.

Port of Adak

Today the Aleutian islands brand themselves as the doorway to the Arctic as the maritime traffic is increasing. ***"With the opening of the NSR happening in the future, the Aleutian Islands and Alaska Peninsula are gearing up for the opportunities they will bring to the region,*** " says Thomas Mack. Adak offers a year-round deepwater port, an ample amount of housing is available, hundreds of acres of open laydown areas, and more than 300,000 sq. feet of warehouse space. There are two 7,600 foot runways capable of landing jumbo jets the size of 767's and allow for intermodal transportation.The fuel terminal holds 22 million gallons of fuel oil. Adak has recently completed the engineering design for a container terminal including new piers and a container-handling yard and is looking for investors.

Digital connectivity

GCI, a telecommunications company from Alaska, is routing a terrestrial broadband cable to Unalaska/Dutch Harbor connecting with several remote communities – King Cove, Sand Point, Akutan, Chignik Bay, and Larsen Bay. GCI will also deploy an approximately 1280 kilometre subsea fibre-optic system to Kodiak island. This is a $58M project, funded by a $25M grant from the US Department of Agriculture (USDA) and $33M capital investment by GCI.

Community capacity building

Ports facilities and services are a major source of local employment opportunities in the Aleutian Islands. With the increased shipping, existing ports will boost the local economy. It will facilitate ancillary businesses and a regular flow of income for local entrepreneurs. "The Aleuts are the Indigenous people of the Aleutian Islands and the Alaska Peninsula and have inhabited and thrived off the sea's bounty in this region for thousands of years. We are sea-worthy people who have used the Ocean and Seas for that many years for Marine transportation, build and grow our local economies, and as a main source of food," says Thomas Mack.

Thomas Mack represents the Aleut International Association at the Arctic Economic Council since its establishment in 2014. The Aleut International Association (AIA) is a not-for-profit corporation that represents the Indigenous peoples of Aleut descent in the United States and the Russian Federation.

AEC
ARCTIC ECONOMIC COUNCIL

TOURISM

GREENLAND DOG ADVENTURE CENTER: INDIGENOUS-OPERATED SLED DOG PROJECT

Sisimiut, Greenland

Tourism, Culture

Private

AEC
ARCTIC ECONOMIC COUNCIL

GREENLAND DOG ADVENTURE

"Indigenous-operated sled dog project in Greenland aiming to increase tourism, provide educational opportunities, and preserve cultural heritage"

SLED DOG VISITOR CENTRE

Greenland Dog Adventure operates a visitor center that focuses on the Greenlandic sled dog. The center comprises the **kennel with 120+ dogs**, where visitors can **interact with sled dogs and participate in their care** and daily life.

Greenland Dog Adventure Center is comprised of 3 parts: **school service, tourism, local collaboration.**

In addition, the center consists of a **knowledge center** where you can study the Greenlandic sled dog's history and nature, as well as **a research and health department**, where students and researchers can participate in the conservation of the Greenlandic sled dog and ensure the health of the entire Greenlandic sled dog population.

Sisimiut, Greenland

Tourism, Culture

Private

KEY DATA

"Indigenous-operated sled dog project in Greenland aiming to increase tourism, provide educational opportunities, and preserve cultural heritage"

PRODUCTION/OUTPUTS

- School program with focus on cultural, physical activity, and academic subjects.
- All year tourism products.
- Strengthening community interest in sled dog culture.

PERSONNEL

- 6 staff
- Estimated 10 volunteers employees

PROJECT TIMELINE

- 5 year budget plan for school service

Sisimiut, Greenland

Tourism, Culture

Private

AEC
ARCTIC ECONOMIC COUNCIL

FINANCIALS

"Indigenous-operated sled dog project in Greenland aiming to increase tourism, provide educational opportunities, and preserve cultural heritage"

$1.325 M TOTAL COST

School Service 5 budget Total

- 2022: DKR1637K / US$261.3K
- 2022: DKR1528K / US$243.9K
- 2023: DKR1613K / US$257.5K
- 2024: DKR1711K / US$273.1K
- 2025:DKR1814K / US$289.6K

$ 46.7K ANNUAL REVENUE

- 2022: DKR1685k / US$269K
- 2023: DKR2730k / US$43.6K
- 2024: DKR2925k / US$46.7K

Sisimiut, Greenland

Tourism, Culture

Private

AEC ARCTIC ECONOMIC COUNCIL

FINANCIALS

"Indigenous-operated sled dog project in Greenland aiming to increase tourism, provide educational opportunities, and preserve cultural heritage"

$260 160 TURNOVER

- 2022: DKR45K / US$7180
- 2023: DKR890K / US$142K
- 2024: DKR965K / US$111K

$1.368 M INVESTMENT NEEDED/RECEIVED

Privat Deposit : DKR100K
Start up: DKR2061K
Operation: school/ Tourism

- 2022: DKR1307K
- 2023: DKR1178K
- 2024: DKR1243K
- 2025: DKR1311K
- 2026: DKR1384K

AEC ARCTIC ECONOMIC COUNCIL

Sisimiut, Greenland

Tourism, Culture

Private

FINANCIALS

"Indigenous-operated sled dog project in Greenland aiming to increase tourism, provide educational opportunities, and preserve cultural heritage"

INVESTMENT BREAKDOWN

Staff
- 2022: DKK1057K / US$168.7K
- 2023: DKK1078K / US$172.1K
- 2024: DKK1143K / US$182.5K
- 2025: DKK1211K / US$193.3K
- 2026: DKK1284K / US$205K

Material
- 2022: DKK250K / US$39.9K
- 2023: DKK100K / US$16K
- 2024: DKK100K / US$16K
- 2025: DKK100K / US$16K
- 2026: DKK100K / US$16K

Kennel operation
- 2022: DKK330K / US$52.7K
- 2023: DKK350K / US$55.9K
- 2024: DKK370K / US$59.1K
- 2025: DKK400K / US$63.9K
- 2026: DKK430K US$68.6K

Total
- 2022: DKK1637K / US$261.3K
- 2023: DKK1528K / US$243.9K
- 2024: DKK1613K / US$257.5K
- 2025: DKK1711K / US$273.1K
- 2026: DKK1814K / US$290K

Sisimiut, Greenland

Tourism, Culture

Private

AEC
ARCTIC ECONOMIC COUNCIL

SUSTAINABILITY

"Indigenous-operated sled dog project in Greenland aiming to increase tourism, provide educational opportunities, and preserve cultural heritage"

Working in the communities with this new sustainable tourism project

The essence of Greenland Dog Adventure is to save and preserve the Greenlandic sled dogs and the unique Greenlandic sled dog culture, which among other things will help to make local young people and children experts in their own culture and history

All project activities must have a sustainable foundation

Well connected with # 12, specifically preserving the Greenlandic sled dogs, whose population has halved in the last 10 years

Sisimiut, Greenland

Tourism, Culture

Private

PROJECT PITCH

"Indigenous-operated sled dog project in Greenland aiming to increase tourism, provide educational opportunities, and preserve cultural heritage"

SLED DOG VISITOR CENTRE

School service: This involves **collaboration with the local schools**. The vision is to strengthen children and young people's subject-specific and social competencies through interdisciplinary teaching in a cultural context, which develops and creates expertise in their own culture, history, and natural environment.

Tourism: This involves the development of **a year-round center** where visitors from all over the world can experience the Greenlandic sled dog, interact with them, and experience them in a cultural context, such as driving a dog sled.

Local collaboration: This involves strengthening the existing dog owners' relationships through access to care, community houses where you can seek help from other sled dog owners, and ensuring the **transmission of the old cultural traditions around the sled dog cultu**re. Local collaboration also helps to ensure the center's relevance and **authenticity through the involvement and descriptions of the still-living Inuit sled drivers.**

The center consists of **a knowledge center** where you can study the Greenlandic sled Dog's history and nature, as well as **a research and health department**, where students and researchers can participate in the **conservation of the Greenlandic sled dog** and ensure the health of the entire Greenlandic sled dog population.

Sisimiut, Greenland

Tourism, Culture

Private

AEC
ARCTIC ECONOMIC COUNCIL

INTERVIEW

How does your project integrate long-term sustainability, especially in the local community, into its design?

The main objective of the project is to maintain the population of the Greenlandic sled dog and keep them healthy. Through the use of tourism, the project works efficiently to promote the sustainability of this breed.

At the kennel, a large area is dedicated to adult dogs, including puppy farms where a minimum of 180 dogs are kept. This is to secure the existence of the breed. In the area around the kennel, tracks have been laid out for sledges and carriages. These tracks are to give visitors various experiences with sled dogs, 365 days a year.

In general, participation and togetherness on trips and in the company of the dogs are fundamental steps in deepening the experiences of visitors. Significantly, this helps to maintain the knowledge, interest and cultural traditions of the Greenlandic sled dog.

How does your project strengthen local/indigenous communities and traditional livelihoods?

The Greenland Dog Project interacts with the community at different levels and in different areas. The GDA consists of a school service, local collaborations, visitor center and tourism activities. The school service consists of programs throughout a child's school life.

The programs teach and introduce the children to life with the dogs and the culture while interacting in nature. All the courses also have an educational focus, where the children learn general school subjects, such as mathematics, biology, history, etc.

Local collaboration takes place with the local dog sled owners. Here, the exchange of knowledge and sparring is the purpose, where there is a constant exchange of new knowledge about health and diet with old knowledge about traditional driving, training, knowledge of nature, experiences and all the intangible stories and culture associated with the dog sled culture.

In practice, we will establish a workshop for local sled mushers, where new and old riders can meet each other and exchange knowledge while helping each other build and repair equipment over a cup of coffee.

The visitor center will be the crown jewel of the work; a world-class center to house all knowledge about the Greenlandic sled dog, and to host both a research and a health center.

It will first and foremost be a lively and interactive visitor center, where both locals and tourists are led through the marvelous Greenlandic sled dog universe.

INTERVIEW

Examples of activities and tourism products:

- Summer trip on your own, where you learn to drive yourself.
- Winter trip on your own, where you learn to drive yourself.
- Man's best friend, everyday life in the kennel.
- Experiences tailored to cruise guests.
- Volunteer DG Adventurer - a meaningful job.
- Adopt a Greenland dog.
- Traditional dog sled in collaboration with the local sled drivers.

What channels have you set up to effectively communicate with local communities, including addressing grievances and requests for information?

In addition to meetings with local authorities, leisure organizations, schools, and the local dog sled association, we have established a local advisory council consisting of stakeholders with extensive knowledge, such as older experienced sled drivers, young innovative sled drivers, and especially passionate people about the project.

Navarana Lennert chairs this group. In this way, we ensure a locally anchored foundation in the project, and a focus group to which we can always reach out, formally and informally. This helps to ensure authenticity but also broad local support and understanding of the project.

How have you entered into public/private partnerships with the local community and/or government?

GDA collaborates with Qeqqata municipality on the school service, so that all primary schools in the municipality are affiliated with GDA. The plan is to expand this collaboration nationally. The Bank of Greenland's Business Fund has provided grants for the initial phases of the establishment of the visitor center, and NATA has provided funding for knowledge sharing and the collection of knowledge from other countries with sled dogs so as to ensure best practices.

How does your project balance economic and social goals with environmental protection?

Climate change is one of the reasons why the sled dog population is declining. Hunters and fishermen who have used sled dogs for hunting and fishing on the sea ice are moving to dinghies, as the amount of sea ice is in decline.

Most of the use of sled dogs today is recreational and in connection with tourism. Still, a small part of North Greenland can use sled dogs to hunt on sea ice. In our area, the Arctic Circle Region, sled dogs have been used for winter hunting on land for musk oxen and reindeer.

Otherwise, it is mainly in connection with tourism that dog sledding is maintained, and it is in this connection that we want to expand and ensure a continued healthy and self-sustaining economy. Nature and environmental conservation are crucial to secure the sled dog in the future. Greenland Dog Adventure is a unique partnership between Nature, Culture and Tourism.

Climate change is one of the reasons why the sled dog population is declining. Hunters and fishermen who have used sled dogs for hunting and fishing on the sea ice are moving to dinghies, as the amount of sea ice is in decline.

Greenland Dog Adventure

STAKEHOLDERS

"Indigenous-operated sled dog project in Greenland aiming to increase tourism, provide educational opportunities, and preserve cultural heritage"

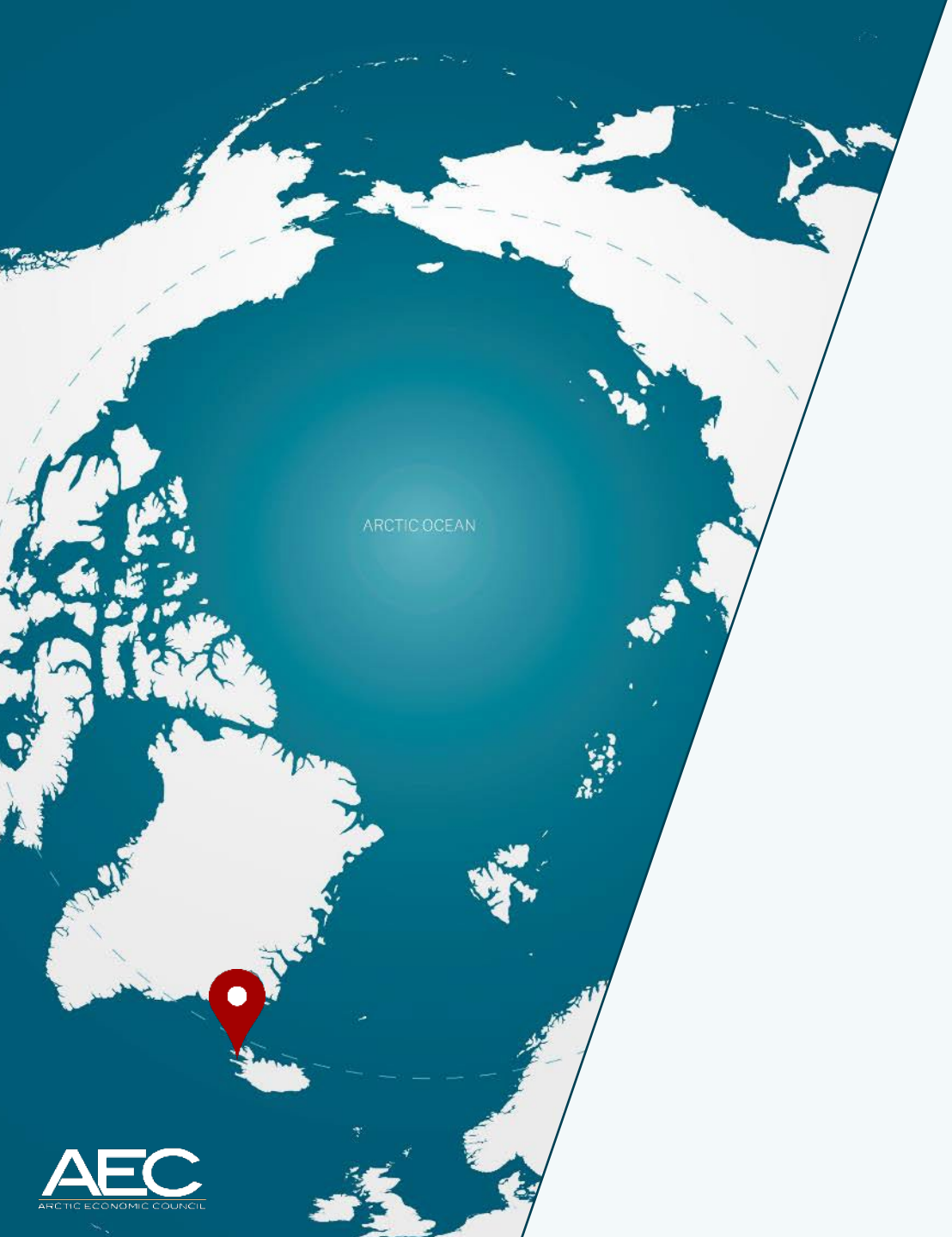
- NATA (North Atlantic Tourism Association)
- Hotel Sisimiut Anette Lings
- SILA Greenland Lykke Geisler Yakaboylu
- Morten Melgaard, University of Greenland project leader for the Qimmeq project
- Local sled dog association and local advisory group
- The municipality of Qeqqata

AEC
ARCTIC ECONOMIC COUNCIL

Sisimiut, Greenland

Tourism, Culture

Private



ALDIN BIODOME

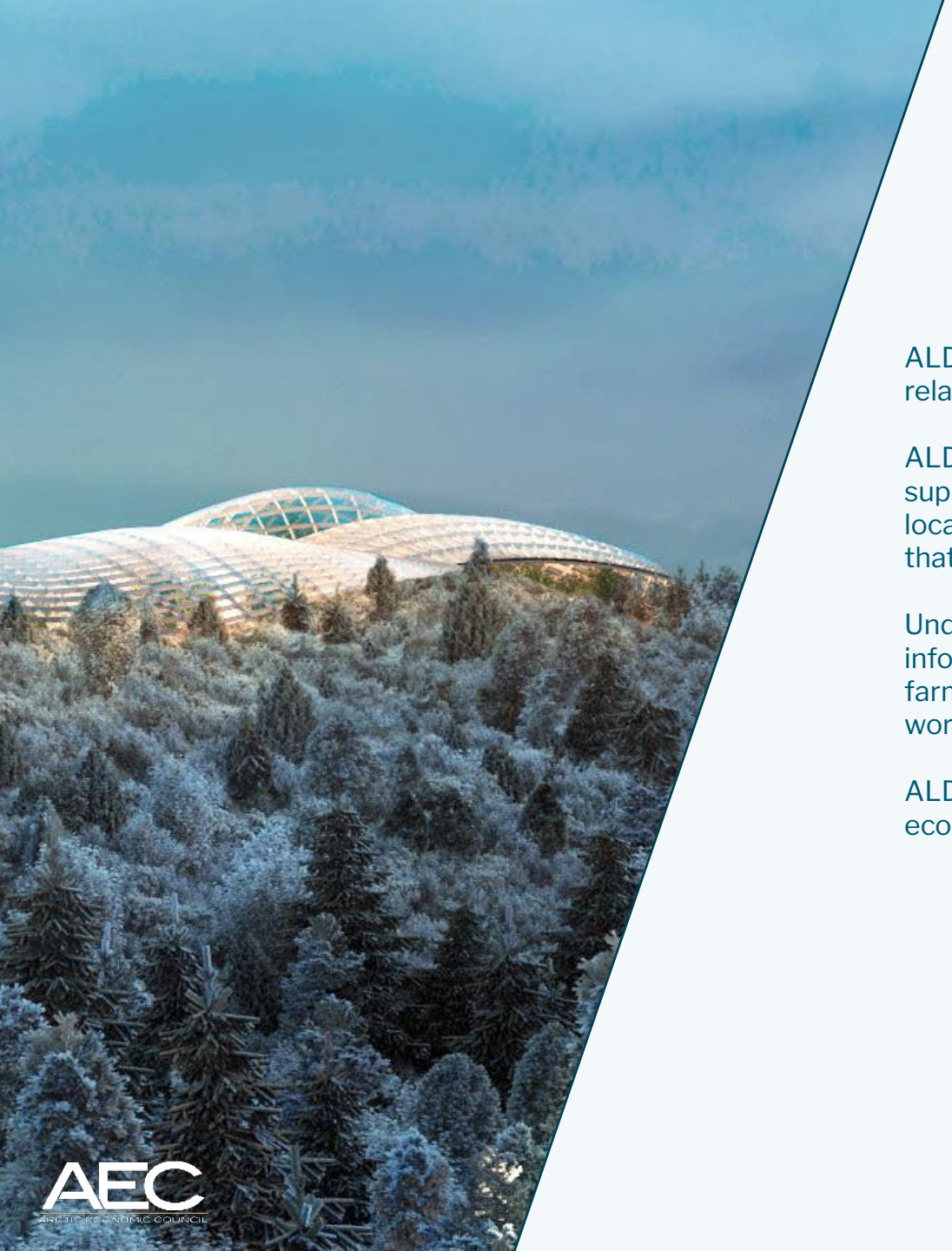
THE FIRST GEO-CLIMATE SUSTAINABLY POWERED BIODOME

Reykjavik, Iceland

Tourism, Education

Private

ALDIN BIODOME



ALDIN BIODOME

"The world's first geo-ciimate, sustainably powered biodome project in Iceland, promoting better connections to nature, education, and a unique form of tourism."

ALDIN Biodome (ALDIN) is **designed to integrate nature into people's everyday lives,** creating a relaxing, exotic environment that serves both residents and visitors alike.

ALDIN is **a unique lifestyle hospitality concept**, where visitors will be able to connect with nature and support sustainability, all in a commercially viable way. The project is fully approved in a prime location in Reykjavik, Iceland's capital, and aims to attract both locals and part of the 2 million tourists that visit the country annually in a normal year.

Under three attached **dome-shaped structures in a climate-controlled environment**, ALDIN offers informative experiences on forest bathing and the food jungle. ALDIN comprises a high-tech nursery, farm-to-table restaurants, unique retail, informative exhibitions, healthy living activities and green workspaces for meetings and the most beautiful surroundings for diverse events.

ALDIN provides **nature-based leisure and exhibitions on sustainable living**, woven into a functional ecosystem. It is an all-weather destination for all age groups and nationalities.

Reykjavik, Iceland

Tourism, Education

Private

ALDIN BIODOME

AEC
ARCTIC ECONOMIC COUNCIL

KEY DATA

"The world's first geo-climate, sustainably powered biodome project in Iceland, promoting better connections to nature, education, and a unique form of tourism."

PRODUCTION/OUTPUTS

- Unique experience on a global scale;
- Throughput of visitors growing from 31 K in Year 1 to 462K by Year 5.
- Nursery able to produce 150 - 200 tons per year (for the restaurant, market, and more).
- ROI 14% by Year 5.

PERSONNEL

- During development: 4 to 9 employees
- After development: 30 employees

PROJECT TIMELINE

- Funding: 2021
- Breaking ground: Spring 2022
- Opening doors: 2024
- **Project status:** approved

AEC
ARCTIC ECONOMIC COUNCIL

Reykjavik, Iceland

Tourism, Education

Private

ALDIN BIODOME

FINANCIALS

"The world's first geo-climate, sustainably powered biodome project in Iceland, promoting better connections to nature, education, and a unique form of tourism."

$41M **TOTAL COST**

€36M (appx.US$41M)

$13.6M **ANNUAL REVENUE**

Anticipated:

- year 1 — €8.2M (US$9.350M)
- year 3 — €12M (US$13.68M)

The operating cash flow is positive from Year 1 and growing to a steady stage by Year 3.

$41M **TURNOVER**

Anticipated:

- year 5 - €12M (US$13.68M)

Reykjavik, Iceland

Tourism, Education

Private

ALDIN BIODOME

AEC ARCTIC ECONOMIC COUNCIL

FINANCIALS

"The world's first geo-climate, sustainably powered biodome project in Iceland, promoting better connections to nature, education, and a unique form of tourism."

INVESTMENT BREAKDOWN

- Design cost : €3.31M (US$3.78M)
- Land acquisition : €1.18M (US$1.35M)
- Construction : €18.79M (US$21.43M)
- Fit out : €5.57M (US$6.35M)
- Interest during construction:€2.86M (US$3.26M)
- Project management costs, marketing and promotion, etc. : €1.74M (US$1.98M)
- Contingency : €2.59M (US$2.95M)

FUNDING

- Equity €18M (US$20.52M);
- Debt €18M (US$20.52M);
- First round €3M (US$3.421M);
- Second round €15M (US$17.10M);
- Already funded via convertible bond €157.750 (US$180k) plus equity (10 years);
- Funding method desired: private equity

$57 M

ASSESTS IN THE ARCTIC

- Building plot secured, valued €1.18M (US$1.345M), and business case developed.
- Assets projected to be €50M+ (US$57M) by 2027.

Reykjavik, Iceland

Tourism, Education

Private

ALDIN BIODOME

AEC
ARCTIC ECONOMIC COUNCIL

SUSTAINABILITY

"The world's first geo-climate, sustainably powered biodome project in Iceland, promoting better connections to nature, education, and a unique form of tourism."

Ensuring the health and well-being of individuals at all ages

Ensuring inclusive and equitable quality education and promoting lifelong learning opportunities

Building resilient infrastructure to promote inclusive and sustainable industrialization

Ensuring sustainable consumption and production patterns

Reykjavik, Iceland

Tourism, Education

Private

ALDIN BIODOME

PROJECT PITCH

"The world's first geo-climate, sustainably powered biodome project in Iceland, promoting better connections to nature, education, and a unique form of tourism."

Unique tourism experience
- Designed to integrate nature into people's everyday lives
- Unique lifestyle hospitality concept
- No comparable attraction or facility in Iceland or the Nordic/Arctic region

Offering local development
- Fresh and healthy locally produced greens and fruit with no transportation miles and nearly zero carbon footprint
- Encourage people to grow and consume healthy greens
- Founders are local, as are some of the key partners

Aiming for sustainability
- Enhancing sustainable tourism
- Balanced economic and social goals whilst providing environmental protection
- WilkinsonEyre architects and Atelier engineers, experts in sustainable building design
- Designed according to BREEAM and WELL standards

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Reykjavik, Iceland

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ALDIN BIODOME

PROJECT PITCH

"The world's first geo-climate, sustainably powered biodome project in Iceland, promoting better connections to nature, education, and a unique form of tourism."

ALDIN will comprise **three stunning biophilic domes showcasing tropical and Mediterranean gardens**, sustainable farming, a restaurant using produce grown in the biodome and other local ingredients, prepared by top chefs ("dome to table"), **cafés, retail shops and various wellness and leisure experiences**, and elements like a pondering pond and waterfall.

The glass domes will shield the interior of the structures from the unpredictable Icelandic weather, letting in natural light, and **enhancing visitors' connection to the global diversity of nature** in a warm climate.

ALDIN will be **100% powered using geothermal energy**, creating significant operational cost savings, and generating close to zero CO_2 emissions.

There are currently a limited number of attractions in Reykjavik. The potential of wellness tourism can be seen in the geothermal Blue Lagoon (located 45 minutes outside of Reykjavik), which attracts 1.2m visitors annually and generates revenues of approximately €80m ($91.22M USD), as well as in the newly-opened Sky Lagoon in the Kópavogur Municipality, which offers a connection to nature via spa rituals. We believe the **iconic design and unique offering** will make ALDIN a "must-see" landmark of Iceland.

ALDIN's grand opening is planned for 2024 and fits in perfectly with future trends in tourism, focused on sustainability, health, and wellness. Several international parties have expressed interest in biodomes for their cities, providing an opportunity to build a unique wellness and leisure brand with a global reach.

Reykjavik, Iceland

Tourism, Education

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ALDIN BIODOME

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KEY CONSIDERATIONS

"The world's first geo-climate, sustainably powered biodome project in Iceland, promoting better connections to nature, education, and a unique form of tourism."

Truly unique: there is no comparable attraction or facility in Iceland or the Nordic/Arctic region. We are also the only known company in the world focused on developing biophilic domes and related wellness services on a commercial scale.

Financing structure: this is 50% equity and 50% debt. We have lenders interested in providing debt. Equity is planned in two rounds; first, €3m ($3.421m USD) for the land and finalizing the design until issuing the building permit, then €15m ($17.1m USD) for development until opening.

Experienced team and world-class partners: this includes the architectural firm that developed the Gardens By The Bay biodome in Singapore.

Growth opportunities: wellness services and facilities expansion in the Middle East, Asia and Arctic.
Sustainable tourism: ALDIN will focus on serving locals and attracting tourists as an authentic experience. Icelandic tourism grew fivefold between 2010 and 2018 and is expected to become strong again after COVID-19, before the grand opening of ALDIN in 2024.

Multiple revenue streams: this comprises admission fees, memberships, high-tech nursery, restaurant, café and events (rent), retail (sales), and more.

Attractive economics: €11m ($12.54m USD) revenue run rate, with upside; 30%+ EBITDA margins.

Project Cost: €36m ($41.05m USD); site secured and fully permitted; City of Reykjavik to fund most of the infrastructure development.

Reykjavik, Iceland | Tourism, Education | Private

ALDIN BIODOME

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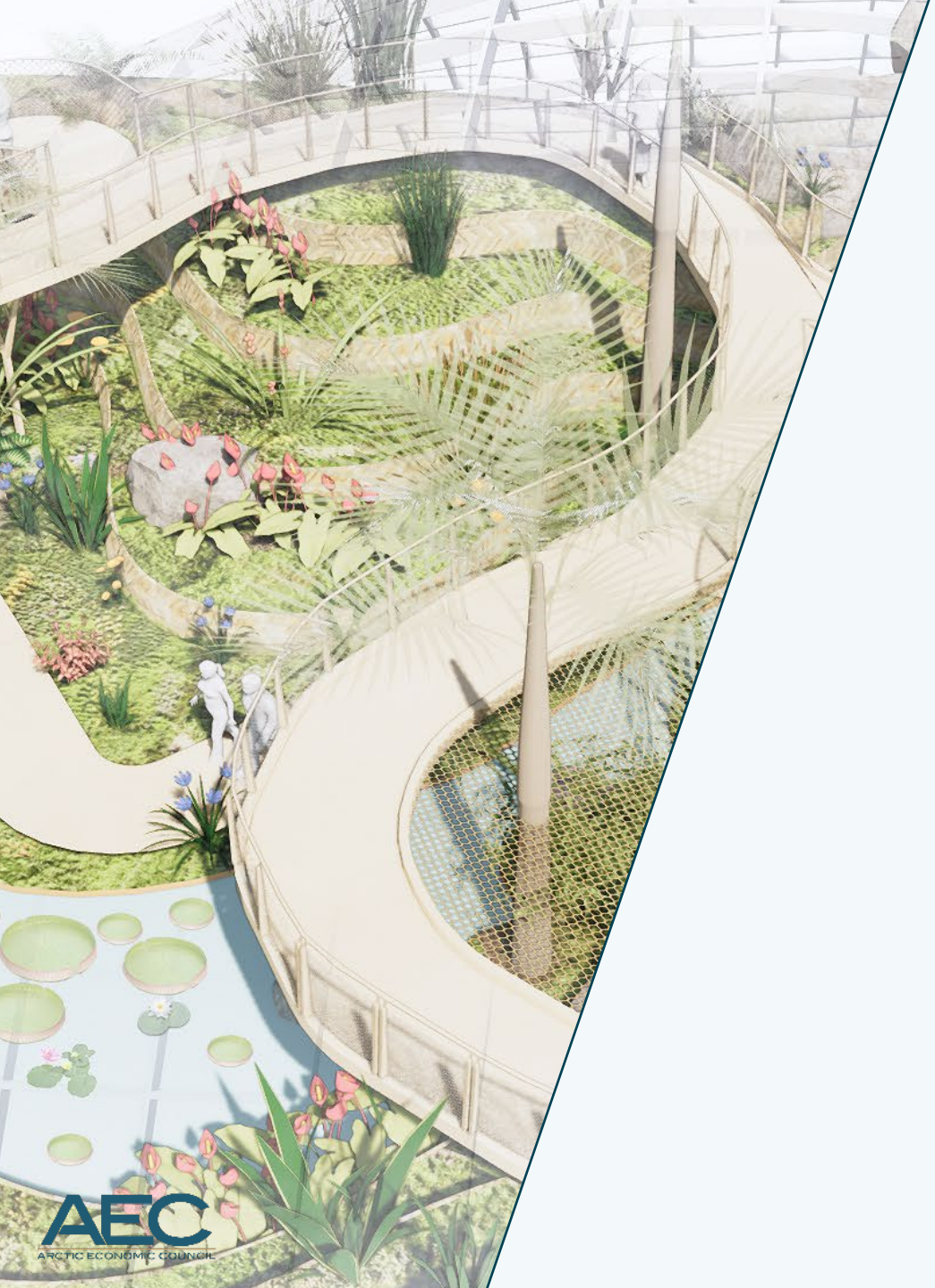

STAKEHOLDERS

"The world's first geo-climate, sustainably powered biodome project in Iceland, promoting better connections to nature, education, and a unique form of tourism."

- Stiklað á steinum ehf./Hjördís Sigurðardóttir, founder & CEO, 82%
- Vertu ehf. / Ágúst Freyr Takacs Ingason Chairman, 7%
- Arion Startup Reykjavík Investment fund, 6%
- ICDC Holding/ Umar Ali, 2.5%
- Giggs ehf. /Einar Páll Tamimi 2%
- Other small stakes 0.5%

Reykjavik, Iceland

Tourism, Education

Private

ALDIN BIODOME

Q&A

What are your project's biggest positive contributions to the Arctic, at the regional or local level?

The project's biggest positive contribution to the Arctic is to provide an opportunity to connect with exotic nature and experience a faraway climate within your own city; to offer fresh and healthy locally produced greens and fruit with no transportation miles and nearly zero carbon footprint; to give an opportunity to learn through the senses – see, touch, taste and feel the nature that grows on the other side of the globe, raise the awareness of its worth and encourage people to grow and consume healthy greens; to operate in sustainable way in all senses (BREEAM- and WELL-certified building and operation), i.e. use of green energy, closed loops, local food, a comfortable energizing environment, a profit-driven but socially responsible operation.

What is your fundraising strategy? What barriers or challenges have been greatest in securing funding for your project?

For the first round, securing €3M ($3.421M) for the land and the design cost until securing the building permit (4-6months). For the second round, securing €15M ($17.01M) for the rest of the equity. The biggest challenge is to secure the first equity without having the promise for the rest. But by doing so, the risk has been decreased considerably at the building permit stage.

Afterwards, the cost can be estimated more accurately, agreements will be made with providers and operators (e.g., the envelope producers), and the timeline will also become clearer. With somewhat higher risk in the first round the valuation will reflect that risk profile

What resources or organizations have you relied on when crafting your project's sustainability strategy?

An experienced team is our key resource! The founder is educated as an urban planner with a specialty in energy landscapes and urban farming (MSc from Wageningen University in Holland);

WilkinsonEyre architects and Atelier engineers are experts in sustainable building design, and moreover it is their passion to work on biomes. They are also experienced in designing according to BREEAM and WELL standards; MOSS Amsterdam are makers of sustainable spaces as frontrunners in the field of redesigning the built environment with a focus on greening and food production;

Karen Róbertsdóttir is a plant expert who is extremely passionate about exotic plants and sustainable growing methods. She has developed a searchable database of tens of thousands of plant species for ALDIN. Karen is managing an experimental garden at the plot already, where we use excess wastewater to heat plant beds and thereby extend the growing season in the cold climate;

EFLA engineers and Basalt Architects are some of the most experienced designers in the field of geothermal technologies.

Q&A

How does your project integrate long-term sustainability, especially in the local community, into its design?

The project integrates long-term sustainability into its design in the first place by bringing nature into the daily lives of city inhabitants, to improve both their awareness and wellbeing. Additionally, this is done through the production of local food, creating experiences for locals and tourists, enhancing sustainable tourism, and through turning a profit. The design of the biodome has also been greatly influenced by local resources, as Iceland has a history of socializing in geothermal environments.

This can be seen in their fruit plantations, which are some of the biggest in Europe. For the biodome, fertile volcanic soil and hot spring water have been used to create a flourishing oasis beneath a glazed dome.

How does your project help develop human capital in the communities where it's located?

This is done through extensive know-how on horticulture, urban farming, and experiences based on this. This can be capitalized further when a franchise is developed internationally. It is also important to note that the biodome has the potential to indirectly help local communities.

This project is one of the most if not the most influential for boosting tourism in the area. Increase in tourism requires a lot of local labor and know-how to allow for everything to run smoothly, from means of transport to local food places or even local accommodation. All these things will be greatly influenced by the biodome and all will help develop local human capital.

How does your project strengthen local/indigenous communities and traditional livelihoods?

Geothermal spa culture has been practiced since the settlement of Vikings in Iceland. The hot tubs have become the 'public square' in Icelandic communities. Based on this, ALDIN extends the geothermal experience to forest bathing and the food jungle experience, as well as providing a meeting place for the community and its guests.

How have you ensured inclusive and equitable consultations with local/indigenous communities?

In the planning process that took three years, an extensive public consultation/ collaboration was required. With the assistance of PR consultant ATON JL, several articles and interviews were published alongside presentations, which were held in public meetings.

The project integrates long-term sustainability into its design in the first place by bringing nature into the daily lives of city inhabitants, to improve both their awareness and wellbeing

Aldin Biodome

Q&A

What specific mitigation measures, technological or otherwise, has your project put in place to safeguard the local environment?

The design in the planning process was based on improving the environment and ensuring the building fits well into the landscape. The design and operation will adhere to strict design standards (BREEAM and WELL).

The basis of BREEAM is key to a sustainable environment, and in Europe it occupies an 80% share of the building market. One of the reasons for its success is due to its strategies revolving around minimizing construction waste, reducing CO_2 emissions and, most importantly, improving the local environment for wildlife.

How does your project balance economic and social goals with environmental protection?

The unique advantage of a biodome is exactly how it balances economic and social goals whilst providing environmental protection. The core of the project is growing plants, producing food and providing an experience based on this. Therefore, the biodome is one of the most environmentally friendly structures.

One of the key aspects of the biodome is to allow visitors to see the behavior of different kinds of plants. Through educational activities, nature interpretations and day camps the biodome will be generating revenue whilst educating the public on nature.

Through providing this public service, the biodome aims to raise further awareness on serious global issues such as global warming and nature loss.

The ALDIN Biodome will be the world's first geo-climate biodome and the excitement behind this project is likely to spark human interest in future geo-projects. Furthermore, following the opening of the biodome, potential investors can view the benefits of having an entirely carbon-emissions free site.

Overall, the environmentally friendly nature of the biodome, the education/ awareness provided, and the generation of capital with employment manifests how it balances social, economic and environmental aspects.

What measures have you taken to increase transparency and guard against corruption in your project's financial and reporting activities?

Our measures have included practicing respectable governance and, in the long run, seeking to fulfill the ESG goals.

Q&A

What channels have you set up to effectively communicate with local communities, including addressing grievances and requests for information?

We engage in collaborative processes in planning, which are a legally mandated and open, public practice in Iceland. Moreover, we use our homepage and social media to inform the public and answer any questions. All of our processes are public

How have you partnered with the research community in measuring project processes and impacts?

Through the student innovation fund, we have received grants for the experimental garden project. We envision working on research with local and international universities in the future.

How has your project integrated local/indigenous knowledge?

The founders are local, as are some of the key partners. The Icelandic community is an open one and people can easily communicate with us.

What technical measures are in place to monitor for local impacts and hazards from your project?

In the planning documents, the terms are set for light pollution and other environmental factors. In addition, the building needs to fulfil strong building standards, etc.

How have you tried to set best practices for Arctic investment and what best practices have you followed from others?

Our key mentors are the highly experienced and international design team.

How have you worked to uphold and strengthen regulatory measures that contribute to healthy Arctic communities and environments?

We have followed all rules in terms of planning and regulatory processes.

RECOMMENDATIONS

RECOMMENDATIONS

The Arctic is not only at the top of the globe but also top of mind of many policymakers these years. This is slowly trickling down to investors. This report highlights the sheer diversity of opportunities in the north. It also highlights some of the trends in the investment environment in the Arctic.

Several of the cases mentioned in this report write about making an impact in the local communities and contributing to the local economy in a responsible manner. This shows the understanding of the holistic nature of sustainability in the Arctic. It is also one of the cornerstones of the Arctic Investment Protocol.

There are challenges for investments in the Arctic. Due to the economy of scale, we often see little competition. In places, with competition we often see it is the local public authorities competing against private investments in, for example, the tourism industry. In places where public support is needed, for example through the use of public-private partnerships, we see that the private sector takes a big part of the burden constructing some larger infrastructures to enable a different economic activity.

Innovation in the Arctic is happening as fast as elsewhere with remarkable cutting-edge solutions being developed in the ocean, on land and in space. Businesses in the Arctic however has to be better at promoting some of these innovations and pitching them to outside investors. Here is the challenge of access to investors locally but the most innovative companies are often not using the Arctic identity in the promotion where it could be beneficial.

In the Arctic an investment often have multiple purposes other than just creating jobs and economic growth. Some of the investments in this report will not only benefit the local communities but also climate researchers and national security. Over recent years there has not been a lack of good intentions and strategies mentioning large-scale investments but the need in the region is greater than the realised investments we see at the moment.

The Arctic region got fish to feed the world, energy to power industries and raw materials needed in the green transition. We now need investments, better infrastructure and most importantly of all – opportunities for people in the north. Because the biggest challenge of them all is demographic trends in the Arctic.

The Arctic Investment Protocol is a set of guidelines to investors and we hope that with this report investors can see some of the investment opportunities that live up to parts of the AIP.

RECOMMENDATIONS

The Arctic regions and municipalities should be more clear in their investment needs and promotion. Using the Arctic identity and the responsibilities and benefits that come with that should be clear to outside investors.

Long-term plans for the roll-out of infrastructure development should be available for investors. These plans should be developed both locally, regionally, nationally and globally with the Arctic in focus.

AEC recommends that local and regional chambers of commerce host an annual investor meeting outside of the Arctic region to highlight the investments opportunities and serve as a vital link between large financial institutions and local projects.

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RECOMMENDATIONS

Investments in the Arctic often benefits not only the investors but also develop infrastructures that can help the local communities, outside researchers and national governments. Commercial activity is also linked with national security considerations.

Understanding the interconnections between constructing a port, a subsea fiber optic cable or investing in satellites for both national governments, researchers and local communities is important and often missed.

AEC recommends that governments identify the “stepping stone” infrastructure which can maximise further community and economic development.

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In 2021, the AEC visited Berlevåg in northern Norway and heard about the amazing opportunity in the high north of north.

In the following pages you can read an article from 2021 about hydrogen production in the small town of Berlevåg and what impact it has on the community.

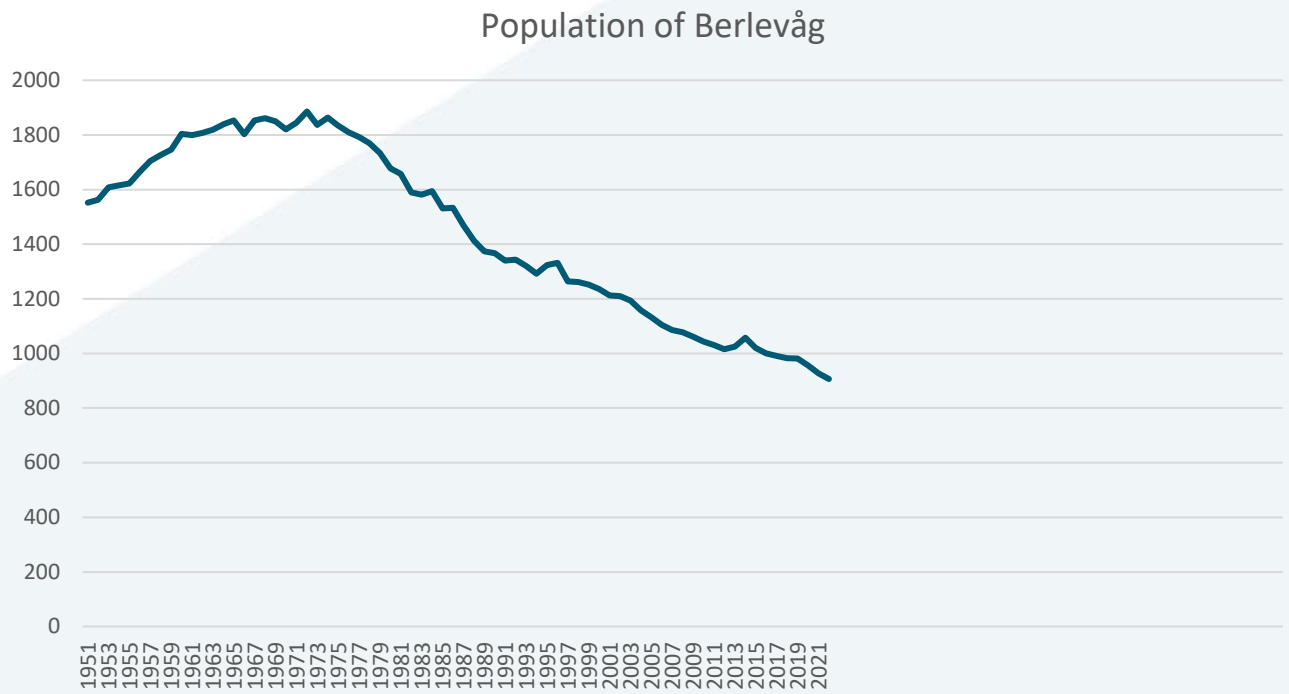
BERLEVÅG. WINDS OF CHANGE

"They can't take the wind away from us" said the mayor of Berlevåg when I met him – and that wind is going to change the small Norwegian town in Northern Norway.

Berlevåg is a small town in Northern Norway but famous in the world literature as the place of Babette's Feast in the book by Karen Blixen. Located far above the Arctic Circle, it has traditionally been a fishing village where smaller fishing boats have been docking to unload their catch. During the second world war the wooden houses were completely burned to the ground because of the "scorched earth tactic". The local villagers rebuilt the place using the leftover wood from the bombed runway at the small airport. Today the villages are rebuilding the entire industrial portfolio of Berlevåg, shaping a state-of-the-art centre for the green energy production.

Getting to Berlevåg takes an 11-hour drive from Tromsø or you can jump on a small plane that stops five times – one of them in Berlevåg airport – on the way to Kirkenes, reminding of an intercity bus connecting remote communities. Scandinavian regional aviation is going through major transformation these years and several companies have aimed for having all-electric planes in the Arctic in five years' time.

The population of Berlevåg grew to a peak of 1810 people in 1976 but then started to decline. As of today, there are only 917 registered residents, and the demographic curve continues to trend downward. Yet, there are high hopes that the new green industry will change that.



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BERLEVÅG. WINDS OF CHANGE

Several years ago, Berlevåg municipality applied to the EU's Horizon programme to construct a small, non-commercial hydrogen test plant. The plan was to start a pilot research project to test electricity storage, mini grid and green fuel production in Arctic conditions. In 2019 their initiative was supported with 50 million Norwegian kroner as a part of the 2020 hydrogen strategy for a climate-neutral Europe.

The success of a small test plant became a part of a big strategic plan for whole community development. Now Berlevåg will use wind energy to diversify its economy, provide green fuels and hopefully grow its population.

Just behind the town you will find a flat moonlike landscape around 300 meters above the sea. Here 15 wind turbines from Siemens Gamesa – and 12 more on the way – are about to produce up to 100 MWh of electricity. This area has some of the most steady wind conditions in Europe. In Berlevåg, the wind blows 50% of the time and the amount of electricity produced by the wind farm will be equivalent to the annual use of 20.000 houses. However, the small population of Berlevåg doesn't need all of that green energy, moreover, nor is the electricity net scaled up for export of energy. No one have ever thought that a small fishing village in the north would become a regional energy exporter. So, instead of letting the abundant wind blow into the air, why not to utilize it to the fullest?

A few passionate people saw a potential in Berlevåg. After having read an article in an engineering magazine about the future of shipping and hydrogen, they realised that Berlevåg had the ideal location for a large-scale hydrogen plant. Now a group of Norwegian industrial partners are developing its country first complete and commercially viable green ammonia value chain that will supply the shipping industry with carbon free energy before 2026.

To put it simple, Berlevåg has key preconditions for large scale hydrogen production. First of all, there is a surplus renewable energy from the wind turbines and abundant water resources to produce hydrogen. Secondly, the municipality owns plenty of land suitable for the construction of the industrial park. Finally, Berlevåg already has operating port facilities from where potential customers can fill their ships with the ammonia produced at the hydrogen plant.

In addition to that, if you sail straight north from Berlevåg you will end up in Svalbard. There, the world's northernmost settlements primarily rely on coal and diesel for energy. But in the future ammonia could be sailed to the Arctic Island and provide it with renewable energy. The new hydrogen plant is expected to produce between 100.000 to 200.000 ton of ammonia per year. To put it into scale, Longyearbyen on Svalbard needs only 20.000 ton of ammonia to be independent from coal.

The dreams do not stop at the hydrogen plant for Berlevåg. They want to use the excesses of the hydrogen production to further economic diversification. When producing hydrogen, one uses electrolyse to split the H2 and the O2 from the water. The H2 is used in the ammonia production and the O2 can then be used for land-based fish farms, combined with the surplus heat from the hydrogen production that can ensure a stable water temperature. The by-product of oxygen and heat combined with the nutrients from the fish farm can also be used in vertical farming. Now the small fishing village will not only be an energy exporter but also an agricultural centre in the north producing lettuce all year round, despite the darkness of the polar night.

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BERLEVÅG. WINDS OF CHANGE

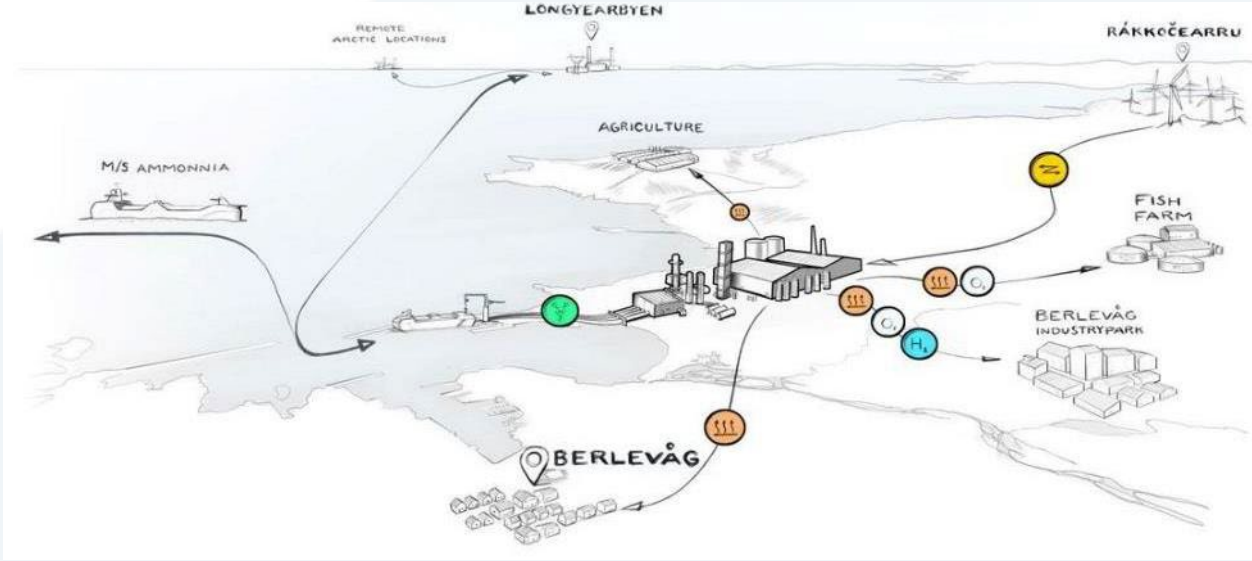
Today, maritime shipping accounts for around 3 percent of global emissions and this figure is expected to rise. Therefore, the shipping industry is already rethinking their way of working. It will demand millions of tons of ammonia, hydrogen or e-methanol. Already now Berlevåg sees itself as a part of a larger supply network along the coast of Norway. There are nevertheless a lot of work ahead. Today green ammonia cost around 600 euro per tonne, compared to around 300 euro per tonne for grey ammonia, so public investments in this sector are needed as well.

There are other hydrogen projects in other parts of the Arctic. Russia's largest independent LNG producer Novatek is targeting the start-up of commercial hydrogen production at the Yamal Peninsula. Outside of Reykjavik in Iceland there is a hydrogen production facility and the Swedish green steel venture HYBRIT recently produced its first steel using hydrogen replacing coking coal traditionally used. In some years, you will be able to buy emission free steel from LKAB in the Swedish Arctic.

In Berlevåg the town of less than a thousand people continue to develop their dream of a hydrogen production plant.

Paradoxically, the main challenge for Berlevåg is neither funding, nor resources. Declining demographics is the main obstacle for economic development. Berlevåg located in the in the very far north is in urgent need for qualified workforce, willing to become a part of the green transformation in the Arctic. The hope is that this new sustainable economic development will attract younger generations that are eager to work in a purposeful job. The answer is blowing in the wind.

This article was originally published in the Barents Observer in August 2021



INVESTOR SQUARE

INVESTOR SQUARE

The investor square is a short introduction to some of the investors in the Arctic.

The AEC has detailed information about each investor to share with relevant project partners.

Nordic Council of Ministers

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INVERSTOR SQUARE

NAME	TYPE	ASSETS	FOCUS AREA	NOTABLE PROJECTS
Canadian Infrastructure Bank	State-owned development corporation	$35 billion	Canada	GO Expansion – On Corridor,City of Edmonton Building Retrofits, Lake Erie Connector
Canadian Coastal Restoration Fund	Governmental	$1.6 billion (20 million per project max)	Canadian Wetlands and Coastline	Northumberland Strait Saltwater Marsh Restoration, Making Room for Wetlands, Restoring a healthy Placentia Bay coastal ecosystem
China Silk Road Group	Limitted Company	N/A	Global	Arctic Silk Road, Visions and Actions on jointly building belt and road, Silk road development Fund
Pension Denmark	Non-profit Labor market pension	$42.4 billion	North America and Europe	Odense, Terma and PensionDanmark Naval Project, Anholt Offshore Wind Farm, Slough Multifuel Project
European Investment Bank	Supranational investment bank	€76.8 billion	Global with arctic interests	Stockholm Albano Campus, Sparebank Climate Action Loan for SME's & Midcaps, Nordfuel Biorefinery Second Generation Biofuels.
Arctic Smartness	Public	N/A	Lapland, Finland	Arctic Smart Growth, Arctic Smartness RDI-Excellence (ASR), Arctic Investment Platform (AIP), Smart and International Lapland
Nordic Investment Bank	International Financial Institution	$63 billion	Nordic Arctic	Arctic Financing Fund
Cube Infrastructure Managers	Independent Fund	N/A	Europe	Varanger Kraftvind, Heliot, Osprey, CogenInfra, dst telecomunicações, RPIPE
Arctic Green Energy	Private Equity	N/A	China, Asia with some Arctic interests	Sinopec Green Energy Geothermal Development Co., LTD , Additives Plant Waste Heat Project, Dongguang Waste Heat District Heating Project
KoBold Metals	Private business	N/A	Global	KoBold Canadian Glencore Project, Disko-Nuussuaq project

INVERSTOR SQUARE

NAME	TYPE	ASSETS	FOCUS AREA	NOTABLE PROJECTS
Olgoonik	Indigenous Corporation	N/A	Northern Alaska	Wainright assets, Olgoonik Oilfield Services
Guggenheim Partners	Private investment fund	$255 billion	N/A	Arctic Glacier Group Holdings Inc, SeaPort Financing LLC, Elm Tree
Alaska Permanent Fund	State owned Corporation	$65.3 billion	Alaska	Alaska Mental Health Trust Fund, Alaska Banks CD Program, APFC's Alaska College Student Internship Program
Arctic Space Technologies	Private enterprise	$570,000	Sweden/Arctic	InfoStellar Ground Station, EcoDataCenter in Piteå
Teck resources limited	Private enterprise	$31.4 billion (2018)	Canada, USA, Peru, Chile	Galore Creek, Red Dog Zinc Mine, Fort Hill
NEFCO	International Financing Institution	$473 million	Nordic and Russian Arctic	Barents Hot Spot Facility, NOPEF, Baltic Sea Action Plan Fund
Canadian Northern Economic Development Agency	Governmental	$12 million	Northern Canada (Nunavut, Northwest Territories, Yukon)	Northern Aboriginal Economic Opportunities Program (NAEOP), Economic Development Initiative, Canada Community Revitalization Fund
Innovation Norway	State-owned development bank	$2257239 in gross lending (2019)	Norway	ProRus, Norwegian partners in EEA projects,
Greenland Business Association	Governmental	N/A	Greenland	Buksefjord power plant expansion, Sermeq City
Tesi	State-owned venture capital investor	$1.42 Billion	Finland	Geyser Batteries, Rocsole, picsun, NoHo, Relais

INVERSTOR SQUARE

NAME	TYPE	ASSETS	FOCUS AREA	NOTABLE PROJECTS
C Change Group	Venture Capital Investor	N/A	Alaska	Anchorage South Cargo Campus
Cooper Investment Partners	Private Equity Fund	$323.6 million	N/A	Quintillion Undersea Cable Network
DP World	Public Company	$26.1 billion	Global	Northern Transit Corridor, ports in Pakistan, US, Europe, India
Nebari Natural Resources Credit Fund	Investment Fund	N/A	Arctic, North America	Greenland Ruby, Speyside Sand and Stone,
New Business Venture Fund	State Owned Venture Capital Investor	N/A	Iceland	Grants for Women Entrepreneurs in Iceland and the technology development fund
Enova SF	Government Enterprise	N/A	Norway	Smart Senja
Sparebank	Savings Bank	$72 billion	Norway	
Framtak	Venture Capital Investor	≈$800,000	Faroe Islands	Nemlia
European Regional Development Fund	Supranational		Nordic Europe	FI OP
C Change Group	Venture Capital Investor	N/A	Alaska	Anchorage South Cargo Campus

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Nordic countries already fare particularly well in terms of renewable energy production (100% electricity in Norway) however Canada and Russia continue to lean heavily on fossil fuels due to remote settlements and existing infrastructure.

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