Sustainable Development Working Group

THE ARCTIC ENERGY SUMMIT
FINLAND • 2017

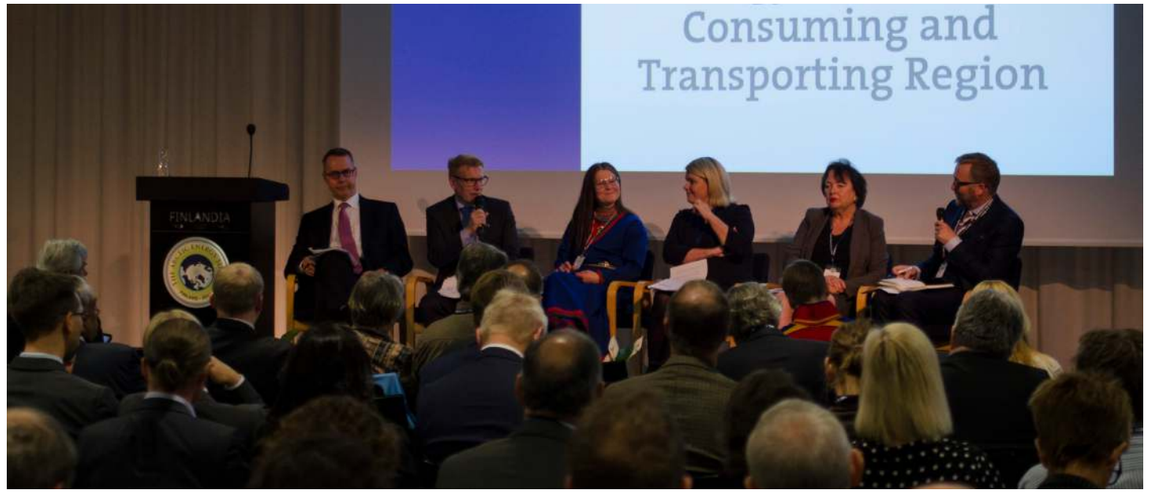
ARCTIC COUNCIL

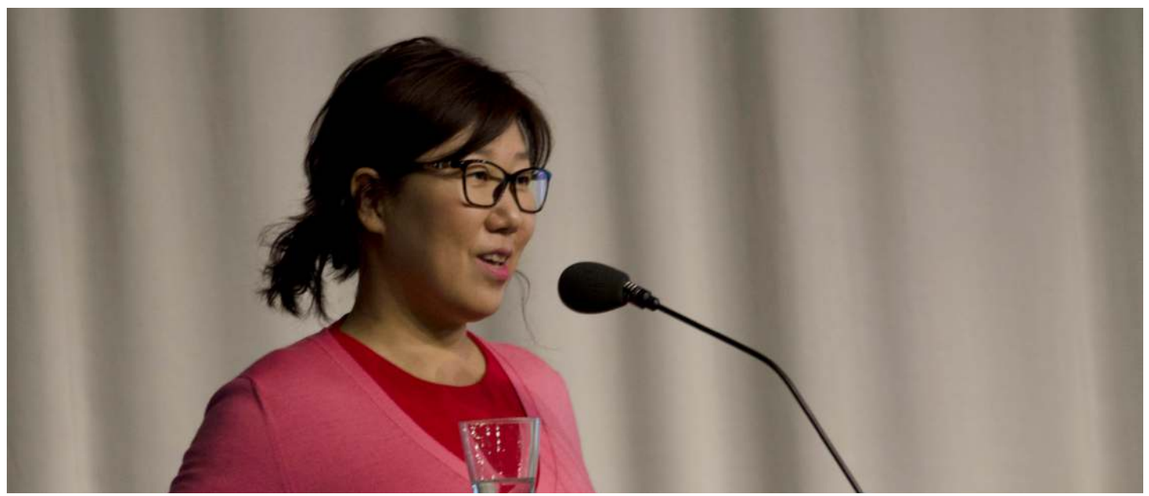
2017 Arctic Energy Summit Finland

FINAL REPORT

REMOTE. RENEWABLE. RESPONSIBLE.

ENERGY LEADERSHIP IN THE ARCTIC





INTRODUCTION

The biennial Arctic Energy Summit, an endorsed project of the Arctic Council's Sustainable Development Working Group (SDWG), is a multi-disciplinary event, drawing together several-hundred industry officials, scientists, academics, policy makers, energy professionals and Indigenous and community leaders to collaborate and share leading approaches on Arctic energy issues. Co-led by Finland, Iceland, Russia and the Gwich'in Council International, and involving subject matter experts from around the Arctic, the Arctic Energy Summit's Organizing Committee produced a comprehensive platform that allowed Arctic stakeholders and partners the opportunity to learn, share, and build on good practices.

Expertise provided from a diverse group of participants highlights the importance of providing benefits to Northern communities while minimizing cultural, social, environmental, and economic risks. Broadly, the 2017 Summit addressed energy in the Arctic as it relates to:

- Small and off-grid community energy solutions and investment
- Oil and gas development
- Renewable energy and energy efficiency
- Indigenous engagement and local capacity building
- Mitigating climate and environmental impacts
- Transportation and transmission

Consistent with the SDWG's mandate and its Strategic Framework, the 2017 Arctic Energy Summit profiled the importance of energy as a fundamental element of sustainable development in the Arctic. This included the Arctic region's leadership role for advancing renewable and responsible energy solutions, capacity building and community well-being.

The Institute of the North, co-host of the 2017 Arctic Energy Summit, is a research organization that seeks to enhance quality of life and economic opportunities in the Arctic. The Institute, like its founder former Alaska Governor and U.S. Secretary of the Interior Walter J. Hickel, works toward the responsible management of resources, consistent with the public interest. This year, the Institute of the North was grateful for the opportunity to collaborate with Finland's Ministry of Economic Affairs and Employment. Helsinki provided a vibrant backdrop for productive conversations regarding innovation, sustainable practices, and the utilization of energy resources for the prosperity of generations to come.

The outcomes of the Summit included identifying leading practices, gaps in research, and potential future projects. Through collaboration and camaraderie, and demonstrated circumpolar cooperation and partnerships, our partners worked to improve existing energy systems, generate solutions, and recognize policy-relevant findings. After a productive 2017 Arctic Energy Summit, we look forward to further exploring Arctic energy issues at the next Summit planned for 2019 in Iceland.

Ministry of Economic Affairs and Employment of Finland

INSTITUTE OF THE NORTH
Governor Walter J. Hickel, Founder

A COMPREHENSIVE APPROACH TO ARCTIC ENERGY THEMES AND ISSUES OF THE 2017 SUMMIT

The development of Arctic energy should encompass and be responsive to the needs of local people and economies of the region.

SMALL COMMUNITY ENERGY SOLUTIONS

Early and sustained community engagement and partnerships • Energy efficiency – smart grids, housing, storage, etc. • Effective micro-grids and off-grid utilities • Reducing use of diesel fuel for power generation • Generators and efficiency • Local use of natural gas • Energy conservation and weatherization

OIL AND GAS

New technologies to drive down exploration and production costs • Ways to bring innovation into the sector • Safety, oil spill response and risk management • Supply chain management, transportation • Stakeholder engagement and community impact

RENEWABLE ENERGY

Resource potential and current projects – tidal, solar, wind, biomass, hydro, geothermal • Energy storage technologies • Integration of renewables into power supply

REGULATION

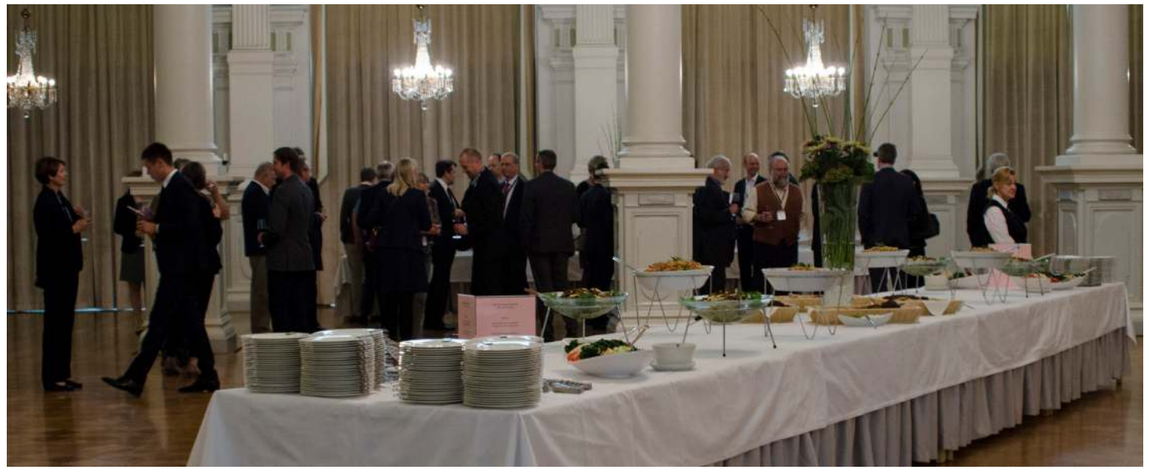
Arctic national and sub-national energy policies and strategies; geopolitical environment • Local government initiatives • Climate impacts of petroleum development • Indigenous peoples and tribal governments' role • Government efforts to address cost of energy • Arctic Economic Council and private sector perspectives • Arctic challenges and ecosystem resilience

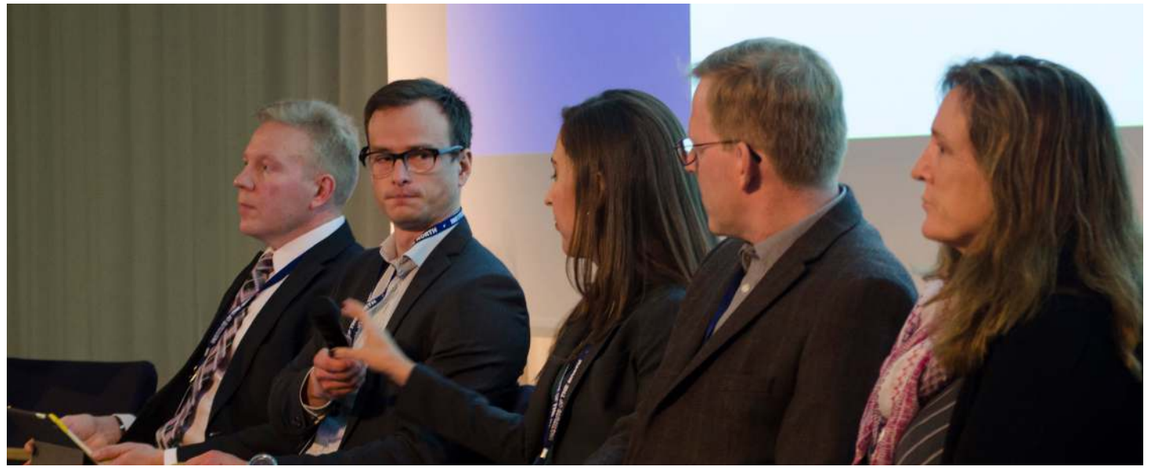
FINANCING

Public-private partnerships • Co-investment • Tax credits • Renewable energy funds • Public procurement • Energy efficiency contracts • International energy project financing

COMMUNITY IMPACT

Environmental protection • Stakeholder engagement • Capacity-building • Indigenous peoples and resource development • Energy literacy • Science and traditional/Indigenous knowledge • Economic growth and community capacity building • Promoting local benefits





ARCTIC ENERGY SUMMIT EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

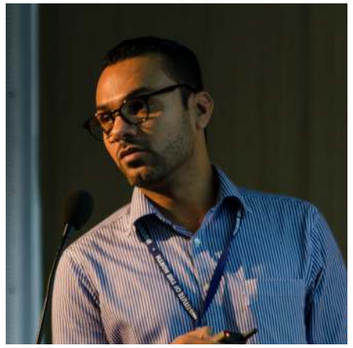
The panels, presentations, and discussions at the Energy Summit presented opportunities to explore how political, economic, social, academic, and environmental sectors interact with energy extraction, production, transmission and utilization. Climate change provided a new framework within which to address these issues, as governments, companies and stakeholders increasingly make decisions based on commitments made in the Paris Agreement. Finland presented its *New Energy and Climate Strategy for 2030*, for example, which focused on historical trends and strategic objectives for electricity, heating, and transport.

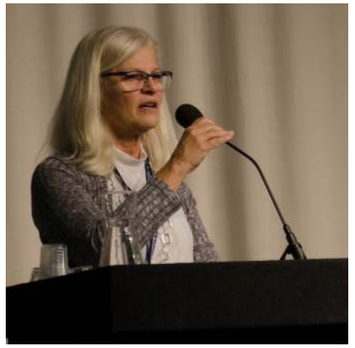
The approach by Arctic States to climate change and petroleum development is clearly a flashpoint for debate. The Summit provided a meaningful forum for the exchange of information, global and regional trends, project development strategies, mitigation measures and community benefit arrangements. Importantly, the Arctic Energy Summit can serve to facilitate climate and energy discussions that are science-informed, engage local rightsholders, and utilize the many forms of knowledge present in the region. In general, there was consensus that northern regions must be prepared to adapt.

Since the first Arctic Energy Summit convened in Anchorage, Alaska, USA in 2007, the Arctic oil and gas landscape has changed significantly. In 2007, most governments of Arctic countries were inviting industry to participate in licensing rounds, with an emphasis on the offshore basins to test the potential of the lightly explored Arctic petroleum basins. Exploration outcomes, moratoria in North America, EU and US sanctions related to the Russian Arctic, made the context in 2017 very different. These factors have had the effect of reducing the number of active Arctic exploration theatres. Additionally, regulatory responses to Macondo, the US shale gas revolution, and the drastic drop in oil prices in 2014/2015 affected the affordability and economic viability of Arctic oil and gas exploration and development respectively. The increased emphasis on climate change culminating in the 2016 Paris Agreement and the focus on energy transition and societal perceptions regarding environmental risk of Arctic oil has influenced investor and oil company appetite to drill for oil in the high Arctic offshore environment.

The renewables sector has undergone just as rapid changes over that period. Costs have come down as technology improves and government policies have resulted in increased implementation of clean energy systems. At the same time, the narrative in the Arctic has changed from one of need to what the region can offer. In many arenas, Arctic energy expertise can be exported to help other regions of the world adapt or transition to cleaner energy. Challenges remain, of course, as northern communities face affordability, reliability and security concerns, but the coordinated effort to address these is remarkable.

The Arctic is increasingly defined by its renewable energy and energy efficiency leadership. As governments, communities and Indigenous peoples respond to climate change goals, clean energy will feature prominently. Oil and gas development will occur where economics, environmental and societal interest align. For many in the region, that development will facilitate additional investments in renewables as Arctic states generally work toward a green transition. This green energy transition will happen at different rates and scales, and over different periods of time across the Arctic, but the Arctic Energy Summit set out clear interests in this process.
The following are a sample of good practices that were offered at the 2017 Arctic Energy Summit





STRATEGIC PLANNING

- Dynamic planning is integral due to the non-static energy landscape, climate, and economic situation; standards include adaptability, regular review and updates.
- Investments should be made both with regard to projects and to capacity and capability development of local people and local businesses; contribute to long-term sustainability.
- Partnerships with governments are productive and strategic approaches to these relationships should involve exploring win-win solutions, and developing trust and respect for both parties.

COLLABORATION AND BRIDGING NETWORK GAPS

- Respectful cooperation that leads to success should occur between Arctic energy partners, including utilities, industry, communities, government, and academia.
- Regional collaboration distributes and shares investments in and costs of renewable energy, which leads to the potential for more success for communities and countries.
- Energy partners may utilize the experience and knowledge of engineers, financial advisors, and researchers to troubleshoot challenges.
- Greater engagement with energy expertise outside the Arctic region can result in the exchange of lessons learned and facilitate inter-regional research collaboration.

DATA-COLLECTION AND DATA-SHARING

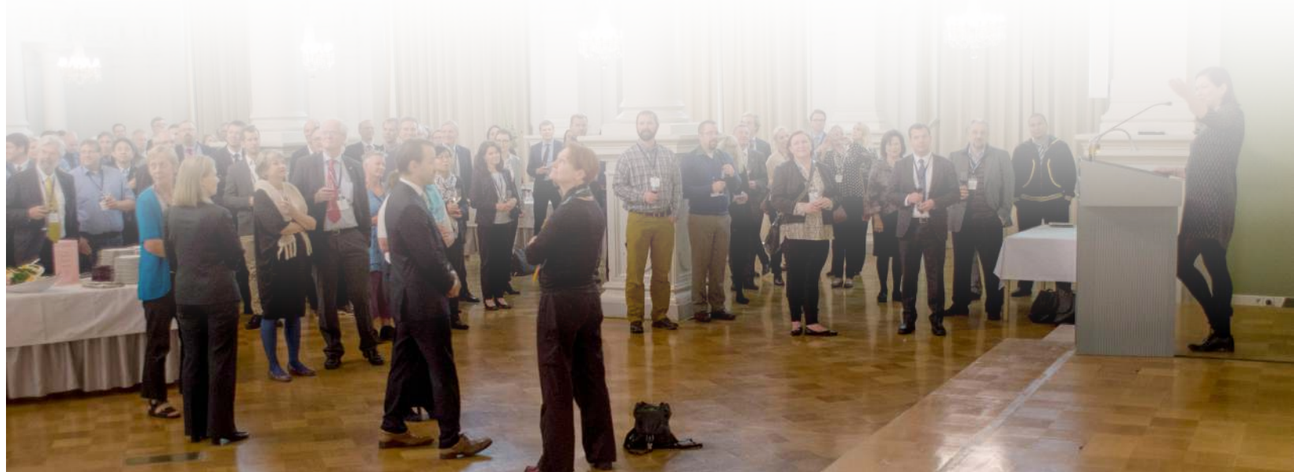
- The exchange of information between energy partners should be consistent, easily accessible to Arctic stakeholders, and updated regularly.
- Successful projects should be shared across the Arctic, and include reasons for the project's success, separate the 'if's' and 'how's', be geographically specific, and discuss the scale of the community to allow others to determine if such a project may be feasible elsewhere.
- Raise energy-consumption awareness, reinforce connections to sustainability, and review solutions for energy savings.
- Discussion of energy and climate-related topics should involve science and the many forms of knowledge in the Arctic, including Indigenous. Stories, mentorship and informal education are effective strategies for learning and sharing.

ENGAGEMENT

- Early consultation and meaningful engagement with local communities and Indigenous peoples helps to develop interpersonal relationships that are integral to project success.
- Support two-way communication and follow through on deliverables that meet the commitments made to all rights- and stakeholders.
- Engagement should include access to information, participation in decision-making, and access to effective means of justice, including the upholding of rights and the correcting of injustice.
- Project proponents and governments should be mindful of 'engagement fatigue' and carefully plan for engagements in a collaborative manner so as not to overburden local capacity.

FINANCING

- Micro-financing could be a helpful option for certain projects and should be considered early in the process.
- Speaking to the interests of potential investors is most productive. Utilize science, emotion, and fiscal interest to encourage investment.
- Developing private and public networks and partnerships will aid in co-production and innovation, lessening the costs for small communities.



THEMATIC AREAS

LOCAL, RENEWABLE SOLUTIONS: STRATEGIC PLANNING AND MEANINGFUL ENGAGEMENT

The Summit identified local communities and Indigenous peoples as key stakeholders, rights-holders, and energy partners, with whom project proponents and governments must engage in constructive dialogue. Engagement at the local level must include the option to say 'yes or no' to development and provide ways in which concerns or hope will be addressed. It is important that local peoples are at the table and not represented or misrepresented by outside interests.

The Gwich'in Council International (GCI) played a key role as an Indigenous sponsor and SDWG co-lead to the Summit. The GCI-led session on Community and Indigenous Consultation and Stakeholder Engagement provided an important opportunity to discuss these issues, and noted that depending on the Arctic state in focus, there are different levels between "stakeholders" and "rights-holders" depending on the different legal regime. For example, Gwich'in in Canada are not "stakeholders" of projects happening on their lands, but are rights-holders and decision-makers as outlined in the constitutionally-protected land claims agreements.

The SDWG's the Arctic Renewable Energy Networks Academy (ARENA), and Arctic Environmental Impact Assessment (Arctic EIA) projects were well-profiled. Both presentations highlighted the importance of engaging local and community expertise in sustainable development planning. Benefits of doing so included improved project planning and design, better decision making, and ensuring more equitable benefits to community and Indigenous stakeholders.

The SDWG's ARENA project demonstrates how a collaborative circumpolar renewable energy training program is bringing lasting benefits to Indigenous and northern communities in Canada, the U.S, Iceland, and Norway. Its unique approach to developing "community energy champions" and having these champions present their stories first-hand was an effective demonstration of energy literacy, capacity building, and training opportunities as good practices.

Indigenous and Northern Affairs Canada spoke to the importance of having governments support multi- stakeholder engagement and collaboration in energy planning. Improved engagement from Indigenous partners and stakeholders was a key part of this discussion, with a focus on meaningful, two-way communication and dialogue.

Many examples of good practices in community involvement on the North Slope of Alaska were presented, where local communities have played a key role in prudent oil field development for more than 40 years, for example, utilizing a Cultural Resources Management Plan. Industry and community alignment and collaboration is a must; inclusive multi-layered engagement encourages innovation and project success.

"Energy poverty" was discussed at the Summit, referring to the lack of access to modern, reliable and affordable energy supplies that will have a severe negative effect for economic development in some regions, especially relevant to the Arctic energy debate, as well as to highly developed nations following the phasing out of coal and nuclear. Energy poverty was brought forward as a concept that needs further development and engagement from all sectors.

The sustainability requirements from the investor and shareholder community who consider spending capital on Arctic energy projects, infrastructure, industrial projects, and societal development projects is a key element to sustainable development. Policies to reduce emissions and the environmental footprint of projects to desirable levels may influence future decision-making by both investors and companies.

In challenging and remote locations, including large parts of the Arctic, the sharing of ideas and good practices is often a prerequisite for successful cost-effective projects and technology implementation.

GOOD PRACTICES & NOTABLE SUCCESSES

- The 2017 Summit offered excellent examples of smaller northern municipal and community approaches to energy planning. These plans, however, do not have to be created by communities alone; assistance from industry and citizen engagement can serve this end.
    - *Vaasa, Finland successfully created such a plan (http://energyvaasa.vaasanseutu.fi). Multiple bodies with connections to energy policy collaborated and brainstormed, including the university, industry, municipalities, political players, and institutions. The outcome was a short-list of renewable energy projects that was voted on to move forward. "We did it together," shared Erkki Hiltunen from the University of Vaasa, "and it was our project." Sharing ownership leads to long-term success.*
- Utilize international standards to support participation, and ensure that engagement happens on the ground and not just in theory.
    - *In Russia, transparency and stakeholder engagement is extensive in projects that are financed by international banks.*
- Educating the community and speaking beyond cost-savings helps build relationships and buy-in, and a long-term vision is integral.
- Collaboration on social investment projects aimed to preserve culture and traditional ways of life are complementary to building local and Indigenous capacity and participation in industry.
    - *The Arctic Renewable Energy Network Academy (ARENA), a program with the Arctic Council's Sustainable Development Working Group, is a leading initiative working to promote renewable energy literacy in arctic communities, as well as collaboration and capacity-building. See http://arena.alaska.edu for more information.*
- Communication with local actors is important; go into communities for engagement. Utilize emotion, traditional values, scientific evidence, lessons learned and lessons yet to be learned, to build relationships.
    - *In some sectors, fact-finding missions have been successful, where companies can bring community leaders to different projects to examine successful outcomes and to build relationships.*
    - *Telecommunications and fast broadband brought by companies to support projects can aid in communication across the industry, as well as support community health, education, economic development, and public safety. However, reliability is key.*

KEY CHALLENGES AND GAPS IN RESEARCH

- Challenge - Russia is the largest oil and gas producer in the Arctic by far, with significant logistics resources and environmental impacts. Active engagement from all Arctic states will be critical.
- Challenge - Success stories need better mechanisms and strategies to be disseminated to relevant audiences.
- Challenge - Stakeholder engagement, capacity building and community support.
- Challenge - How to market projects to different groups of actors (locals, investors).
- Challenge – Transparency.
- Research Gap - Modularity can respond to adaptive nature necessary for community projects.

ARCTIC ENERGY SUMMIT EXECUTIVE SUMMARY

ARCTIC INNOVATION, INVESTMENT, AND RENEWABLE ENERGY

Innovation and renewable energy dominated discussions regarding the future of the Arctic. Building on the 2015 Energy Summit in Fairbanks, the 2017 Summit went further in demonstrating the feasibility and the regional benefits of renewable energy projects. The Nordic states were particularly well-positioned in this regard, with many technological and policy-based good practices identified.

Both Norway and Iceland have found success in hydropower and geothermal (for the latter) development, resulting in low cost, renewable power for their industrial growth and community well-being. Northern Sweden has experience in wind power, and Lapland is increasingly investing in biofuel technologies.

Canada's Pembina profiled the benefits of Power Purchase Policies for supporting Indigenous-owned clean power projects. Under these models, governments and utilities support the independent generation and selling of power by third party producers. In turn, emerging best practices include promoting larger numbers of clean power projects, new electricity generation and storage technologies, and more modernized regulatory environments. Similarly, Canada's Chris Henderson (President, Lumos Energy) described progressive financing approaches for promoting off-grid energy infrastructure in various communities across Canada.

Representatives from the oil and gas sector pointed out that petroleum is also the feedstock for many industries. Currently, society is highly dependent on petroleum products like plastics, chemicals, and a vast array of synthetic materials that originate from petroleum. In the discussion of climate change and petroleum development, this aspect is something that needs to be included.

The oil and gas business is transitioning at an increasing pace to renewables and lower carbon emissions through technological innovations and the gradual shift from oil to gas. In addition, many oil and gas companies engage in developing low carbon downstream solutions and fuels (including hydrogen). This has important implications for Arctic societies and Arctic businesses wishing to secure sustainability in a low carbon future. More focus on the transition roadmap of the energy industry should be included in 2019. The successful transition to renewable energy is an element that affects all energy and political sectors.

GOOD PRACTICES & NOTABLE SUCCESSES

- The payback time should be emphasized to local people investing in renewable solutions and a debt repayment plan in place before project moves forward.
    - *King Cove, Alaska, USA successfully transitioned to hydropower utilizing the strength of the fishing community and rivers/geography of the region. It is now the most remote micro-grid renewable energy community in Alaska, saving massive amounts of diesel and cost ($5,5 million in 22 years).*
- Step-by-step guides for communities to build affordable, cost-effective and energy-efficient homes have been tested in northern Canada.
- Utilize academia, which can serve as an apolitical bridge to policy makers.
- Holistic approaches are needed since so many energy issues are interconnected.

KEY CHALLENGES AND GAPS IN RESEARCH:

- Research gap - Offgrid energy security and cost reductions; renewable energy integration into microgrids.
- Research gap - Different types of green energy are not always suitable for the grid. Finding the right technology for different circumstances is integral, rather than replicating from other context.
- Research gap - A roadmap for the energy industry to transition to renewables and a low-carbon future.
- Challenge – Explaining climate change and black carbon to multiple audiences.
- Challenge - Value must be quantified on renewable-energy related issues and consider impacts to traditional resources, such as reindeer.
- Research gap - How to move large-scale transport, including airlines and commercial shipping to renewable energies.
- Research gap - Beyond economic calculations, what are the ecological/environmental and human health impacts of different modes of energy production?
- Research gap - Discussions and examples of implementation of renewables and how existing initiatives for renewable energy production can be replicated and/or scaled up.
- Research gap - How does the financing of large projects compare to that of small projects?
- Challenge - More information on Russia and their renewable energy projects.

OIL, GAS AND PREPARING FOR THE FUTURE

The balance of maintaining a focus on the oil and gas sector as a means of securing economic development and energy security in the Arctic, and at the same time working towards a sustainable low carbon future, was the theme of many presentations and discussions during this year's Summit. The Paris Agreement is the most important backdrop for this discussion and informs both government and private sector decisions. The Summit provided a platform for multiple perspectives to be presented and ensured that the climate change and energy development discussion happened in a structured manner and in a global context, based on science and current knowledge.

Increasing the amount of data at the Summit will be crucial in the future, and broader presentations of relevant "Energy Outlooks" encouraged. Global consultancies (e.g.; Bloomberg, IHC, Wood Mackenzie), oil and gas companies (e.g.; BP, ExxonMobil, Shell, Statoil) and global institutions (e.g.; IEA, IPCC) all prepare global long term energy projections that could be an important common basis for the discussions at future Summits.

The Nordic countries are currently leading the way to a carbon neutral future in the Arctic. The oil and gas business plays an active part in this transformation. It formulates climate roadmaps and concrete targets of emission reductions (including black carbon). It works systematically with efficiency improvements and new technological solutions. It seeks ways for gas to replace coal in electricity generation and also to act as a reliable back-up to renewable sources such as wind and solar. Carbon capture and storage projects are in early implementation phases, but full-scale pilot projects are in operation / under development, e.g. in Canada and Norway. Widespread application of such capital intensive schemes strongly depend on effective carbon pricing or alternative incentives. Emission free transformation of hydrocarbons to hydrogen are being tested and full-scale projects are being planned. Downstream oil and gas (refining, chemicals) products provides critical support to alternatives like wind (e.g.; specially formulated lubes to increase efficiency and lower maintenance costs), solar (e.g.; the special films derived from petroleum are critical to panel performance), and numerous adhesives and polymers. There is a significant need for advocacy to inform the public and policy makers of these developments.

Leading practices should also be shared between sectors. In general, and in particular in challenging and remote situations like large parts of the Arctic, sharing of the good ideas is often a prerequisite for cost-effective and successful projects and technology implementation. The shipping sector has come a long way in this regards (ref. PAME best practices project in Arctic shipping operations) and could be used as an example. Cooperation in phasing out the use of Heavy Fuel Oil (HFO) in shipping operations should be high on the agenda and the application of LNG as the cleanest and least emitting fossil fuel is being introduced. However, further work towards zero carbon Arctic shipping is needed; this could be addressed at future Summits. The risk management and HSE culture that pervades the oil and gas industry is an important field of good practise sharing with other sectors. The oil and gas sectors' use of Integrated Impact Assessments and prevention of incidents and emergency response are examples of this HSE culture.

Efficient oil spill prevention and response is part of the oil and gas sector's 'license to operate'. Many decades of experience and research on oil spill in ice should be shared with the various actors in the Arctic marine environment. A very comprehensive, seven-year long, Arctic Response Technology Joint Industry Program reported its findings this year (http://www.arcticresponsetechnology.org/). This effort brought together experts across academia, industry and independent research centers, focusing on Dispersants, Environmental Effects, Remote Sensing, In-situ Burning, Trajectory Modeling, and Mechanical Recovery. Further engagement regarding the (pre-) approval and ratification by government agencies is required of existing response technologies and systems, like the use of dispersants and in-situ burning of oil in ice covered waters. Not everyone agrees that adequate techniques for dealing with oil spills in ice-covered waters exist. The effectiveness of response methods for biofuel and new mixed fuel spills should also be investigated.

Carbon pricing was generally held as the best incentive for carbon emission reductions because it is independent of the source of energy and encourages open competition, innovation and technology development. Several examples were highlighted at the Summit, including the Norwegian special carbon tax that has contributed to putting Norway at the bottom of the list of carbon emitters, and the various emission trading schemes across the globe. This is of course highly relevant for the Arctic energy debate since there are clear expectations of the lowest possible carbon emissions from future energy production including oil and gas and other industrial activities in the Arctic.

Collaboration with multiple stakeholders in the Arctic is important at many levels (local, regional, national and global). The merits of regional oil and gas operator collaboration, for

example, is demonstrated in the Norwegian sector of the Barents Sea, where the Barents Sea Exploration Collaboration (BaSEC) achieved significant savings in operating cost through shared logistics, reduction of environmental footprint and enhanced cooperation on HSE matters. Science (including Indigenous and local knowledge) must be a primary basis for decisions in the energy sector, and Arctic endeavours tend to have high levels of scientific activity within the oil and gas industry itself. Research and education generally follow in the wake of large petroleum projects, but it is important to coordinate and cooperate early in project development to reduce the research burden on communities, as well. Local communities should be involved in the scientific work, including sharing of Indigenous knowledge. Indigenous knowledge is a valuable resource and it is wise to incorporate this knowledge base and partner with local experts in a range of fields.

Industry and community alignment and collaboration is a must and inclusive multi-layered engagement should pursue shared life cycle project benefits. Collaboration on social investment projects aimed at preservation of culture and traditional ways of life are a good complement to building local capacity for participation in industry.

GOOD PRACTICES & NOTABLE SUCCESSES

- Practices must aim at a low-carbon future.
    - *Nordic countries are currently leading the way to a carbon neutral future. They are especially successful in coordinating in the electricity field. Widespread application of capital-intensive schemes strongly depend on effective carbon pricing or alternative incentives. Emission-free transformation of hydrocarbons to hydrogen are being tested and full-scale projects are being planned; transitions to biomass CHP and nuclear fuels are being arranged.*
- Information sharing across energy sectors must be prioritized.
    - *The Arctic Council's Protection of the Arctic Marine Environment (PAME) Working Group is one success story that provides operating guidelines for Arctic transport and conduct through the Arctic Shipping Best Practices Information Forum. That new website can be found at https://pame.is.*
- Cooperation in phasing out the use of Heavy Fuel Oil (HFO) in shipping operations should be high on the agenda and the application of LNG as the cleanest and least emitting fossil fuel is being introduced while work on zero carbon options continues.
- Carbon pricing was discussed as a key incentive for carbon emission reductions because it is independent of the source of energy and encourages open competition, innovation, and technology development.
    - *Several examples were highlighted at the Summit, including the Norwegian special carbon tax that has contributed to putting Norway at the bottom of the list of carbon emitters, and the various emission trading schemes across the globe.*

KEY CHALLENGES AND GAPS IN RESEARCH

- Research gap - Quantifying how much oil is used in primary energy generation and what part of oil is consumed in raw material production.
- Research gap - Timeframe for each nation/sub-region to transition from oil to gas and renewables.
- Challenge - There is a significant need for outreach to inform the public and policy makers of developments in low-carbon initiatives, in Nordic countries and beyond.
- Research gap - Further investigation is needed to understand what happens and how to respond if oil spills occur on ice, as well as the effectiveness of response methods for biofuel and new mixed fuel spills.
- Research gap - Carbon capture and storage (CCS) is important to the future; exploration into how to accelerate technological as well as policy development.

LESSONS LEARNED

COLLABORATION AS KEY

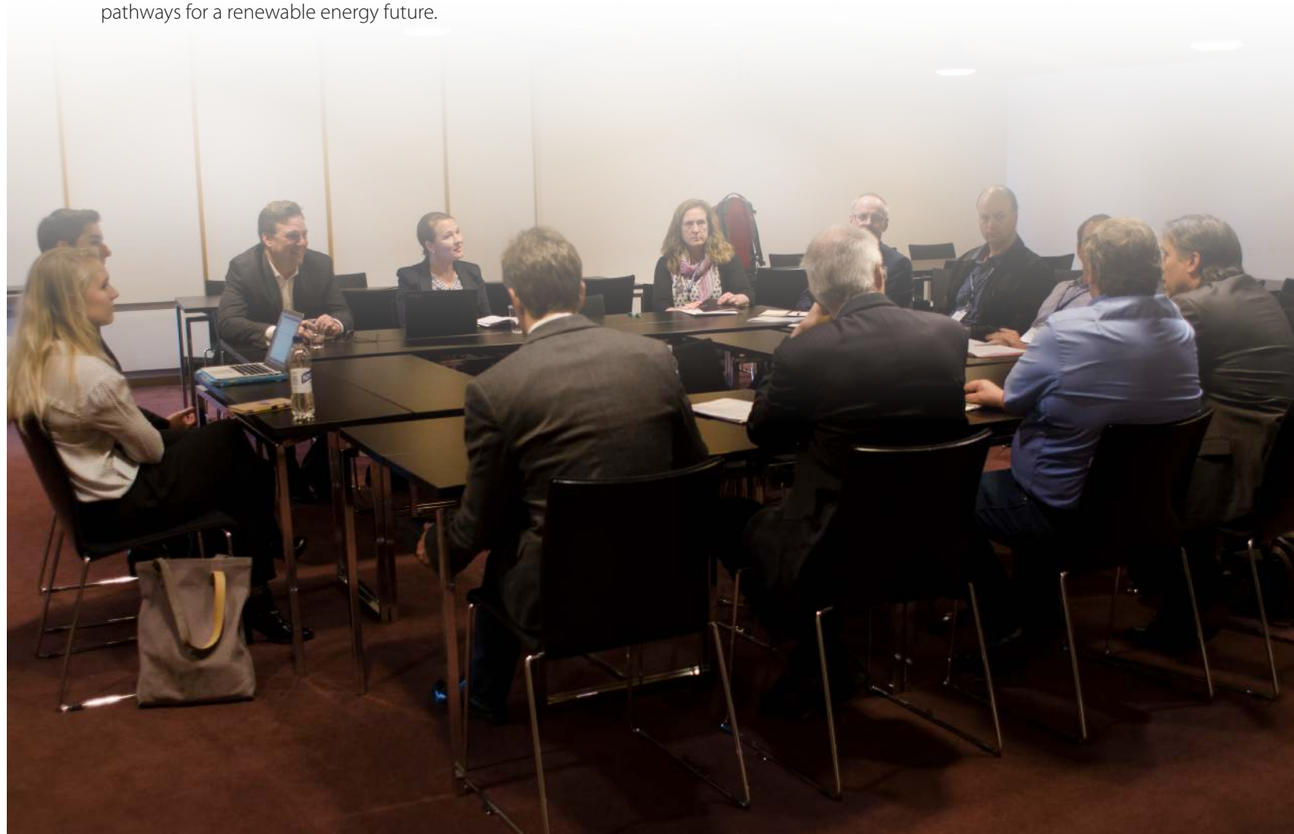
The necessity of collaboration and innovation were key outcomes from the 2017 Arctic Energy Summit. Opportunities to continue working together are numerous. Suggestions to collaborate included the creation of sister energy communities, ground-up exchange initiatives, and cohorts designed around energy topics. Collaboration may be a fundamental component of public and policy maker education.

The 2017 Arctic Energy Summit provides a platform for learning and sharing of good practices, for the development of solutions, and identification of research gaps and policy-relevant findings. Much of this summary report intersects with all of these. As an SDWG project, it is especially important to highlight findings that Arctic states could respond to as they consider policy in the region.

To advance sustainable development in the Arctic region, as it relates to energy, the Summit produced the following considerations:

- Support reliable tax policy that is both durable and predictable to help incentivize energy innovation and meet climate change goals.
- Encourage initiatives that aim to phase out the use of heavy fuel oil and promote alternative fuels in the region.
- Invest in Arctic research and strategic planning to encourage further energy information exchange and use in renewable energy development.
- Engage in international agreements and collaboration across sectors to provide tools for energy transition.
- Facilitate the inclusion of local and Indigenous peoples in energy decision-making processes.

The Arctic Energy Summit demonstrates that in partnership, Arctic communities, as well as representatives from industry, utilities, government, and academia, can demonstrate leadership, navigate the future of oil and gas development, and strengthen the pathways for a renewable energy future.



ABSTRACTS

AFFORDABLE AND SECURE LOW CARBON ENERGY FOR RURAL COMMUNITIES

Antti Arasto, VTT

Rural communities in Alaska and elsewhere encounter high energy prices and cash flow out of the community due to purchase of large amounts of fossil diesel to power their community. Small scale biomass based combined heat and power production will lower climate impact, dependency on imported oil and boost local economy by enabling use of local wood resources.

ICEBREAKING & OIL SPILL PREPAREDNESS AND RESPONSE WITH DUAL FUEL LNG ICEBREAKER POLARIS

Hanna Suutarla
R&D Manager, Arctia Ltd.

The newest Finnish icebreaker Polaris is unique in many ways. It is the first icebreaker in the world capable of running on both liquefied natural gas (LNG) and ultra-low-sulphur diesel. Its total output of about 22 MW also makes it Finland's most powerful icebreaker. Polaris is the most environmentally friendly diesel-electric icebreaker in the world.

IB Polaris is equipped with three Azipod propulsion units rotating 360 degrees which enables excellent maneuvering qualities. The icebreaking capacity of IB Polaris is 1,2 meters at a speed of 6 knots. Finnish Lamor Corporation Ab delivered the in-built oil recovery system, which enables Polaris to collect 1015 m^3 oil with a rate of 200 m^3/h in harsh weather and ice conditions.

This presentation will showcase the technical features of the world's first LNG icebreaker Polaris. It will also present the vessels in-built oil recovery system and discuss the use of the vessel in the sub-Arctic Gulf of Bothnia. Possibilities for the use of LNG in vessels operating in the Arctic will also be discussed.

FACILITATING MULTI-STAKEHOLDER ENGAGEMENT AND COLLABORATION ON THE DEVELOPMENT OF A COMPREHENSIVE PLAN AND TIMELINE TO REDUCE DIESEL RELIANCE IN CANADA'S NORTH

Jennifer Ardiel, Senior Policy Analyst, Climate Change and Clean Energy Directorate, Indigenous and Northern Affairs Canada

On March 10, 2016, the Canadian Prime Minister committed to developing a plan and timeline with partners for deploying innovative renewable energy and efficiency alternatives to diesel as part of the broader commitments on the U.S.-Canada Joint Statement on Climate, Energy, and Arctic Leadership. Reducing diesel use in Canada's North also responds to the government's priorities on clean growth and climate change, supporting infrastructure to build healthy communities, and building a renewed relationship with Indigenous Peoples.

In Canada, the Minister of Indigenous and Northern Affairs Canada (INAC) provides federal leadership in the North, however Northern and Indigenous communities, governments, and organizations have the primary role in setting direction, decision making, and moving to action. The development of a comprehensive shared plan and timeline that would be meaningful and relevant to all stakeholders presented several challenges primarily due to the significant number of partners and stakeholders working from different perspectives spread across Canada's significant northern landmass, and the remoteness of many of the diesel-dependent communities.

The process of developing a plan and timeline to reduce diesel reliance in Canada's North, the mechanisms used to support collaboration across a vast area and array of stakeholders and partners, the results of the process, and the lessons learned will be discussed.

RESOURCE EFFICIENT TECHNOLOGY IN ARCTIC OIL AND GAS COMPLEX

D. P. Barakhtina, T. A. Kulagina
Siberian Federal University,
Krasnoyarsk, Russia

Oil and gas development is directly connected with the Arctic Region. The areas of the Arctic seas are the potentially richest oil and gas basins.

There is the problem of incompetent seam in the Arctic Region, and therefore lightweight grouts are used for columns cementing. With the current well technologies design, cementing is the final and most important step that is largely effects on successful construction. During the period of well using the cement stone quality should be consistently high, so it has high resistance requirements against negative factors (impact, geological and technical factors, etc.).

Laboratory investigations have allowed developing a new technology for production lightweight grout with a minimum amount of water and use of waste products (foam glass, fly ash). This technology has provided high-quality cementing of wells in Arctic region environment with high economic efficiency.

It is also proposed to use the cavitation technology for improving cement stone properties, to the point hydration degree and particles surface energy. As a result of the dispergation, basing on cavitation effects, aluminate, coarse-grained, primary and weak structure goes into the finely crystalline structure, and it's strength increases 2-3 times compared with the solution preparation in conventional mixers.

OIL POLLUTION FROM OFFSHORE INSTALLATIONS IN SOUTHEAST ASIA: CONCERNS AND QUESTIONS FOR THE ARCTIC

Oil Resources in the Arctic: Concerns and Questions from Tropical Singapore

Robert Beckman

The prospect of the exploration and exploitation of hydrocarbon resources in the Arctic is viewed with concern by this international law professor from Singapore. There are several reasons for this. First, although the 1982 UN Convention on the Law of the Sea (UNCLOS) calls on States to establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control pollution of the marine environment from seabed activities subject to national jurisdiction, no global rules and standards have been established. In most parts of the world there are also no regional rules, standards and recommended practices and procedures. Second, although liability and compensation schemes have been established for oil pollution damage caused by oil pollution from tankers, there is no liability and compensation scheme for damage caused by oil pollution from offshore installations. This was brought home to us in Southeast Asia when Indonesian islands and waters were polluted in 2009 from the Montara oil field in the Timor Sea, off the northern coast of Western Australia. Third, although the IMO Convention on Oil Spill Preparedness, Response and Cooperation calls for the establishment of oil spill contingency plans to combat pollution from oil installations as well as oil tankers, one wonders how prepared States are to respond to an oil spill in the Arctic. How effective are booms, skimmers and dispersants if the oil spill is in ice-covered waters? Are oil spill response companies ready and able to respond effectively to an offshore spill in the ice-covered waters of the Arctic? Finally, what impact would a major spill have on the pristine marine environment of the Arctic? And most important of all, what effect would a major oil spill from either a tanker or an offshore installation have on the indigenous peoples who live on the ice and rely on the living resources in the Arctic waters for their survival?

ARCTIC ARCHITECTURE & DESIGN PRESENTATION

Larry Cash,
CEO of RIM Architects

Designing structures in the Arctic requires those responsible for the design to understand the many complex parameters that must be addressed carefully and thoughtfully. This presentation draws on RIM's architectural expertise in arctic and sub-arctic Alaska, and highlights one of Alaska's largest infrastructure projects, the Trans-Alaska Pipeline, to express expert design and construction ingenuity.

Discussed is RIM's focus on designing for energy efficiency and sustainable architecture, highlighting building performance metrics RIM has achieved through the utilization of technology, modeling design options to achieve projected total energy use savings of 41% above code requirements.

Two major RIM projects in Arctic Alaska are described: The Samuel Simmons Memorial Hospital in Utqiagvik (Barrow), and the Northwest Arctic Heritage Center in Kotzebue. Utilizing modeling ensures best orientation and structure shape for daylight and snowdrift management; elevating buildings on permanently frozen piling foundations allows wind to blow freely beneath keeping the tundra frozen and clear of snow. The critical importance of designing in partnership with Indigenous Populations is emphasized to assure culture is incorporated and respected by the architecture designed.

In conclusion, through the practical utilization of advanced technology, it is possible to dramatically reduce the energy consumption of the built environment in the Arctic.

CLEAN POWER PURCHASE POLICIES FOR REDUCING DIESEL FUEL RELIANCE IN REMOTE INDIGENOUS COMMUNITIES OF CANADA WITH INTERNATIONAL EXAMPLES

Dave Lovekin and Barend Dronkers

Remote Indigenous communities in Canada consume more than 90 million litres of diesel fuel annually for electricity. Fewer than 5% of these communities have locally owned or operated clean energy projects, mainly small (<10 kW). Some more are currently in development. The newest projects integrate small energy storage and commercialized grid-controls.

Canada's federal, territorial and provincial governments are keen to address over-reliance on diesel fuel in remote communities. *Power purchase policies for remote Indigenous communities in Canada* supports development of clean power projects with a review of current and trending power purchase policies. It outlines how these policies came to be, and the resulting power purchase agreements. Policy discussion focuses on price-based mechanisms for power purchasing, net-metering, and some key grant-based programs, such as Alaska's Renewable Energy Fund.

Findings point to three approaches to clean power purchasing in remote Indigenous communities: 1) an enabling regulatory environment 2) government-driven policy, and 3) utility-driven programs. Further steps should address subsidies allotted to delivered diesel fuel, a better understanding of renewable energy value in remote grids, and resolving rate-base and grid reliability concerns. Most importantly, addressing how to capture clean energy project opportunities as a means of building stronger, more resilient communities.

POTENTIAL AND CHALLENGES FOR OFFSHORE WIND ENERGY IN THE GULF OF BOTHNIA

Dr. Jaakko Heinonen
Principal Investigator - Ice-structure Interaction
VTT Technical Research Centre of Finland Ltd

Finland's national target increasing the share of renewables above 50% of total energy production in the 2020s will only be realized by large-scale investments in the sea areas. This development is also strongly supported by the Europe Union's Blue Growth strategy. The Gulf of Bothnia features a potential for large capacity wind farms because of relatively high and constant wind velocities. Shallow coastal areas enable simple foundation and grid connection. However, in the Gulf of Bothnia the sea freezes annually introducing a challenging operational environment for marine structures and operations. Sea ice loads introduce the most significant uncertainties in the structural design.
The presentation introduces opportunities, challenges and solutions to utilize the Gulf of Bothnia as a resource for sustainable growth. As an example, the world's first offshore wind farm in harsh ice conditions will be built in the Gold of Bothnia outside Pori at the West coast of Finland. Reliable and cost-effective solutions are essential from the viewpoint of manufacturing, site-installation, operation and maintenance. Therefore, mutual understanding of environmental conditions and their actions on structures is required. Site-selection of wind farms from the perspective of technological, economic and environmental impact is a key part of the marine spatial planning.

RENEWABLE ENERGY IN KING COVE, ALASKA UNIQUE AND SUCCESSFUL

Gary Hennigh, City Administrator for King Cove

King Cove is located at the western end of the Alaska Peninsula about 625 air miles south of Anchorage. It is an isolated, non-road connected community of 900, predominantly Aleuts. The city was founded in 1911 and organized as a local government in the late 1940's.

King Cove is the FACE of a highly-successful, renewable energy community in Alaska. Since 1994 as a single grid community, more than 50% of the community's annual energy (5MW) comes from a run-of-the-river hydroelectric facility, known as Delta Creek. Now, the community's second hydro facility, Waterfall Creek, will be coming on-line in a couple of months. Together, these two hydroelectric facilities will produce at least 75% of our total annual energy demand.

We want to share our story of technical, financial, and locational courage and risk to reach this point. For good reasons, King Cove has the lowest cost of energy anywhere in rural Alaska. We have displaced over 3 million gallons of diesel fuel in the last 20 years, and now expect to increase that amount by 50% more over the next twenty years. Carbon reduction is real in King Cove. Our energy future is bright!

FINLAND'S NEW ENERGY AND CLIMATE STRATEGY

Riku Huttunen,
Director General,
Ministry of Economic Affairs and Employment

Finland is an energy-intensive economy due to cold climate, long distances, as well as country's industrial structure. The national energy and climate strategy for 2030 describes the way and means to reach national and EU targets. The main emphasis is in cutting greenhouse gas emissions cost-effectively. The strategy also sets the course for achieving 80-95 per cent reduction in emissions by 2050.

By 2030, Finland will increase the share of renewable energy in final consumption to 50 per cent. At least 30 per cent of transport fuels will be covered by renewables, in practice advanced biofuels. The share of fossil energy will be decreased by phasing out the use of coal for energy and halving the domestic use of crude oil. The development of well-functioning, regional electricity and gas markets is also a priority.

The northern, subarctic location brings specific challenges. Security of power and heat supply is very important. Seasonality in energy demand and intermittent electricity production has to be taken into consideration. Base-load power production and CHP play a big role and there is a growing need for smart grid solutions and demand flexibility. Energy efficiency is a key issue at all levels from technologies applied to building instructions and system optimisation.

ROBUST WIND ENERGY SOLUTION FOR ARCTIC REGIONS

Risto Joutsiniemi
Managing Director
Oy Windside Production Ltd

Important and demanding tasks in harsh and remote working environments demand professional equipment. Windside has a proven solution for such conditions.

Windside wind turbines are premium quality micro wind turbines designed and manufactured in Finland since 1982. The primary function of the wind turbines is to charge 12/24/48VDC battery banks, which power DC loads including DC/AC inverters for 110/230VAC output. Available also for grid-connection in larger scale. Hybrid-compatible allows integration of solar or other energy sources.

Windside Turbines are built using only the highest grades of materials. They are built to last a lifetime in all conditions: Freezing ice and snow, high heat and humidity, marine salt corrosive atmospheres, abrasive sand storm atmospheres and extreme wind speed environments (60 m/s +). They can be found the world over: in mountain ranges thousands of metres above sea level; on glaciers; coastlines; deep sea and marine navigation systems; in deserts; but also in remote rural areas and in densely populated urban areas.

Windside Turbines are designed to be safe, reliable and efficient. Proven track record from Antractica, Siberia, Lapland, Greenland and Iceland. We wish now to present durable applications for Arctic use.

MAKING GREENLAND GREENER

Jannik Kappel,
Nukissiorfiit, Greenland

Greenland has 16 towns (500-6000 p) and 53 settlements (20-250p). The capital Nuuk has 16.000p. All but two towns are on isolated grids. Five hydropower plants supply six towns. Here all power and the majority of heating is delivered from hydro. All other towns and settlements are on diesel. This amounts to 62 % of the public power and heating being supplied by renewable energy (RE). The goal set by the government however is 90 % by 2030.

There isn't yet a plan on how to achieve this goal, but Nukissiorfiit is working on it in several tracks. In towns heating should to a larger degree come from hydro, in settlements RE must be implemented to reduce diesel consumption.

Case 1: In the settlement of Igaliku (25p) 100 kW photo voltaic solar panels and 20 kW of wind turbines were installed together with a large battery bank in 2017. On a sunny day the battery bank will keep the city on RE all though the night. This is a pilot project and isn't expected to be feasible, but knowledge gained here will help with energy transformation on other locations.

Case 2: In Sisimiut the level of the lake has dropped drastically since start-up of the hydro plant. A preliminary investigation of erecting wind turbine(s) in the size range 0,5 - 1 MW is currently being done. A location near the mining school has been found suitable. Students are preparing the road and installations as part of their education. Turbines can go up as early as 2018 or 2019.

Case 3: In the settlement Atammik, near Nuuk a small 25 kW with a hinge-foundation will be erected in 2018. The project is expected to be very feasible and if successful will be rolled out in many other settlements. Local acceptance is likely dependent on reductions of power prices.

A major challenge for the energy transformation is the politically decided price structure favouring remote settlements over towns, thus subsidising fossil energy at the cost of RE. This makes it hard to recue prices in settlements further and thus create an incentive for RE projects
Key points:

- Save energy first - then implement RE (to a feasible level).
- Remember the citizens! – local acceptance is critical
- Create (price) incentives for RE.
- Greenland has large unused hydro-potentials – please come and use them!

INTERNATIONAL ENERGY OUTLOOK – SUPPLY, DEMAND AND ARCTIC RESOURCE

Hans Jørgen Koch,
CEO, Nordic Energy Research

Jorma Ollila recently analyzed the Nordic cooperation in the energy field, and his report states this cooperation is strong, but can be even stronger. The Nordic energy system can be the smartest energy system in the world. To achieve this, energy system analyses are required, and as part of these analyses it is important to explore and analyze the Arctic region.

EVA – Energy in Western Nordic and Arctic, is a project that will collect, present and analyse coherent data from Iceland, Greenland, Svalbard, Jan Mayen and the Faroe Islands. The project will explore how the region can reach their energy climate targets for 2035 in the most cost efficient way.

The project launched in 2017, and the first phase of the project will soon be complete. This first phase consists of gathering and sharing data. The second phase includes scenario descriptions, analysis and discussion of results. The project will finish in Q1 2018.

The results of the study will contribute to a common Nordic knowledge base on the energy system in the Arctic and can be used as input in discussions on national policy in the region. The aim is that the results will help the region asses and develop their unique energy resources.
Nordic Energy Research is the platform for cooperative energy research and policy development under the Nordic Council of Ministers. We fund R&D to promote a sustainable future, and we contribute to policy-making.

RENEWABLE ENERGY DEVELOPMENT IN OFF-GRID COMMUNITIES IN THE RUSSIAN ARCTIC

Alexey Kokorin, WWF Russia, Moscow. Alexander Shestakov,
WWF Arctic Program, Ottawa.

WWF completed a study on barriers and drivers for wind and solar energy in off-grid communities in the Russian Arctic which are currently fully dependent on diesel. Economic, climatic, institutional and other factors were analyzed for eight Arctic administrative regions from Murmansk oblast on the west to Chukotka and Kamchatka on the east. Study sets up technical requirements to wind farms to ensure reliable supply under harsh weather conditions (temperature up to -500C and gusty winds of 40m/s). Business options have been successfully tested in 2016 in several locations. It has economic effect due to savings on expensive diesel fuel as well as reducing environmental risks including black carbon emissions. Local authorities and top management of energy utilities bear personal responsibility for delivery of fuel to remote communities. Thus any reduction in complexity of delivery is a top priority. Today such delivery may take many months and include transit from sea vehicles to river boats or/and further to road transport. Current and expected climate changes lead to worse conditions as despite sea ice regime makes sea navigation

easier, but delivery by rivers and roads is becoming significantly worse and unpredictable. Delivery hugely relies on winter roads (legs of hundreds of kilometers are often used) through frozen wetlands, rivers and permafrost while 'summer' roads are non-existent. Climate conditions fully determine this transportation system and the warming is rapidly destroying it. Communication of solutions based on renewables as well as specific examples of climate change risks helps to directly influence authorities and decision makers to support efforts to create autonomous energy supply, in particular wind and solar units, to substitute expensive, risky and less reliable current fuel model.

ENERGY STORAGE PROSPECTS AT MISO, WITH MINNESOTA AS THE ENTRY POINT

Rao Konidena, Principal Advisor, Policy Studies, MISO

Abstract: Midcontinent Independent System Operator (MISO) is one of the ten US Federal Energy Regulatory Commission (FERC) approved Regional Transmission Organization (RTO) in United States. Rao's presentation provides background on MISO and discusses current and future resource portfolio changes. Specifically, Rao's presentation dives deeply on opportunities for Finnish energy storage and other renewables oriented companies (including distributed energy resource providers, and aggregators) in the MISO's wholesale energy, ancillary services and capacity market areas. Finally, the presentation will cover US state regulatory policy objectives towards renewables using the example of Minnesota Energy Storage Alliance.

HOLISTIC APPROACH TO INTEGRATING ENERGY SUPPLY TO MEET COMMUNITY NEEDS

Building On What We Know and Learning From Experience

Clay Koplin,
CEO, Cordova Electric Cooperative

Developing a successful energy project often relies on understanding the unique needs and capabilities of the communities that it will serve. Good communications amongst community stakeholders builds an understanding of these needs and capabilities. Using local skills and resources to advise a project that will meet local needs creates broad-based support and engagement to structure a more successful project. Potential partners like government agencies, builders, equipment suppliers, designers, land owners, electric energy customers, adjacent landowners, other utilities, employees, native tribes and organizations concerned with the environment and other social impacts can either work to oppose new infrastructure or to support it. Sharing the concept for a new project with a large group of stakeholders and then seeking their input in the planning stage can result in a higher value project that meets not only the energy needs, but the economic and social needs of a community. This presentation compares two projects in Cordova, Alaska – The Power Creek Hydroelectric Project commissioned in 2002, and The Crater Lake Hydroelectric Project currently under development. The comparison shares lessons learned in developing the first project and applied to development of the current project to more fully meet the needs of Cordova, Alaska.

CAPACITY-BUILDING FOR SUSTAINABLE ENERGY ACCESS IN REMOTE LOCATIONS: COMMON CHALLENGES AND INTERNATIONAL OPPORTUNITIES

Dr. Christopher LEN

PANEL: SUSTAINABLE DEVELOPMENT AND THE SOUTHEAST ASIAN EXPERIENCE

For this presentation, the speaker will compare the profiles of the Arctic and Southeast Asian regions. His main argument is that despite being geographically apart, and having very different climates, there is room for cooperation in terms of facilitating energy access in remote locations. In this presentation, the following key points will be elaborated: First, both the Arctic and Southeast Asia are undergoing Energy Transitions and face common challenges in providing energy to their respective remote (and often small) communities which are scattered across the region. In the Southeast Asian context, this is especially the case for island communities such as those in Indonesia and the Philippines as they are archipelagic. Second, technological advancements in the development of off-grid renewable and hybrid energy systems have a positive enabling effect for remote communities all over the world. However, these communities, including those in the Arctic and Southeast Asia face similar high barriers of entry in the deployment and maintenance of such off-grid systems due to a number of issues, namely, remoteness, harsh local conditions, the need for rugged systems, and the lack of skilled operators. Finally, the presenter will discuss a report based on an event held in Singapore in August 2016 titled, Energy Transitions and a Globalised Arctic: The Role of Science, Technology and Governance, where participants from both the Arctic and Southeast Asian energy research communities gathered to discuss technical collaboration and energy governance.

PARTICIPATION AS A PART OF BENEFIT SHARING ARRANGEMENTS IN KOMI REPUBLIC

Minna Pappila, Soili Nystén-Haarala, Ekaterina Britcyna

This article addresses Corporate Social Responsibility (CSR) model of benefit sharing observed in Komi Republic. Oil industry is vital for the economy of the Komi Republic. It also benefits the municipalities in the vicinity oil production in the form of benefit-sharing agreements between oil companies and local authorities. These agreements compose the most important part of the corporate social responsibility (CSR) of oil companies in the Komi Republic, and in general in Russia. Local people, however, rarely participate in formulating benefit-sharing agreements. In addition, most local people consider ecological sustainability the most important component of CSR as they suffer from constant oil leaks near oil drilling areas and along rivers and oil pipes. This paper demonstrates an exceptional case when Russian legislation and traditional Russian CSR practices guarantee very few participatory rights for the locals, yet the indigenous peoples' association Izviatas have managed

to conclude a new type of a benefit-sharing agreement with an oil company, Lukoil-Komi. In addition to traditional social benefits, the company agreed to consult the communities on new projects and to inform the locals about oil leaks, e.g. this new type of benefit sharing arrangement incorporates elements of environmental justice.

GLOBAL STANDARDS AND BENEFIT SHARING IN THE RUSSIAN NORTH

Svetlana Tulaeva and Maria Tysiachniouk

This presentation is devoted to two models of benefit sharing between the oil companies and indigenous peoples in Russia, e.g. paternalistic and partnership. They are based on various tools and techniques of governance, some of which were formed in Soviet times and others were borrowed from international practice. The paternalistic type was formed in the Soviet times and assumes the strong involvement of state authorities. The second type – partnership was promoted by international organizations (UN with it ILO convention, World Bank, International Finance Corporation, the Arctic Council and others) and suggests high participation in decision-making of recipients of benefits—indigenous peoples. Which models of interaction are most effective in the Russian North? How existing models affect the well-being of local communities and indigenous peoples? What factors influence formation of these models? This study contributes to development of private policies of benefit sharing and suggests balance between traditional techniques and more flexible, negotiated approaches to benefit sharing.

PROPOSED PRESENTATION 1: ENERGY AND COST OPTIMIZATION OF RESIDENTIAL CONSTRUCTION IN CANADA'S NORTH

(delivered by Julia Purdy) NATURAL RESOURCES CANADA/ Ressources naturelles Canada
CanmetENERGY - Ottawa 2017-02-21

To achieve the goal of reducing diesel dependence in Canada's North, communities need cost-effective approaches to address their residential heating and electrical loads. In support of more efficient northern housing, NRCan-CanmetENERGY recently collaborated with two territorial housing corporations to examine energy efficiency in new construction and retrofit. We partnered with the Yukon Government to identify cost-effective approaches to improve the energy efficiency of new construction. We examined various building component and assembly combinations for an archetype home using our Housing Technology Assessment Platform (H-TAP). H-TAP uses computer optimization to search for cost-effective combinations of technologies to reduce home energy use. These combinations included over 20,000 whole-home combinations of upgraded walls, windows, attics, and mechanical systems. Our analysis also incorporated material and labour costs as well as utility rates. In the second project, we partnered with the Northwest Territories Housing Corporation (NWTHC) and Canada Mortgage and Housing Corporation (CMHC) to identify cost-effective energy retrofit options for houses within the NWTHC social housing stock. We used H-TAP to study energy use in two different housing archetypes, with retrofit options and cost data supplied by NWTHC. In this study, 48,000 retrofit combinations were simulated and analyzed. Energy use and upgrade costs were compared to the base case homes. Based on findings from our optimization exercises, a series of practical guidelines were developed to illustrate how builders can replicate energy and cost optimized construction designs.

ARCTIC INDIGENOUS VOICES ON OIL DEVELOPMENT

Brandon Ray
Henry M. Jackson School of International Studies and School of Marine and Environmental Affairs, University of Washington

The Intergovernmental Panel on Climate Change has shown that the rate of climate change in the Arctic far exceeds the global rate, impacting northern communities, and that the release of carbon dioxide from fossil fuels is largely the cause of recent warming. In terms of international approaches to this issue, the 2016 U.S.-Canada Joint Statement on Climate, Energy, and Arctic Leadership is explicit in its goals to "anchor economic growth in clean development" and to incorporate indigenous perspectives into its climate change decision-making. A similar statement between the U.S. and Nordic countries was released shortly after. Although scientific and political inertia are present, local indigenous communities are not in agreement on this economic transition. As Northern economies are largely dependent on the oil and gas sector, the transition to clean development represents a large paradigm shift for the North. This presentation examines indigenous perceptions of the oil/gas sector, using case studies from the five nations bordering the Arctic Ocean. These perspectives are drawn from media (e.g., newspapers, organizational statements) to represent the public discourse surrounding this conflict. By examining perspectives, the discourse illuminates several socially feasible options to pursue to ease the transition from one regime to another.

OIL SPILL PREPAREDNESS AND RESPONSE: THE SINGAPORE EXPERIENCE

Capt M SEGAR

PANEL: SUSTAINABLE DEVELOPMENT AND THE SOUTHEAST ASIAN EXPERIENCE

The Port of Singapore itself is one of the world's busiest ports with more than 140,000 ships calling annually and more than 1,000 vessels in her waters at any one time. Singapore is also one of the major oil-refining centres and petrochemical hubs in the world, which in turn has been a catalyst for developing Singapore into the world's busiest marine bunkering hub. In 2016, more than 48 million tons of bunker were lifted from Singapore. The heavy marine traffic and high volume of oil moving in and out of the port makes Singapore not only vulnerable but also sensitive to pollution from oil spills. To minimise disruptions to shipping and port activities as well as other uses of the coastal and marine environment and their consequential economic and/or social impact, it is important for Singapore to be prepared to respond to oil spills effectively and expeditiously.

This presentation describes Singapore's strategies and experience in oil pollution preparedness and response and highlights pragmatic tools and processes developed for that purpose. In addition, it discusses various cooperative mechanisms that Singapore has with neighbouring States, as well as with other ASEAN member States, and will offer some observations for cross-learning and exchange of best practices with the Arctic States.

FOSSIL FUELS SUBSIDIES AND COMPETITIVENESS OF RENEWABLE ENERGY INVESTMENT IN THE TERRITORY OF NUNAVUT, CANADA

Farid Sharifi, Senior Specialist,
Renewable Energy, WWF – Canada

WWF-Canada commissioned The International Institute for Sustainable Development (IISD) to undertake analysis to quantify fossil fuels subsidies in Nunavut. Fossil fuel subsidy data is not readily available to fully disaggregate and account for the different types of subsidy programs across the territory, despite the existence of information concerning the processes and programs.

Based on Nunavut's Energy Secretariat recent estimates, the Government of Nunavut spent approximately $195 million to import fossil fuels in the territory in 2012-2013. Nunavut is highly dependent on the purchase and subsequent bulk storage of fuel, in part because 100 per cent of the electricity generated in the territory comes from diesel.

IISD also estimates the impact of carbon pricing and renewables on electricity costs in five communities in Nunavut under the following scenarios: 100% diesel electricity without a price on carbon; 100% diesel electricity with a price on carbon of $50 per ton; Renewable electricity and diesel without a price on carbon; Renewable electricity and diesel with a price on carbon of $50 per ton.

COPERNICUS CLIM4 ENERGY BIOENERGY PRODUCTION CONDITIONS INDICATOR

Mikko Strahlendorff,
Ilmatieteen laitos

Clim4Energy project is pilotting Energy related climate services for Europe. FMI is developing an indicator for BioEnergy related production conditions mainly based on analysing frozen soil depth conditions into the future. Seasonally frozen soil is an important means for transport and forestry related applications. The presentation will show the state of current abilities to predict changes in frozen soil depth both in 6 months ahead seasonal weather predictions and in climate predictions until 2100.

As Finnish Delegate to the EU Copernicus Committee, Group on Earth Observation Executive Committee Member and as a Member to the Sustaining Arctic Observing Networks I could represent in the Panel both the opportunities of satellite based EO observations as well as the current state of intergovernmental collaboration to improve Arctic Observing Systems.

ADVANCED BIOETHANOL AND WIND POWER IN THE NORDIC REGION

Jari Suominen
CEO, St1 Renewable Energy Oy

St1's vision is to be the leading producer and seller of CO2-aware energy. The company has chosen three main methods for producing clean energy: advanced ethanol for transportation, wind power for electricity, and geothermal heat pumps for heating.

St1 produces the cleanest transportation fuel bio-component in the world when comparing life cycle emissions thanks to its unique biowaste-based production technology. Strong continuous R&D investment in cellulosic-based waste and residues will further multiply ethanol production in the future. St1 has committed to only producing ethanol from feedstock outside the food chain.

In the power sector, TuuliWatti, a joint venture between St1 and S Group, has just completed a € 650 million investment programme in Finland. After completing the first programme, the natural next step is to expand the operations to other Nordic countries and to Arctic wind power in particular.

Wind is one of the main production methods of a carbon free power system. The wind conditions of the northern parts of Scandinavia are extremely good, making the region an obvious location for extensive wind power production. The wind power potential of Finnmark county alone is estimated to be over 163 TWh per year, which is almost twice the annual power consumption of Finland.

While Arctic wind power is a Nordic strength, its wider utilisation calls for new kind of thinking and cooperation between the Nordic countries. Cross-border cooperation is needed in grid construction transmit the power from wind farms to consumers.

A similar transnational approach can be used to reduce the carbon footprint the transport sector cost-effectively. Arctic cross-border harmonization of policies and measures to replace fossil fuels with renewable alternatives would make the region an attractive investment environment and lower the cost of emission reductions due to economies of scale. With active cooperation, the Nordic region can provide clean energy to all of Europe.

TYPES OF BENEFIT SHARING ARRANGEMENTS IN THE RUSSIAN NORTH AND ALASKA

Maria Tysiachniouk

Oil extraction in remote territories of the Russian North and Alaska on the one hand brings opportunities for development to remote areas and on the other hand, costs to local communities and indigenous peoples, affecting their subsistance way of life and extracting land from traditional resource use. In many cases it is apparent that the costs of resource extraction to local communities outrage the benefits. Most transnational corporations in the Arctic oil and gas sector have declared their commitment to benefit-sharing arrangements that assist Indigenous communities and protect Indigenous

rights to land and access to traditional resources, but the local implementation of these commitments is different. Differences in benefit sharing arrangements depend upon legislation, local and regional contexts and the level of empowerment of indigenous communities. Benefits from oil extraction can be shared by oil companies with local communities in a number of ways: taxes, development of infrastructure, local employment, and through less formal negotiated benefits, such as sponsorship, compensation for damage, oil dividends, socioeconomic agreements, etc. Ideally, the concept of benefit sharing have to incorporate both procedural and distributional justice that go beyond compensations for loss.

Through literature review, several models of benefit-sharing arrangements have been identified, e.g. paternalism, corporate social responsibility, partnership and shareholder types. Field research showed mixed types of benefit sharing arrangements in both Russian North and Alaska, resulting in different outcomes for local communities and Indigenous peoples. This issue analyze benefit sharing arrangements observed in Nenets Autonomous Okrug, Komi Republic, Yamalo-Nentsk Autonomous okrug, Irkutskaya oblast and on the North Slope of Alaska (Barrow, Nuiqsut, Kaktovik).

Articles in this issue demonstrate that indigenous people in all research sites become dependent on oil money and experience significant impacts from oil extraction on their subsistence lifestyle and culture, benefits from oil extraction are highly variable . The issue contributes to policy the development of benefit sharing policy for the Arctic. We urge the Arctic Council Sustainable Development Working Group to conduct a study with the aim of finding best practices, reproduction of lessons learned, and development of guidelines for companies on benefit-sharing arrangements.

Therefore development of the benefit sharing policy for Arctic regions is essential. It is important that the extractive industries share a portion derived from the resource extraction with native inhabitants in an equitable way. Ideally, the concept of benefit sharing have to incorporate both procedural and distributional justice that go beyond compensations for loss.

AN ASSESSMENT OF THE CURRENT STATE OF O&M DELIVERY IN ALASKA RURAL COMMUNITIES

Steve Theno, PE
Past Principal
PDC Inc. Engineers

The vision for the developing Arctic is to leverage the opportunities to build sustainable communities. Sustainability would include, among other things; stable economic opportunity, an elevated standard of living and the ability to interact with the global community.

Keys to achieving sustainable communities must include, among other things; affordable energy costs; reliable, efficient utilities infrastructure, and the integration of renewable energy technologies. While the trusted paradigm for the built environment in remote cold regions, "keep it simple", will continue to be good advice, new development and new systems supporting sustainable communities will inevitable benefit from the implementation of leading edge technologies. Indeed, it is the technology advancements that offer the opportunity for successful implementation and integration of renewable energies and the establishment of reliably performing, cost effective infrastructure.

To realize the maximum potential and long term benefit of the leading edge systems and technologies, a robust, responsive and technically qualified operations and maintenance delivery system will be essential, something that has been a challenge for remote rural communities historically.

This paper will explore and assess the current state of operations and maintenance delivery in remote, rural Alaska communities. It will use a combination of literature research and case studies of prominent public agencies, institutions, organizations and private sector entities with facilities in remote rural Alaska communities. It is anticipated that this paper will lay the foundation for a follow on study to evaluate operations and maintenance delivery alternatives and recommend either possible methodologies, best practices, or both.

ENERGY SELF-SUFFICIENCY IN THE ARCTIC SCANDINAVIA

CEO Leena Vuotovesi and
Chief Energy Engineer Heidi Takalo,
Micropolis Ltd

Utilizing the regional potential of the renewable energies it is possible to reach the sustainably energy self-sufficient Arctic. The usage of renewables including bioenergy, solar and wind energy, heat pumps as well as hybrid solutions, impacts on the regional economics, employment and environment. Case Ii shows results of the ambitious work towards carbon-neutral society that has enabled cost-efficiency, cut down the emissions and welcomed jobs and investments in the region – and raised Ii to the forerunner of emission cuts in Finland. Piloting, calculating, modeling and engaging is the direction on the way to the success. Sustainable model towards the regional development of energy self-sufficiency is the collaboration within the local research institutes and development companies. The case *Arctic Energy* reveals strengths and possibilities of the Arctic collaboration.

The publication of seven energy self-sufficient pilot regions in Norway, Sweden and Finland takes place in the presentation.

FULL-SCALE CCS IN NORWAY

Gassnova is working to establish what can become Europe's first industrial CCS project. The project will show that CCS is feasible and safe.

This can pave the way for the implementation of this completely necessary climate solution in Europe and the rest of the world.

The feasibility study from July 2016 shows that CO_2 capture is technically feasible at three industrial emission sites in Norway: at Norcem's cement factory in Brevik, at Yara's ammonia factory

in Porsgrunn and at the energy recovery plant at Klemetsrud. All three of these sites are currently conducting concept studies. They are planning to transport CO_2 by ships from the point of emission to an onshore facility connected to the storage facility. The CO_2 will be stored in the Smeaheia area east of the Troll Field in the North Sea.

The feasibility study estimates that the planning and investment costs for a full-scale CO_2 management chain will range from NOK 7.2 to 12.6 billion (excl. VAT). The planning and investment costs will depend, among other things, on how much CO_2 is to be captured, where it is to be captured from, and how many transport ships are required. The annual operating costs vary from NOK 350 to NOK 890 million. The estimates are based on a confidence level of +/- 40 per cent.

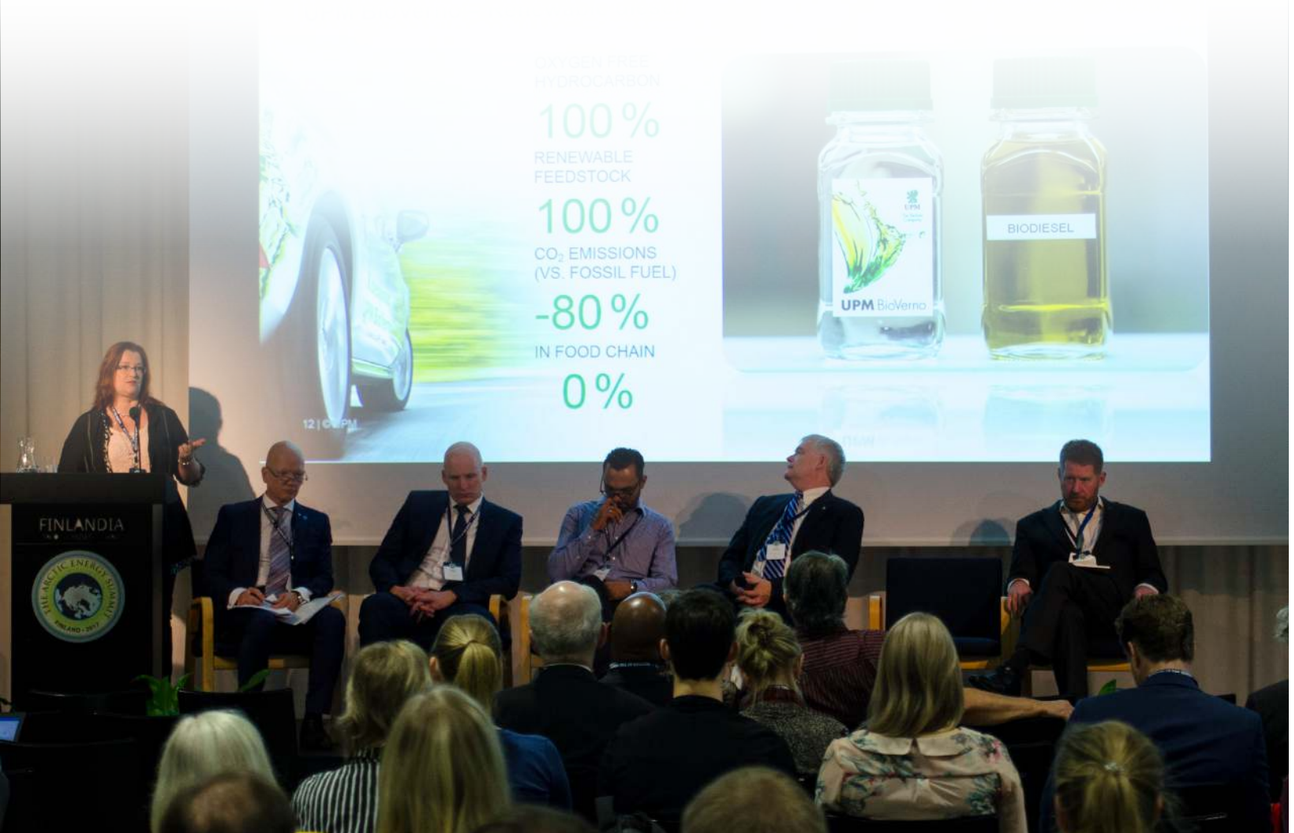
The basis for an investment decision (DG3) for capture, transport and storage should be ready by the autumn of 2018, so that the Storting can make an investment decision in the spring of 2019. The facility can then be commissioned according to plan in 2022.

REGULATORY GAPS IN OFFSHORE ACTIVITIES IN THE ARCTIC: CONCERNS AND LESSONS FROM SOUTHEAST ASIA

Dr. SUN Zhen

PANEL: SUSTAINABLE DEVELOPMENT AND THE SOUTHEAST ASIAN EXPERIENCE

The continuing retreat of the sea ice has increased the accessibility of the hydrocarbon resources in the Arctic Ocean. The prospect of the offshore activities presents increased demands on the existing legal and regulatory structures challenged to meet the needs for enhanced marine safety and environmental protection. Drawing from the experience from Southeast Asia, in particular, the 2009 Montara oil spill incident, there are several regulatory gaps require closer examination. First, there are no global rules, standards and recommended practices and procedures established to prevent, reduce and control pollution of the marine environment from seabed activities subject to national jurisdiction. In most parts of the world there are also no regional rules, standards and recommended practices and procedures. Second, there is no liability and compensation scheme established for damage caused by oil pollution from offshore installations. Third, should the Arctic States develop a regional oil spill contingency plan to combat pollution from offshore activities? The Arctic States need to consider whether to develop further binding regional rules and standards for offshore oil and gas activities during planning, exploration, development, production and emergency responses. This is to



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