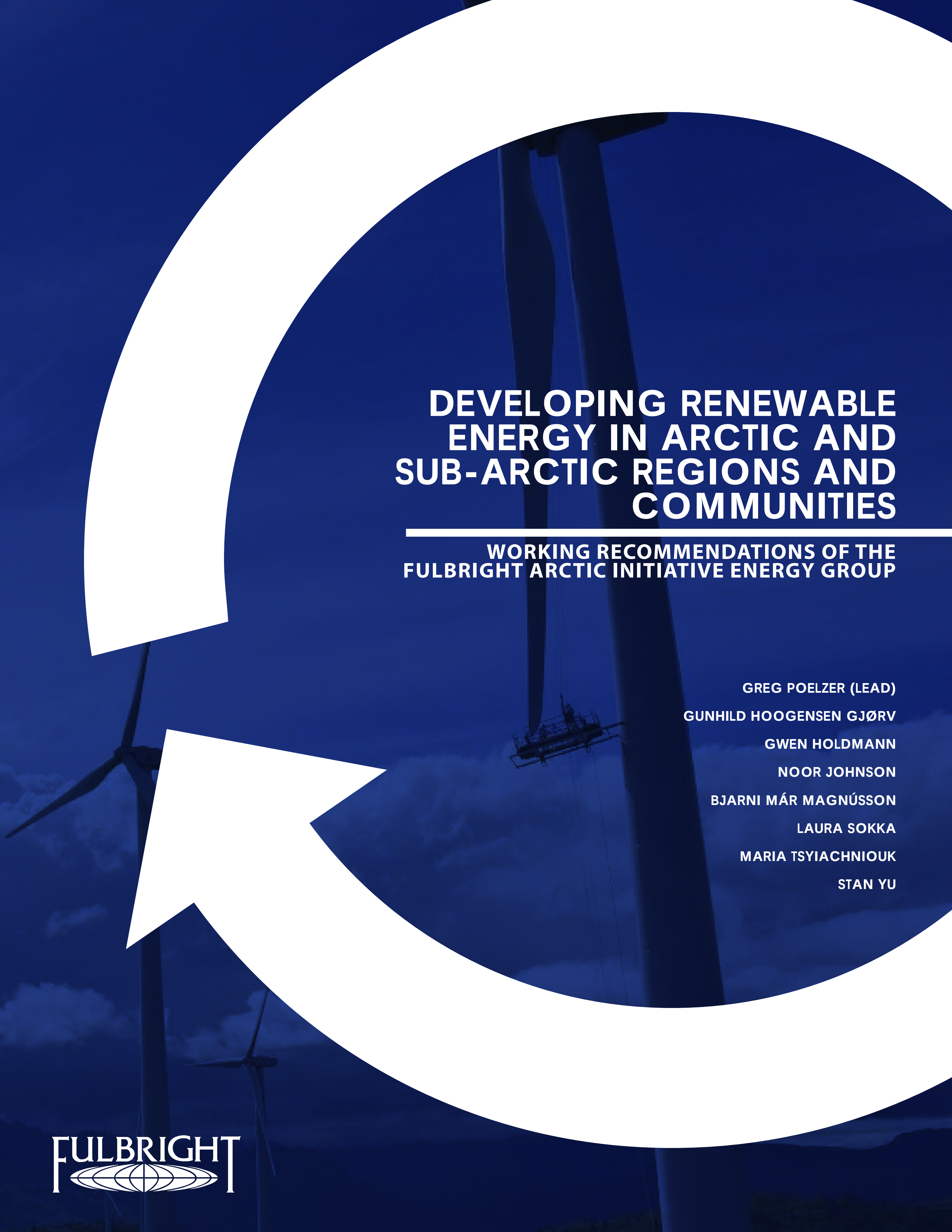


DEVELOPING RENEWABLE ENERGY IN ARCTIC AND SUB-ARCTIC REGIONS AND COMMUNITIES

WORKING RECOMMENDATIONS OF THE FULBRIGHT ARCTIC INITIATIVE ENERGY GROUP

GREG POELZER (LEAD)

GUNHILD HOOGENSEN GJØRV

GWEN HOLDMANN

NOOR JOHNSON

BJARNI MÁR MAGNÚSSON

LAURA SOKKA

MARIA TSYIACHNIOUK

STAN YU

FULBRIGHT

A Message from Lead Scholars

Dr. Ross Virgina and Dr. Mike Sfraga

The Arctic faces complex sustainability challenges that are critical to the social and economic well-being of its communities. There is a critical need for more interdisciplinary research designed to inform policy decisions in areas such as community health, energy development, environmental protection, climate change response, infrastructure, and governance.

The work presented here is an outcome of the Fulbright Arctic Initiative sponsored by the U.S. State Department's Bureau of Educational and Cultural Affairs. This initiative was created in 2015 to initiate new research broadly supportive of the U.S. Arctic Council Chairmanship (2015-17) priorities in the focal areas of improving economic and living conditions for Arctic communities; Arctic Ocean safety, security and stewardship; and addressing the impacts of climate change. The Fulbright Arctic Initiative brings together 19 scholars in diverse fields from the 8 Arctic nations to work on individual research projects and in teams on energy, water, health, and infrastructure problems. The scholars were organized into thematic research teams with the goal of creating interdisciplinary dialog and diversifying international perspectives on solutions to pan-Arctic problems.

The research of the Energy Group focuses on understanding the impacts of extractive industries and the transition to renewable energy in the Arctic. The tensions between economic, energy, and environmental security continue to be central to the future development of energy resources in the Arctic, and continue to make the transition to renewables difficult. The Energy Group drew upon respective national perspectives, comparative research exchange experiences, the literature, as well as each scholar's past research and diverse disciplinary strengths, to collaboratively identify a set of significant policy recommendations to support the development and deployment of renewable energy in the Arctic and Sub-Arctic regions. The primary goal of these recommendations is for the Arctic Council to consider establishing guidelines to facilitate the development of renewable energy in Northern areas.

The Fulbright Program was established in 1946 "to increase mutual understanding between the people of the United States and the people of other countries." The work produced by the Fulbright Arctic Initiative demonstrates the power of international cooperation and interdisciplinary collaboration to create policy relevant research to solve problems facing the Arctic and the world.

Ross A. Virginia is the Myers Family professor of environmental science in the Environmental Studies Program and director of the Institute of Arctic Studies at Dartmouth College in Hanover, NH, USA. He is co-lead scholar of the Fulbright Arctic Initiative and co-director of the University of the Arctic Institute for Arctic Policy.

Michael Sfraga is Vice Chancellor for University and Student Advancement and professor of arctic policy in the School of Natural Resources and Extension at the University of Alaska Fairbanks, USA. He is co-lead scholar of the Fulbright Arctic Initiative and co-director of the University of the Arctic Institute for Arctic Policy.

FOREWARD

The Arctic and sub-Arctic regions of our planet are at the front lines of climate change; these regions are also leading the way in providing solutions to this shared global challenge. It should come as no surprise that the 2015 Conference on Global Leadership in the Arctic: Cooperation, Innovation, Engagement and Resilience (GLACIER), along with Pope Francis' Encyclical on climate change, proved to be an historic moment that helped set the stage for the success of the 2015 Conference of the Parties (COP21) meetings in Paris. That the United States chose to host the GLACIER meetings in Anchorage, Alaska, was no accident: climate change affects the Arctic hardest. The real message at GLACIER, however, was global. U.S. Secretary of State John Kerry identified the need "to factor carbon dioxide and its cost into the actual accounting of business and of our economies." And he emphasized, "Energy policy is the solution to climate change."

In 2015, a truly world-wide consensus emerged among governments, communities, and the private sector for the need to accelerate investment in renewable energy. The energy sector alone accounts for more than two thirds of global greenhouse gas emissions;[1] renewable energy (including hydroelectricity, bioenergy, wind power, solar, geothermal, and ocean energy) and microgrids (localized grids that can disconnect from the traditional grid to operate autonomously) can deliver half of all emission reductions needed to meet global targets.[2]

In this regard, the Arctic and sub-Arctic regions must play a leading role in providing energy policy solutions, especially through renewable energy. Both the "U.S.-Canada Joint Statement on Climate, Energy, and Arctic Leadership" (March 10, 2016) and the Joint Communication to the European Parliament and the Council, "An Integrated European Union policy for the Arctic," (April 27, 2016) recognize the critical role of Arctic and sub-Arctic regions in this effort.

However, renewable energy development across the Circumpolar North is highly variable, with much greater deployment in the Nordic countries. Norway, for, example uses renewable energy for about 40-50% of its total primary energy production and almost 100% of its electricity.[3] Meanwhile, in Canada, for instance, there are more than 175 off-grid communities that generate electricity using diesel-fuel generators as part of their energy mix; 140 of these communities rely solely on diesel.[4] Approximately 100,000 people live in these communities, where the average unsubsidized price for electricity can be as high as $1.14/kWh, considering communities as far north as Nunavut.[5] Greenland, Russia, and Alaska face parallel challenges, though Alaska has been a pioneer in renewable energy deployment in remote communities.

Our report, "Developing Renewable Energy in Arctic and Sub-Arctic Regions and Communities: Working Recommendations of the Fulbright Arctic Initiative Energy Group," draws on the expertise of scholars from around the Arctic, including Canada, Finland, Iceland, Norway, Russia, and the United States and from different disciplines engineering, environmental science, law, political science, anthropology to provide a set of recommendations to advance the deployment of renewable energy in Arctic and sub-Arctic regions. We strongly believe that these recommendations could serve as the basis for the development of Arctic Council guidelines on renewable energy that could foster greater cooperation in the Arctic to reduce barriers, increase opportunities, and even develop a global export market driven by the collective experience of the Arctic and sub-Arctic regions and the vibrant communities that give life to the region. The recommendations are based on more than 100 years of collective research and field work in Arctic and sub-Arctic communities, including extensive work in the energy sector. We have titled the recommendations, "working recommendations," as these are but a first step, as continue to work with communities, governments, utilities, Indigenous organizations, and engineering firms who have a shared interest in facilitating the development of renewable energy across the Circumpolar North and indeed globally.

The Energy Group Scholars of the Fulbright Arctic Initiative wish to extend an enormous thank you to Fulbright, Fulbright Canada, Fulbright Finland, and Fulbright Iceland for their generous support in our work. We would also like to acknowledge a debt of gratitude to the International Centre for Northern Governance and Development and the School of Environment and Sustainability, both at the University of Saskatchewan, Canada, for funding much of the work that produced this report. We would also like to extend a debt of gratitude to the Alaska Center for Energy and Power and the University of Alaska Fairbanks for their financial and in-kind support in research that contributed directly to this report. We would like to recognize the contributions of our research assistants and graduate students Melanie Plante, Mariia Iakovleva, and Petr Barnovsky for their contributions. Finally, we wish to acknowledge Stan Yu for his contributions to the writing, editing, and coordinating of this document.

Greg Poelzer
Lead, Energy Group, Fulbright Arctic Initiative
Professor, School of Environment and Sustainability
University of Saskatchewan
Saskatoon, Canada

TABLE OF CONTENTS

Executive Summary **1**

Introduction **7**

Addressing Barriers **11**

Recommendation #1:
Have processes to actively engage communities in the earliest stages of project planning and development. 11

Recommendation #2:
Create a transparent information-sharing system on energy costs and subsidies 14

Recommendation #3:
Conduct an assessment of existing energy policies, subsidies, and institutional structures to identify potential barriers to adoption of renewable energy systems and energy efficiency measures, and develop mitigating strategies. 17

Local-Level Renewable Development **21**

Recommendation #4:
Recommendation #4: Create opportunities for knowledge sharing and development of core competencies at the local level in the renewable energy sector 21

Recommendation #5:
Recommendation #5: Facilitate regional cooperation opportunities 23

Recommendation #6:
Develop parallel strategies to support complementary industries (e.g., biomass supporting forestry industry) 26

Recommendation #7:
Provide supports for communities in the event of failures to the power system. . 29

Capital Development 33

Recommendation # 8:
Explore using an early stage renewable energy fund to support the high-risk, early stages of project development.. 33

Recommendation #9:
Facilitate equity ownership opportunities for northern communities. 35

Recommendation #10:
Develop better access to capital at multiple scales 38

Research, Development and Export 41

Recommendation #11:
Establish funds for emerging technologies to incentivize investment in next-generation energy projects. 41

Recommendation #12:
Promote certification standards for renewable energy technology used in the Arctic. 43

Recommendation #13:
Cultivate opportunities for knowledge export. 45

Annex A: Pan-arctic Circumpolar Off-grid Settlements 49

Annex B: Glossary. 51

Annex C: Endnotes 57

Annex D: Authors Biographies. 63

EXECUTIVE SUMMARY

Following the Conference on Global Leadership in the Arctic: Cooperation, Innovation, Engagement and Resilience (GLACIER) and the 2015 Conference of the Parties (COP21) meetings, a global consensus has emerged among governments, communities, and the private sector for the need to accelerate investment in renewable energy. The energy sector alone accounts for more than two-thirds of global greenhouse gas emissions. Renewable energy (including hydroelectricity, bioenergy, wind power, solar, geothermal, and ocean energy) and microgrids (localized grids that can disconnect from the traditional grid to operate autonomously) can deliver half of all emission reductions needed to meet global targets. The recent U.S.-Canada Joint Statement on Climate, Energy, and Arctic Leadership (March 10, 2016) recognizes, for instance, the critical role of Arctic and sub-Arctic regions in this effort.

Investment in the renewable energy sector provides an enormous opportunity for Arctic communities to create new economic and business opportunities to address local energy needs, increase quality of life and overall human security, and meet national and subnational emission goals. Though Arctic communities have shown strong interest in participating in renewable energy development, many of these communities have experienced and continue to experience salient challenges, including: (1) human capacity development to manage renewable energy deployment at the community level; (2) financial capital to invest in renewables at the local level; (3) legal issues to enable net metering and/or Power Purchase Agreements with local and tribal governments; (4) technical challenges for deployment of renewables in islanded, micro-grid communities; and (5) technological issues related to the intermittent nature of renewable energy.

The development of renewable energy in the Arctic would be significantly strengthened through the creation of guidelines under the auspices of the Arctic Council (AC). To chart a path forward, this document outlines thirteen recommendations for consideration in the development of the guidelines.

In particular, the Arctic Council Renewable Energy Guidelines would identify principles and best practices, to ***address barriers*** to developing renewable energy in northern areas:

- Have processes to actively engage communities in the earliest stages of project planning and development
- Create a transparent information-sharing system on energy costs and subsidies
- Conduct an assessment of existing energy policies, subsidies, and institutional structures to identify potential barriers to adoption of renewable energy systems and energy efficiency measures, and develop mitigating strategies

Furthermore, the Guidelines would, encourage ***Local-Level Renewable*** Development for northern regions and communities:

- Create opportunities for knowledge sharing and development of core competencies at the local level in the renewable energy sector
- Facilitate regional cooperation opportunities
- Develop parallel strategies to support complementary industries (e.g., biomass supporting forestry industry)
- Provide supports for communities in the event of failures to the power system

The Guidelines would facilitate ***capital development*** opportunities in the renewable energy sector for northern regions and communities:

- Explore using an early stage renewable energy fund to support the high-risk, early stages of project development
- Facilitate equity ownership opportunities for northern communities
- Develop better access to capital at multiple scales

Finally, the Guidelines would support the investment in ***Research, Development and Export***:

- Establish funds for emerging technologies to incentivize investment in next-generation energy projects
- Promote certification standards for renewable energy technology used in the Arctic
- Cultivate opportunities for knowledge export

The Guidelines would define a set of recommended practices and outline strategic actions for consideration by those responsible for regulation of renewable energy in the Arctic. The goal is to assist government and regional authorities, local communities, and the private sector in developing standards, which would be applied consistently by all involved in renewable energy development in the Arctic. While the Guidelines are nonbinding in nature, they are intended to encourage the development of standards appropriate to local, environmental, and cultural contexts in northern regions. The Guidelines are not intended to preclude states from setting equivalent or stricter standards, where appropriate.

INTRODUCTION

Investment in the renewable energy sector provides an enormous opportunity for Arctic communities to create new economic and business opportunities to address local energy security needs, increase quality of life and human security in the Arctic,[6] as well as meet national and subnational emission goals.

Though Arctic communities have shown strong interest in participating in the development of renewable energy to benefit their communities and becoming power producers, many communities have experienced and continue to experience many challenges, including human capacity development to manage renewable energy deployment at the community level; financial capital to invest in renewables at the local level; legal and jurisdictional issues to enable net metering and/or Power Purchase Agreements with local and tribal governments; technical challenges for deployment of renewables in islanded, micro-grid communities; and technological issues related to the intermittent nature of renewable energy.

The development of renewable energy in the Arctic would be significantly strengthened by the creation of guidelines under the auspices of the Arctic Council (AC). The development of these guidelines would require the guidance of the Senior Arctic Officials (SAOs) and Permanent Participants (PPs) and include the input of the Sustainable Development Working Group (SDWG) and Arctic Economic Council. The Arctic Offshore Oil and Gas Guidelines drafted by the Protection of the Arctic Marine Environment Working Group (PAME) provide both a precedent and an inspirational marker for the development of Arctic Council Renewable Energy Guidelines.

Existing principles of international environmental law that are found in treaties and nonbinding declarations or other instruments relevant to renewable energy can constitute the basis for these Guidelines, especially (1) the principle of sustainable development; (2) the duty to prevent and control environmental harm; (3) intergenerational equity; (4) the polluter-pays principle; and the precautionary principle. These well-known legal principles help form the basis for the promotion of renewable energy.

The Guidelines would define a set of recommended practices and outline strategic actions for consideration by those responsible for regulation of renewable energy in the Arctic. Arctic nations would then use the Guidelines for renewable energy activities during planning, assessment, development, and production to help secure common policy and practices. The goal is to assist government and regional authorities, Indigenous and local communities, and the private sector in developing standards, which would be applied consistently by all involved in renewable energy development in the Arctic. While the Guidelines are nonbinding in nature, they are intended to encourage the development of standards appropriate to local, environmental, and cultural contexts in northern regions. The Guidelines are not intended to preclude states from setting equivalent or stricter standards, where appropriate. If adopted, we further recommend that the Guidelines should undergo periodic review and amendment, as necessary, to take into consideration experiences in the management and control of renewable energy. The Guidelines must remain current if they are to support timely and effective measures for protection of the Arctic environment and for energy security reasons.[7] A meeting of experts could be held after the third anniversary of the adoption of the Guidelines to review and update them.

To chart a path forward, this document outlines thirteen recommendations for consideration in the development of the Guidelines. These recommendations can be categorized into four thematic areas: Addressing Barriers, Local-level Renewable Development, Capital Development, and Research, Development, and Export.

RECOMMENDATION #1:
HAVE PROCESSES TO ACTIVELY ENGAGE COMMUNITIES IN THE EARLIEST STAGES OF PROJECT PLANNING AND DEVELOPMENT

RATIONALE AND BACKGROUND

Renewable energy is power generated from the sun, wind, earth, biomass, and water. Converting these sources into usable forms of energy requires infrastructure that has its own environmental impacts. These impacts most acutely affect local residents, and as such, it is important to have meaningful early stage engagement with communities and comprehensive assessments of potential cultural, social, and environmental impacts prior to renewable energy development.

Early stage engagement is a process that provides space for community members to meaningfully offer feedback that informs decision-making and is acted upon by government and industry.[8] Historical and contemporary examples, such as the Alta Hydroelectric Power Station in Norway, have shown that a lack of early stage engagement with affected communities can lead to public opposition and conflict.[9] These examples suggest that early engagement and consultation and ongoing dialogue between proponents, the government, and potentially affected community members are particularly important. In addition to community engagement, the quality of the environmental impact assessment (EIA) is extremely important. Renewable energy production needs comprehensive EIA to ensure that the technologies chosen actually reduce GHG emissions, and that they do not lead to other adverse environmental impacts. We recommend the use of Strategic Environmental Assessment (SEA), which is a form of impact assessment that identifies and evaluates the potential impacts of policy, plans, and programs (PPPs).[10] Unlike other EIAs that are triggered once a project is proposed,[11] SEA is proactive and takes a medium- or long-term planning perspective. This allows decision-makers to consider cumulative effects and environmental and socioeconomic impacts, and propose alternatives before a significant capital investment is made.[12]

CURRENT EXAMPLES

The Tazi Twé Hydroelectric project in Northern Saskatchewan offers an example of a renewable energy development project that practiced ongoing and meaningful engagement with community members. Tazi Twé is a 50 MW proposed water diversion hydroelectric project that will be built on reserve land in Saskatchewan.

SaskPower, a state-owned electric utility company, and Black Lake First Nation began the process of engagement right from the start, leading to the development of a framework agreement that provides a 30 per cent ownership of the project for Black Lake First Nation, which is expected to generate $1.3 billion dollars CAD to the community over the project's 90-year life span. As well, the community will incur the least amount of financial risk in the development of the project. Finally, Tazi Twe is a "run-of-river" hydroelectric project, which will not involve the construction of a dam and thus, making the project less environmentally disruptive. In turn, this meaningful engagement, involvement of the community as partners and owners of the project, and proper impact assessment led to a successful vote by community members to support the project and partnership in 2015.

Public participation in the EIA processes has been studied in the Barents-Euro Arctic region (Norway, Sweden, Finland and Northwest Russia)[13]. Although the EIA legislation in Russia is based on general international standards and the Nordic countries is based in the EU EIA directive, the rationale for public participation are consistent in practice. In all of these countries, there are two points when the public can receive information of the planned project and give written comments or assert influence in the stakeholder meetings.

In all of the Nordic countries studied by Nenasheva et al., numerous additional meetings have been also been held and these are generally actively attended.[14] For example, the Finnish Kemijoki Oy, which produces hydropower in the Northern and Eastern Finland, has worked on actively maintaining good relations to its stakeholders. In the early 2000s, the company even presented two equally viable facility upgrade plans for the Valajaskoski power plant, of which the public was asked to choose which one to execute. In Russia, the situation is different. Companies rarely inform the public of new developments, even though they are legally required to do that, and conflicts between the companies and local people are common.[15]

NEXT STEPS:

Legal requirements for early stage engagement and SEA vary by country. For instance, in Canada, there is a distinct legal doctrine, called the "Duty to Consult", that mandates early stage engagement processes with Indigenous communities when activity could adversely impact Indigenous rights.[16] Within the EU, the use of SEA is mandated by Directive 2001/42/EC, which states that SEA has to be conducted for a wide range of public plans and programmes (e.g. on land use, transport, energy, waste, agriculture, etc.).

It is critical that any proposed renewable energy project embed processes for early community consultation and engagement, such as public meetings, informal coffee sessions, online communications (i.e. website, blog), telephone access (i.e. 1-800 number) and traditional media such as flyers, newspapers, and mail.[17] We acknowledge that the engagement process would differ depending on whether the renewable energy development is for local use vis-à-vis energy export. Generally, we suggest that these processes should be meaningful in that there should be opportunities for communities to veto or require significant alteration of proposed projects if they could damage existing cultural and economic practices. In addition to community engagement, the quality of the cultural, social, and environmental impact assessment is extremely important. Thus, it is critical that any impact assessment be undertaken prior to the development of a renewable energy project. These results of these efforts ultimately play important roles to determining the community's support for any future projects.

RECOMMENDATION #2:
CREATE A TRANSPARENT INFORMATION-SHARING SYSTEM ON ENERGY COSTS AND SUBSIDIES

RATIONALE AND BACKGROUND

A continuing hurdle in supporting the development of renewable energy is the lack of publicized data on energy, energy costs, energy consumption, utility rates, and energy subsidies. This information is especially lacking for Indigenous, Northern, and Remote communities. While publicly accessible international data on renewable and non-renewable energy do exist,[18] access to current and historical data regarding non-fuel costs (management, distribution system, etc.) and government subsidies of power production in the North is inconsistent across Arctic states. This information void makes it difficult for investors, researchers, and the public to understand how energy costs compare across the Circumpolar Arctic. A better and more accessible baseline data on true energy costs (fuel, non-fuel, and subsidies) would help address many of the challenges in developing renewable energy in the Arctic, including identifying economic opportunities, obtaining financial capital to invest in renewables at the local level, empowering communities in negotiation processes, and understanding and addressing the technological challenges of producing power in the Arctic.[19] For instance, a consistent argument for the development of renewables in Indigenous, Northern, and Remote communities is the high cost and inefficiency of diesel generating stations.[20] However, in many cases, the true cost of diesel power production is poorly documented and cannot be easily calculated.[21] Comprehensive databases, such as Alaska's Alaska Energy Data Gateway (AEDG), would allow residents to better understand the components of the cost structure, the investment each respective government is making to offset high-energy costs, and where these subsidies are being applied, and how their energy costs compare to other similar communities in the Circumpolar Arctic. For potential investors, including the communities themselves, this would facilitate first-hand analyses to understand where opportunities for investment in renewable energy systems potentially exist.

CURRENT EXAMPLES

The AEDG offers a prime example of accessible data sharing that facilitates the development of renewable energy in the North. The AEDG is a comprehensive online database that includes information from small remote communities and larger urban centers, as well as power generating facilities. The AEDG's 'Community Data Summaries' includes basic geographic information such as population size and employment figures, as well as detailed information on fuel prices, fuel consumption, utility rates, subsidy costs, energy production, sales, revenue and number of customers. Historical data is also included. The AEDG also provides access to the Alaska Energy Statistic Publications and includes detailed information on funding programs such as the Power Cost Equalization program and the Renewable Energy Fund. The database is funded by the United States Department of Energy. This easy-to-navigate database assists decision-makers, communities, project developers and researchers to make evidence-informed decisions regarding development and efficient energy use. A database such as the AEDG would be useful to provide pertinent information related to renewable and non-renewable energy for current and prospective communities.

NEXT STEPS

We propose that a comprehensive online energy database, similar to the AEDG, be created to present data for communities in the Circumpolar countries. This database would be publicly accessible and its primary function would be to provide accurate and comparable information on renewable and non-renewable energy production, consumption, costs, subsidies, fuel types, and utility rates that is continuously maintained and updated. A further goal of collecting data is to track progress and trends within the Circumpolar energy sector over time.

In order to achieve comparable data across different countries, the format and form of data must be consistent. Therefore, we suggest the introduction of an annual "Energy Census" to Arctic countries, which entails a predetermined format of obtaining data for governments and industry to more simply respond to.

We acknowledge that accessing and compiling the needed data from industry and governments from different countries can be a challenge. However, in many cases the needed data is already being collected by governments, regional authorities, companies or international and national organizations. Thus, we suggest that a regulatory agreement between Circumpolar countries can be explored to obtain industry and government buy-in to provide their respective data on energy for the proposed database. To ensure that the database complies across the respective information and privacy laws of different Circumpolar countries, as well as to whether comparable data across countries can be obtained, some preliminary work will need to be completed. As far as possible, the data can be adjusted to the data already collected. We suggest that academic research centres that have demonstrated competency in the creation, maintenance, and outreach of databases can spearhead the work needed to create this database. Funding from governmental bodies would assist to incentivize the labour needed to undergo this project.

RECOMMENDATION #3:

CONDUCT AN ASSESSMENT OF EXISTING ENERGY POLICIES, SUBSIDIES, AND INSTITUTIONAL STRUCTURES TO IDENTIFY POTENTIAL BARRIERS TO ADOPTION OF RENEWABLE ENERGY SYSTEMS AND ENERGY EFFICIENCY MEASURES, AND DEVELOP MITIGATING STRATEGIES

RATIONALE AND BACKGROUND

To date, there have been markedly different experiences in the adoption of renewable energy and energy efficiency measures within the Circumpolar Arctic. There is similar diversity in national or regional policies, and in the institutional structures that either help or hinder clean energy development. While there are unique policy drivers in each jurisdiction, there may be opportunities to learn from the specific strategies or policy instruments that have been successful in another part of the Arctic. For example, policies or programs that have been successful in Alaska might be more applicable to Canada or Russia than to other places in the United States. In addition, an improved understanding of some of the crosscutting root causes that are common to multiple areas could create opportunities to collaborate on innovative solutions and may help inform future decision-making processes.

CURRENT EXAMPLES

For many remote Indigenous and Northern communities in Canada, existing regulatory, financial, and institutional structures inadvertently discourage renewable energy adoption by subsidizing status-quo energy systems – most of which are heavily reliant on diesel-based generation. As a result, communities or utilities often have little incentive to switch to renewables energy systems, which are both high in capital costs, and would reduce reliance on the fuels which are the basis for calculation of many subsidies. In Russia, remote regions are also subsidized for electricity and heating through cross-subsidization. Cross-subsidies entails subsidies in the power sector for residential users by establishing a high energy prices for large-scale industrial and commercial consumers. Through this cross-subsidization scheme, remote regions have less incentive to develop renewable energy; however, this cross-subsidization is slated to end in 2020. The completion of these subsidies will entail dramatic rises in electricity prices for individuals in remote regions. Therefore, this change in policy could lead to a dramatic increase in interest for renewable energy development in remote regions.[22] Meanwhile, in Alaska, subsidy and utility structures are quite different and seem to provide greater economic incentives to transition to renewables.

NEXT STEPS

We recommend that efforts can be taken to develop a comparative framework to examine national policies, subsidies, and institutions, so that governments can develop a better understanding of the larger spectrum of possible policy options in comparison to their own. We further propose the development of a report that outlines successful policy incentives for renewable energy development and presenting specific case studies or best practices of renewable energy development in Circumpolar countries that could be transferred to other jurisdictions. Ultimately, both deliverables would facilitate increased understanding of the policy enablers and barriers from different national contexts.

RECOMMENDATION #4:
CREATE OPPORTUNITIES FOR KNOWLEDGE SHARING AND DEVELOPMENT OF CORE COMPETENCIES AT THE LOCAL LEVEL IN THE RENEWABLE ENERGY SECTOR

RATIONALE AND BACKGROUND

Renewable energy projects are often most successful when the host communities are the main proponent of development, have a clear stake in the outcome, and have the capacity to play a key role in every phase of project development, from siting and design, to long-term operation and maintenance.[23] Providing avenues for acquiring the business, technical, and leadership skills required to manage and operate a project successfully is therefore essential, but developing this human capacity can be a significant challenge for communities across the Circumpolar North.

In addition, knowledge related to specific renewable energy technologies and their application in the Arctic is diffuse, and practical expertise relevant to a particular technology is often concentrated in a few specific regions. As the unique requirements associated with project development in northern areas with often harsh climate conditions are often not familiar to many practitioners from more temperate regions, mistakes are often made and frequently repeated in ways that can threaten the long-term viability of installed infrastructure.[24] Even where highly effective strategies are developed, this knowledge is rarely transmitted beyond the region or the national level. For example, Finland has developed a great deal of expertise in biomass combined heat and power systems that is potentially quite relevant to the North American sub-Arctic, and Alaska has developed specific expertise related to high penetration of variable renewable energy on isolated microgrids. In both cases, this specialized expertise is not broadly understood or easily accessible to others that could benefit from the knowledge. In short, knowledge transfer is occurring longitudinally, but not latitudinally on each continent.

A long-term strategy for facilitating knowledge transfer and exchange across the Circumpolar Arctic, through the development of a peer network of community leaders and practitioners, could significantly increase the capacity of local people to participate in the renewable energy sector, while simultaneously ensuring that lessons learned are transmitted more broadly.[25] This international program would complement any existing regional or national training and capacity-building programs that are tailored to the specific needs of a local population.

CURRENT EXAMPLES

An example of how an existing international knowledge sharing and training program has enhanced renewable energy development in underdeveloped areas of the world is Iceland's United Nations University Geothermal Training Program (UNU-GTP). As the result of expertise gained through the domestic development of its geothermal resources, Iceland has become recognized as a global leader in this niche technology area. The program is highly prestigious and most fellows are fully funded for their studies by the Icelandic government. Participants are specifically selected not only for their relevant background, but also because they are in a position to influence the future development of geothermal resources in their home country.[26] These fellows are encouraged to bring their own data or projects from their home country to work on with assigned mentors and instructors in Iceland during an intensive 6-month certificate-training program. This ensures the knowledge they acquire can be put to immediate practical use for their benefit, as well as their employer and home nation.

NEXT STEPS

The Arctic Remote Energy Networks Academy (ARENA), a pilot program, modeled after the UNU-GTP, has been developed through the Sustainable Energy Working Group of the Arctic Council. ARENA focuses on sharing knowledge and establishing professional networks related to microgrids and integration of renewable resources for remote Arctic communities. Preparations are underway for a pilot program in mid-2017, co-led by the United States, Canada, Iceland, Finland, and Gwich'in Council International.

The ARENA program includes a series of widely accessible web-based seminars providing introductory overviews of key Arctic energy topics, and in-person/in-field learning experiences in Alaska and Canada for approximately twenty individuals. These participants will be competitively selected from a multi-national pool of applicants, with an emphasis on the northern circumpolar region. Following on the examples of UNU-GTP and ARENA, we recommend exploring the development of other platforms for international knowledge sharing.

RECOMMENDATION #5:
FACILITATE REGIONAL COOPERATION OPPORTUNITIES

RATIONALE AND BACKGROUND

A continuing challenge for utility companies to participate in community-level renewable energy projects is the comparatively small proportion of energy they produce in comparison to large-scale energy projects.[27] In addition, local-level communities often do not have adequate human or fiscal resources to develop and manage power utilities.[28] In response, cooperation on a regional level may be a mechanism to enable Indigenous, Northern, and Remote communities to develop and operate renewable power production and distribution. However, cooperative arrangements may also be beneficial to larger-scale utility projects.

Different approaches can be utilized to facilitate regional cooperation. One approach is the development of renewable energy cooperatives. Renewable energy cooperatives can be defined as organizations that own and operate renewable energy facilities, and are jointly owned and democratically controlled by the people who use their services. Another approach is energy sharing, which involves the creation of a regional energy grid through consolidating the energy produced from multiple communities.[29] A third approach is clustering the development of renewables in communities, which entails a concentrated effort to create small-scale renewable energy projects for communities within an accessible distance of each other.

Using any of these approaches can help to address the aforementioned challenges. Even where communities have sufficient human and fiscal resources, the pooling of resources can lead to achieving greater efficiencies through economies of scale, developing capacity building programs to train personnel within the communities, strengthening purchasing power with vendors, and accessing more favorable lending rates from financial institutions.

CURRENT EXAMPLES

In terms of the co-operative model, the Alaska Village Electric Cooperative (AVEC) and the Inside Passage Electric Cooperative (IPEC) are examples of renewable energy cooperatives. For instance, AVEC was established in 1968 as a non-profit electric utility owned by the people it serves. AVEC operates in 56 communities throughout interior and western Alaska and its service area is the largest of any retail electric cooperative in the world. The smallest community, Pitkas Point, has only 125 people and the largest is Bethel (recently joined) with 6,000 people. In 2014, AVEC generated a total of 104,428 MWH and revenues of $53.8 million. Through funding received from the Denali Commission, Rural Utilities Service and the State of Alaska, AVEC has installed 34 wind turbines in eleven communities with interties to three other communities. In 2014, these wind turbines generated 4,268,565 kWh (net) and displaced an estimated 327,748 gallons of diesel fuel, saving $1,311,215 dollars in diesel generating costs.

In Finland, over 40% of the electricity production is operating with the so-called Mankala principle. The Mankala model is a special cost price model where an energy production company is owned together by a number of owners, who proportionally bear the costs of the production company.[30] The model is not based on any specific legislation but originates from case law. A Mankala company does not aim to make profit or pay dividends to its owners. Instead the owners benefit by using the product (electricity or heat) or by selling it forward. In a project based on the Mankala principle, companies or other actors can take on projects that would be too large for each of them to undertake separately. The model makes possible competitive production costs and facilitates large investments. It also promotes competition in that it enables more and smaller players to enter the market. Moreover, it facilitates energy producers to diversify their energy production sources. The model is unique to the Nordic energy markets. In addition to Finland, it is used in the Swedish nuclear industry.

Finally, an example of energy clustering can be found within the Republic of Sakha (Yakutia) in Russia, where upon completion of the solar power plant in Batagay settlement of Verkhoyanskiy district, a further decision was made to construct small-scale solar power plants in Betenkes and Stolby settlements of Verkhoyanskiy district. Since these communities were clustered closely together, the cost of construction, transportation, and logistics, as well as the time required for construction, was deemed to be cost-effective. In addition, operation of the solar power plants in the form of a single cluster can reduce maintenance costs and further supplies of basic equipment. Currently, RAO Energy Systems of the East is considering replicating this model in four clusters of settlements, including Cluster Deputatskiy – Ust'-Kuiga with installed capacity of 1400 kW in 2 settlements, Olekminskiy cluster: 940 kW in 9 settlements, cluster Zyryanka –

Ugol'noe: 1400 kW in 2 settlements, cluster Oymyakon – Kuidusun: 450 kW in 2 settlements.

NEXT STEPS

Governments can stimulate the development of regional renewable energy consortiums through allocated incentives. Providing opportunities for loans and grants where Indigenous, Northern, and Remote communities can jointly apply would encourage cooperation and partnership in renewable energy development. Extending the range of loans further provides flexibility for renewable energy development projects that can encompass the spectrum of community-level renewables to larger-scale renewables. Examples of funding sources that can be used for this purpose already exist in most or all of the Arctic Council member countries, such as the energy development finance program of the Alaska Industrial Development and Export Authority. Programs and instruments should be targeted specifically to support cooperation and partnerships of northern communities in renewable energy development.

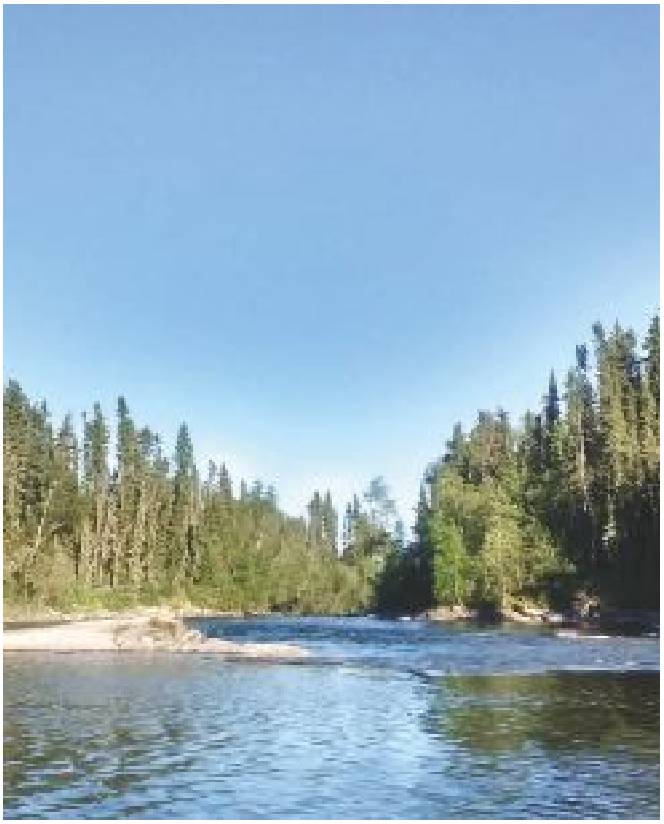
RECOMMENDATION # 6:
DEVELOP PARALLEL STRATEGIES TO SUPPORT COMPLEMENTARY INDUSTRIES (E.G., BIOMASS SUPPORTING FORESTRY INDUSTRY)

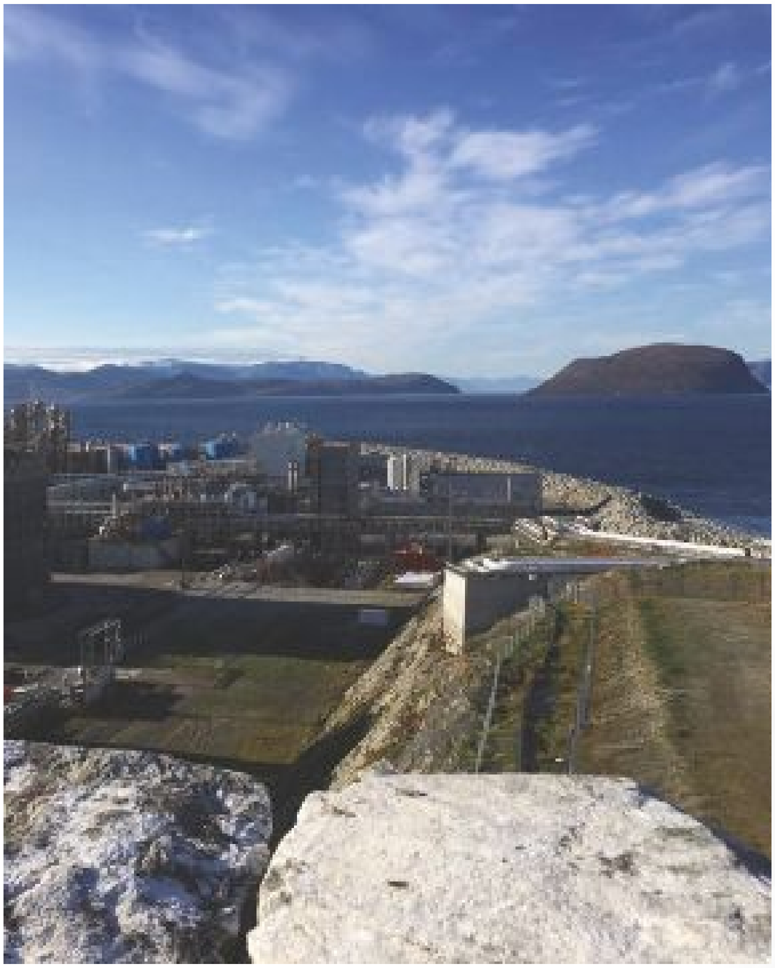
RATIONALE AND BACKGROUND

The most successful projects have taken into account not just energy needs, but economic development and sustainable resource utilization to ensure long-term sustainability, local pride, and ownership of systems. Development of complementary industries can lead to a win-win outcome for both sectors, thereby creating spillover impacts into other sectors. For example, it has been observed that regional industrial clusters can produce many types of externalities, such as knowledge, skills, and input-output linkages.[31] New regional industries may develop where a strong industrial cluster already exists. Of course, the best opportunities exist when pre-processing materials are available, most commonly related to biomass energy. However, other opportunities exist depending on the nature of the resource and local drivers. For instance, in Iceland, a great deal of emphasis has been placed on developing cascaded uses of geothermal to support additional industries and businesses, beyond just local heat and power. In particular, HS Orka Reykjanes Resource Park further provides a varied range of businesses, such as the Blue Lagoon, cosmetics manufacturers, biotechnology companies, and aquaculture, in addition to producing electricity and hot water.

CURRENT EXAMPLES

As Midtun and Koefoedpoint out in their analysis of the Finnish forest industry, the success of the Finnish bioenergy and CHP systems can at least partly be seen as a spin-off of the Finnish forest industry, which created a large enough home market for both energy technologies and fuels.[32] In the systems formed around forest industry, bioenergy is typically produced in the form of black liquor, and from the residues of the forest industry unit. Pulp and paper production units are usually combined with, for example, a power plant, chemical manufacturing plants, waste management facilities, and sewage treatment plants.[33] Often, a local town is involved in the system as well through supply of electricity and heat from the power plant.[34]





Thus, the Finnish forest industry has built optimised wood use cycles and integrates over many decades. The direct energy use of streams, like black liquor or bark, can be considered as reasonable in pulp and paper industry with highly developed facilities and increased self-sufficiency, and sometimes even a surplus in energy use. These residual streams are the most significant renewable energy source in Finland.

During the recent years, targets for biofuel use set in the EU have led to the integration of biofuel production in the pulp and paper mills, or the use of forest residues in liquid biofuel production. For example, in Lappeenranta, Southeastern Finland, in a biorefinery situated next to the UPM Kaukaa pulp and paper mill, biodiesel is produced mainly out of liquid process residues, such as pine oil, black liquor, and tar. The plant produces about 100,000 tons biodiesel per year.

Similar examples can be found in other countries as well. On a smaller scale, the Growing Power Hair Hill (GPHH), located close to Edmonton in Canada, produces out of biomass raw materials originating from local farms, high-value products such as fuel ethanol, green power, and bio-fertilizer in a biorefinery. The process is powered by another Alberta technology in which useful energy is extracted from agricultural waste simultaneously destroying all potentially harmful pathogens and reclaiming water.[35] As a by-product the process produces a high-nutrient feed that can be used for feeding the cattle in a local cattle feedlot.

NEXT STEPS

Renewable energy can develop as a spin-off of other industries, as can be observed in the case of the Finnish pulp and paper mill industries, and Icelandic business development in addition to energy and heat production. Thus, where appropriate, renewable energy development should be perceived as a holistic development opportunity that can also bring along development in other areas in society/community. Thus, from a policy perspective, it is not adequate just to invest in renewable energy technologies alone; it is important to create policies and programs that encourage renewable energy development within the existing socio-economic and cultural ecosystems. Moreover, the development of parallel industries along with the renewable energy development needs to be encouraged. At the same time, it is important to ensure that existing policies, institutional and regulatory structures do not inadvertently hinder the development of renewables by preferentially providing subsidies for status quo (i.e. fossil based) energy systems.[36]

RECOMMENDATION # 7:

PROVIDE SUPPORTS FOR COMMUNITIES IN THE EVENT OF FAILURES TO THE POWER SYSTEM

RATIONALE AND BACKGROUND

Access to sustainable and reliable energy can be considered a central policy goal. For example, according to the goals set in the UNDP's 2030 Agenda for Sustainable Development, "everyone should have access to affordable, reliable, sustainable and modern energy" by the year 2030.[37] Delivery of reliable energy services is more difficult for remote areas, where redundancies in the system are inherently limited due to long distances and small loads. These remote locales often experience harsh weather conditions, which can interrupt service for longer periods of time than would be commonly experienced in populous areas of the same country. In Russia, for example, the environmental, social, and economic impacts related to the transportation of diesel to remote areas in the north are particularly severe due to the large size of the country and its difficult climatic conditions.[38]

Norway often stands out as a leader in renewable energy, given its extensive development and use of hydropower.[39] Northern Norway, including the counties of Nordland, Troms, and Finnmark, has numerous resources that can contribute to the continued and future development of renewable resources, but its potential has not yet been maximized. Specifically, the counties in Northern Norway have a combined energy usage of approximately 19,000 GWh per year, with an estimated energy production potential of over 21,000 GWh per year. The potential to develop further renewable energy projects in Northern Norway is limited, however, by the material reality that there is no grid capacity to handle more power beyond what is currently being produced.[40] The continued variation in unregulated hydro and wind power production means that some areas are subject to power shortages.[41]

Climate change may further affect the integrity and reliability of electricity grids and pipelines, particularly in the Arctic where temperature increases are likely to be higher than average.[42] For example, thawing permafrost may destabilize foundations and support infrastructure for overhead power lines or obstruct access for maintenance and repair.[43] The impacts vary from one energy carrier to another, with some carriers more sensitive to climate change impacts than others. In general, renewable energy may be even more vulnerable to climate change than that of fossil energy resources due to its greater dependence on weather and climate.[44] On the other hand, designing renewable energy systems in ways that can support local distribution grids, independent of the larger transmission network, through the development of local microgrids, can protect communities from power outages and enable more reliable local delivery of electric power services. In addition, because many heat sources rely on electric power to operate, disruptions to electric power can also cause disruptions to heat services. Microgrids have become a common strategy for increasing grid reliability in some more populous areas, such as the continental United States, particularly in conjunction with critical nodes, such as individual facilities like a hospital, or complexes such as a military base or university campus.

CURRENT EXAMPLES

When it comes to microgrid technologies, a number of remote communities in the Arctic have been leading the way, both within the region, and globally. The strategies pioneered by remote communities in developing and maintaining renewable energy powered remote microgrids, can also be applied to grid-connected areas of the Arctic. These microgrid systems can be designed so they feed power to the grid when service is available, but can 'island' a small distribution service area, such as a local municipality, if there is a disruption in service, so that local power supply is maintained.

One example is a remote microgrid on Kodiak Island in Alaska, which serves 14,000 local residents. The community has invested in a 9 megawatt wind farm, a battery storage system, and a flywheel that complements an existing hydropower project to achieve 100% renewable energy generation on a year-round basis.[45] Smaller communities have achieved similar outcomes. For example, four small communities in Southwestern Alaska, with an average population of 500 residents, have formed the Chaninik Wind Group, supporting each other and experimenting with using excess wind to heat individual residences as a strategy for turning diesel engines off when the wind is blowing.[46] In both of these cases, the renewable energy system is capable of providing 100% of power for the local grid, independent of diesel generation.

NEXT STEPS

In some locations, the regulatory structure does not permit the development of microgrids. Reviewing energy policies and assessing possible opportunities for using renewable energy systems as a way to improve energy security and reliability are advised.

At the project level, it is important to make a full accounting of all potential project benefits, and determine whether a particular renewable energy project can be designed and deployed in ways that can improve local energy reliability in a cost-effective manner. Studies, such as the partnership between World Wildlife Fund Canada and the Waterloo Institute for Sustainable Energy to conduct a feasibility study for renewable energy development in Nunavut,[47] provide evidence-informed approaches for communities and can be replicated in other contexts.

In the future, damage to energy systems caused by variations in weather and climate are very likely to increase due to climate change.[48] Emphasis therefore needs to be placed on developing appropriate adaptation mechanisms. We recommend developing and updating adaptation plans concerning safeguarding the energy systems to the impacts of climate change. Changes can, for example, be introduced to the design standards and planning criteria for the construction and operation of pipelines and power transmission and distribution lines.[49] In some countries, such as Iceland and Finland, underground cables are increasingly being used in order to avoid damage caused by e.g. storms on the cables. Promotion of micro-grids or energy production at the household level based on renewable efficiently reduces vulnerability to variations in external conditions.

RECOMMENDATION #8:

EXPLORE USING AN EARLY STAGE RENEWABLE ENERGY FUND TO SUPPORT THE HIGH-RISK, EARLY STAGES OF PROJECT DEVELOPMENT

RATIONALE AND BACKGROUND

Over the past twelve years, investments in renewable energy have demonstrated remarkable growth.[50] New investments will increasingly be required if significant gains are to be realized in new renewable energy development. Currently, a vast majority of the existing energy infrastructure in the Arctic has been constructed using national or sub-national public funding (in Canada, see ecoENERGY and Arctic Energy Alliance's Alternative Energy Technologies Program). While this funding has been instrumental, there are limitations to the amount of public funding available to support project development. In particular, funding directed towards supporting the early stages of project development is far less common. A possible strategy for enticing increased public investment in the early stages of renewable energy development is to further attract private or local funding, whenever possible, to buttress the public investment.

If designed correctly, publicly funded programs can play a positive and essential role in attracting private sector or local investment. The challenge is to move away from a direct-support grant-based model, to one where public finance can be used innovatively to more successfully leverage additional third-party investment. For example, funding the high-risk predevelopment stages of a renewable energy project to improve the project's economic viability can help attract private funding and private partners during the construction and operation phases of the project. This can be particularly important for projects in more remote areas of the Arctic, where project economics are often marginal at best.

CURRENT EXAMPLES

To incentivize geothermal energy utilization for space heating, the Government of Iceland established the Iceland's National Energy Fund in the late 1960s. This fund provided a mechanism to offer low interest loans to municipalities or private local developers for geothermal resource assessment. These reconnaissance steps are the early stage and high risk/cost activities required to assess the potential of a geothermal resource to support a district heating system. Under this program, if the exploration efforts did not identify a viable resource, up to 80% of these costs are converted to a grant and thus, no cost was incurred by the municipality or developer. If exploration is successful, the loan is then extended to include the capital costs for developing the system.

As a result, this shifted the financial risk from consumers to the government, while minimizing government investment since the cost for exploration and drilling for viable projects were repaid by municipalities. This program has had a very significant positive impact on the dramatic increase in geothermal heating in the country over the past several decades. Space heating in Iceland has increased from less than 50% in 1970, to 90% today. Homes and businesses in areas that do not have direct access to local geothermal energy for space heating typically use electric heat produced from hydropower or geothermal sources, which is subsidized to make it more affordable.

NEXT STEPS

We recommend assessing existing grant and loan programs - or developing new programs - that are specifically targeted at early stage reconnaissance and feasibility studies for renewable energy projects. These programs should be structured in ways that minimize risk to consumers and developers, while maximizing public resources in incentivizing renewable energy development. In addition, these programs should ideally encourage economies of scale in project development, such as through the development of new transmission infrastructure or coordinated development of multiple smaller projects. Encouraging economies of scale can further increase the potential for the consumers and developers to pay back the loan to the government.

RECOMMENDATION #9:
FACILITATE EQUITY OWNERSHIP OPPORTUNITIES FOR NORTHERN COMMUNITIES

RATIONALE AND BACKGROUND

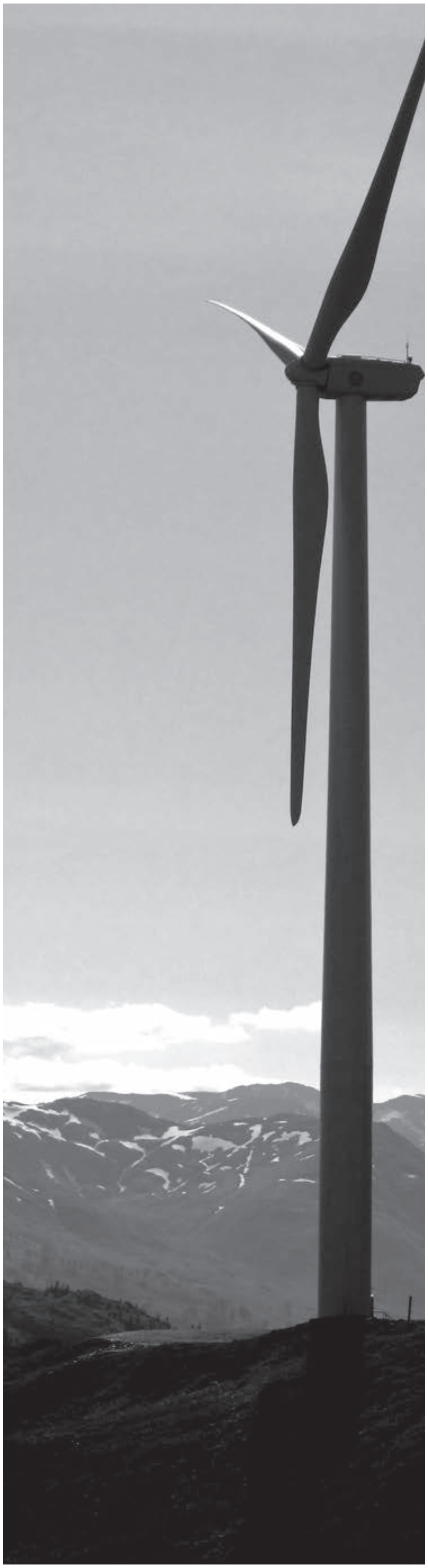
Renewable energy development provides an unprecedented opportunity for long-term, stable economic development in many northern communities, and provides possibilities for these communities to participate, partner, and lead the development of new projects. In traditional, extractive industry projects, northern communities often negotiate revenue, education and training, and employment opportunities through impact benefit agreements. Equity opportunities are not the norm, and where they do occur, often come through the form of public shares in the company, with no direct management of local operations. Renewable energy projects, by contrast, are well suited to equity ownership opportunities, in whole or in part, including opportunities for participation in the business management of local operations.

However, renewable energy systems typically have high capital costs. As a result, finding mechanisms to facilitate equity ownership through a public-private partnership (PPP) model with state-owned or private-owned power producers potentially provides much greater benefits, economic development, and direct management opportunities for northern communities. Public-private partnerships (PPPs) can reduce the risk associated with project development, especially cost overruns; they can protect the consumer from these risks, and because there is a clear performance incentive, the availability of equipment under PPPs often can be better than for utility-owned equipment. Moreover, through a PPP, northern communities can financially benefit from the project, own a significant percentage of the project and/or purchase increasing buy-in rights over time.[51] One example of a public-partnership is the Independent Power Producers (IPP), defined as "a corporation, person, agency, or other legal entity or instrumentality that owns or operates facilities for the generation of electricity for use primarily by the public, and that is not an electric utility."[52]

CURRENT EXAMPLES

The Sjisjka wind power park, one of Sweden's largest wind farms, in the Municipality of Gällivare in Northern Sweden close to Kiruna is an example of a renewable energy project carried out through public private partnership. The wind farm became operational in the Fall of 2012 and comprises 30 wind turbines. The project was built as a cooperation of OX2 (utility company), Skanska (construction company) and Jämtkraft[53] (electricity company). Annually, Sjisjka delivers 200 GWh electricity, an amount equivalent to the annual consumption of approximately 43,000 households. According to OX2,[54] local support has been an important part of the project all along and the Girjas Sami Village, which practices reindeer herding in the area, took part in the planning in the project and helped to ensure that the chosen location does not interfere with their activities. Moreover, part of the income, around SEK 300,000 ($35,000 USD) per year, produced by the project is paid pack to the local community.[55]

Another example is Wataynikaneyap Power, a power company equally owned by 20 Northwestern Ontario First Nations communities and its mission is to provide reliable and affordable power to its residents, businesses, and industry. In 2015, Wataynikaneyap partnered with FortisOntario, a transmission company, and RES Canada, which provides development, engineering, construction, and operation services for energy projects, to connect 16 remote First Nation communities from diesel generation to the provincial grid.[56] The cost of diesel generation in these remote communities is 3-10 times more than the average cost of power in Ontario. Over 40 years, transmission connection to remote communities could result in over $1 billion in cost savings compared to continued diesel generation. Moreover, the majority owner of this project is Watanikaneyap Power and they have the option to become 100 percent owners over time.[57]



NEXT STEPS

Arctic state governments could further facilitate equity ownership opportunities for Northern communities through implementing policy measures and programs to encourage the prudent development of public-private partnerships in the renewable energy sector in ways that protect the public interest.

To encourage PPPs, regulatory constraints against IPPs in certain areas will need to be addressed. We acknowledge that overtures from prospective IPPs have generally been viewed skeptically. This is because utilities prefer to maintain control of their system, the scope or scale of the project proposed is often not well aligned with the community needs, and there is a pervading perception that if revenue is earned from a project, the cost of energy delivered must be higher. This does not have to be the case.

Further policies and programs are needed to encourage public-private partnerships for northern and remote communities to participate in the renewable energy sector. One example of a program that can support this is the First Nations Power Authority (FNPA). In Saskatchewan, FNPA is a not-for-profit organization that provides knowledge and expertise, and helps to build relationships between Northern and Aboriginal business interests and Industry. FNPA can assist communities and utilities in developing RFPs to clearly define technology or project needs when there is an opportunity for private sector investment to meet a specific infrastructure need. This process would decrease the transaction costs and make it easier for private developers to respond to opportunities that have the support of local stakeholders, including the local electric utility. Similar programs could benefit northern communities in other regions.

RECOMMENDATION #10:
DEVELOP BETTER ACCESS TO CAPITAL AT MULTIPLE SCALES

RATIONALE AND BACKGROUND

The availability of capital that meets the needs of the particular project under consideration is critical, especially if there is a desire to develop projects under community ownership or PPPs. Accessible information about available financing tools allows potential borrowers to select the option that best suits their needs. Typically, there are several different financing options and programs available, and navigating between these and understanding their specific goals and limitations can be challenging. In some cases, the lending needs associated with community-scale projects in remote, northern, or indigenous communities are unique. Traditional project financing can sometimes be difficult to access for a project(s) based in these communities because it can be more difficult to demonstrate sufficient collateral, future cash flow, and a high probability of being able to repay the loan, thus making project financing higher risk from the perspective of traditional institutional lenders.

CURRENT EXAMPLES

Alaska's Power Project Loan Fund Program is administered by the Alaska Energy Authority, and is specifically designed to meeting the lending needs of small projects and remote communities. PPLF loans can be used to fund the development or upgrade of small-scale (less than 10 MW) conventional power facilities, and alternative energy generation facilities (no size limitation). Energy conservation, heat recovery, reconnaissance or feasibility studies, transmission and distribution, and bulk fuel storage are also eligible loan uses. The maximum term of the loan is the useful life of the project up to 50 years. Although there are no minimum or maximum amounts, loans exceeding $5 million require legislative authorization. Interest rates range between federal tax-exempt rates and zero. Local utilities, local governments, and independent power producers are eligible to apply. The PPLF is unusually accommodating regarding terms, interest rates, and collateral requirements. As intended, a wide range of projects have been funded in communities of all sizes, including diesel powerhouse construction and bulk fuel storage facilities, as well as various renewable energy projects.

There are several existing permanent and temporary financial support mechanisms available in the Arctic countries. For instance, the Alaska Industrial Development and Export Authority (AIDEA) provides various means of financing and assistance, including loan, fund, and guarantee options for renewable projects. In Canada, none of the current funding programs, such as ecoEnergy Innovation Initiative, Clean Energy Fund, or ecoENERGY for Renewable Power are taking new proposals. The Program of Energy Research and Development

(PERD) only provides funding to federal departments and agencies; thus, Indigenous communities can not directly access those funds either. ecoENERGY for Aboriginal and Northern Communities Program, which has been prioritized to support the development and implementation of renewable energy projects in aboriginal and northern communities, was an ideal program for indigenous communities to develop renewable energy projects; however, that program ended in March 2016.

In Finland, the Motiva Group provides information and services and to companies, public sector and consumers on energy and material efficiency and renewable energy. Motiva operates as an affiliated Government agency (an in-house unit), and its functions will be developed as such. The company's entire share stock is in Finnish state ownership. On its web pages, Motiva gives free information on the available energy audit, investment support and other financing mechanisms for both private and public actors. In addition, information is given on regional energy advice offices and projects. In Sweden, the Swedish Energy Agency[58] provides support for development and dissemination of knowledge targeted at households, industry, and the public sector. The Agency also finances development of renewable energy. For example, it identifies business ideas and start-ups with potential for growth and helps innovators to develop their ideas and products by offering different types of conditional loans. The agency also informs investors about new energy technology companies and about the potential to invest in these companies.

NEXT STEPS

Financing options are not one-size fits all – they have different requirements for collateral, equity, interest rates, and maximum term. Some programs are only available to private companies, whereas some are only available to utilities. It appears that many available financing options are underutilized, at least in part due to lack of awareness. We therefore recommend the development of a clearinghouse and provision of technical assistance to potential borrowers, so they can clearly understand all of their options and receive assistance in applying for loans. Moreover, better training programs to build local community capacity in financial literacy and bookkeeping could help improve bankability of community projects, and help provide residents with the tools needed to understand available financing options.

In addition, education can be provided to lending institutions about the specific needs and circumstances of indigenous and other northern communities, and advocate for changes that can broaden the suite of potential lending tools available to utilities and communities, as well as developing tailored program to meet the unique needs in northern communities.

RECOMMENDATION #11:

ESTABLISH FUNDS FOR EMERGING TECHNOLOGIES TO INCENTIVIZE INVESTMENT IN NEXT-GENERATION ENERGY PROJECTS

RATIONALE AND BACKGROUND

Within each Circumpolar country are already existing funds to support research, development, and innovation in renewable energy. For example, Innovation Norway is a state-owned company that offers support to entrepreneurs and promising start-ups through business development, mentoring, start-up grants, and promotion to broader networks.[59] Recently, in the 2016 state budget, the Norwegian government expressed its interest in strengthening Innovation Norway's Environmental Technology Program with 134 million to 465 million NOK in 2017.[60] Meanwhile, the Government of Canada offers support for innovation in environmental technology through the ecoENERGY Innovation Initiative.[61] This program aims to support energy technology innovation to produce and use energy in a cleaner and more efficient way through government funding. The Alaska Energy Authority's Emerging Technology Fund in the United States provides grants for technology demonstration projects that are applicable to the market, and expected to be commercial within the next 5 years.[62] In Iceland, Startup Energy Reykjavik is an investment program for energy-focused start-ups; it offers mentorship, workspace, and seed capital.[63] These incentivization strategies, however, are largely confined within national borders. What is largely missing in these strategies is the encouragement of cross-border collaboration and cooperation in the development of innovative environmental technologies.

CURRENT EXAMPLES

In 2014-2015, the Alaska Center for Energy and Power (ACEP) tested a flywheel energy storage system (FESS). Flywheels provide the capability of injecting and absorbing short, but large, bursts of power. This capability can aid in stabilizing a microgrid (such as ones found in isolated rural Alaskan communities), particularly when both a renewable energy resource and changes in demand for electricity are especially variable.[64] To ensure diesel generators can keep up with variable power sources, many utilities must limit the contribution of renewable power into their system in order to ensure a stable grid is available to their customers. This problem was solved with the FESS. Subsequently, the FESS was installed in the Raglan Mine in Northern Quebec, which was powered by wind. The FESS has worked flawlessly, contributing to a total of 2.2 million litres of diesel saved and 6,400 tons of GHGs emissions avoided from the successful project.[65]

NEXT STEPS

We recommend that efforts should be taken to modify existing national investments for environmental technology to set aside a portion of these funds to allocate to international collaborative research and development, entrepreneurial and business incubation, and capacity building efforts. This would be especially valuable for the Pan-Arctic countries in the development of renewable energy for Indigenous and Northern communities. While risk of failures is typically higher for emerging technologies, vendors and manufacturers have a strong incentive to ensure projects are successful and are often willing to expend significant financial and technical resources to ensure that they are. If prudently managed, high energy costs and similarities to developing markets can be leveraged to attract investors, many of whom are well capitalized. This can result in near-term benefits from installation of hardware, but also has the potential to provide longer-term benefits such as development of networks and specialized expertise that could result in additional business opportunities for community-based organization, Indigenous Power Corporations, and the communities at large.

RECOMMENDATION #12:
PROMOTE CERTIFICATION STANDARDS FOR RENEWABLE ENERGY TECHNOLOGY USED IN THE ARCTIC

RATIONALE AND BACKGROUND

Certification can be a useful tool to demonstrate that a product has been endorsed by credible standards, which adds legitimacy and confidence for consumers. New voluntary certification and labeling schemes can be explored for emerging renewable energy projects. Certification and labeling schemes have been adopted by other energy sectors in the past. For instance, in December 2010, the European Union Energy Directive introduced the EU biofuels and bioliquids sustainability criteria for biofuels used in transportation and bioliquids used in electricity and heating.[66] As a result, companies that want to use biofuels and be eligible for government support or have the use count towards mandatory national renewable energy targets, must demonstrate their compliance through national systems or voluntary labeling schemes that have been approved by the European Commission.[67]

Although renewable energy brings multiple benefits for individuals and communities, the development of certification schemes for renewable energy sources can bring added value by providing a level of review and quality assurance on multiple indicators. In the Arctic, renewable energy development might impact Indigenous lands and the fragile Arctic ecosystem.[68] Land use issues might cause conflicts over land rights in the Arctic, as they have in several places in the world.[69] Furthermore, it is important to ensure that no components in the renewable energy production, such as toxic waste from solar cells, cause adverse effects on communities. Therefore, a social license to operate is still extremely important for the emerging renewable energy sector. Certification and labeling schemes provide an avenue to attain that social license and common understanding of quality assurance between stakeholders.

CURRENT EXAMPLES

While we do not aim to endorse any particular certification scheme in this report, we would like to present an example of an existing certification and labeling scheme, called Equitable Origin, which is using EO100TM Standard. The EO100TM Standard is a voluntary certification scheme that utilizes six principles to assess individual energy projects:

1. Corporate Governance, Accountability & Ethics
2. Human Rights, Social Impact & Community Development
3. Fair Labor & Working Conditions
4. Indigenous Peoples' Rights
5. Climate Change, Biodiversity & Environment
6. Project Life Cycle Management

Upon assessment and audit by certified operators, individual energy projects are provided a certification score, which demonstrates the extent to which they met the Standard for good policy and performance. This standard was used for certification of oil and gas companies; however, the new version was adjusted to meet the needs and challenges in the renewable energy sector.

NEXT STEPS

There are already voluntary certification schemes related to energy in existence and the goal of this document is not to endorse one over the others. Rather, we would like to endorse principles that would be important for communities in the Circumpolar North countries when considering renewable energy certification schemes: These principles could include economic viability, social equity and environmental performance. The standards based on these principles should be performance based, taking into account both procedural and distributional issues in benefit sharing, where appropriate, between the renewable energy operator and communities. The scheme should contain a mechanism for third party auditing, in conformity with ISEAL alliance sustainability standard e.g. be in compliance with major international conventions. The scheme should involve relevant stakeholders of different levels, but should avoid a one-size-fits-all approach and be adaptable for different localities across the Arctic. The voluntary certification scheme should not be limited to minimal compliance with laws and regulations, but also address benefits for local communities and indigenous peoples and, where possible, provide enhanced opportunities to renewable energy projects.

RECOMMENDATION #13:
CULTIVATE OPPORTUNITIES FOR KNOWLEDGE EXPORT

RATIONALE AND BACKGROUND

Efforts to build capacity and generate knowledge for northern and remote communities to become power producers and owners can further be used to benefit others through knowledge diffusion and export. The knowledge culminated, such as renewable energy options and technologies for rural or islanded communities, paired with the experience gleaned in the areas of proper community consultation, environmental impact assessment, social license, and cold climate technology, would put northern and remote leaders in a unique position to be able to fulfill a global mentorship role. Villages in remote locations in Alaska have more similarities to the developing world, such as indigenous and remote regions in Australia and sub-Saharan Africa, than to densely populated urban places served by the national power grid.[70] There is also a clear need for energy in the rural areas in the South. For instance, based on 2013 data, 120 million people in Southeast Asia currently do not have access to electricity, and this is more pronounced in rural areas.[71]

Knowledge diffusion and export can create further business and innovation opportunities for northern and remote communities. The creation of new training programs for the renewable energy sector would generate new skill specialties and workplaces for community members, which could then lead to the establishment of community-led training programs to pass on those same skills to individuals from other communities and/or countries.

CURRENT EXAMPLES

The Alaska Centre for Energy and Power has established the "Global Applications Program" (GAP) to assess global opportunities for trade surrounding the use of energy systems in islanded grids. The goal of GAP is to develop a robust Alaska knowledge economy that can be exported globally. To achieve this goal, stakeholders have been involved in the design, construction, and efficient operation of reliable microgrids, and the development and demonstration of emerging technologies that have the potential to immediately reduce energy costs in high energy costs areas and are community-level in scale.

In Canada, the 20/20 Catalysts Program, developed by Lumos Clean Energy Advisors and the Aboriginal Human Resources Council, hosted a three-week workshop for 20 participants from First Nations, Inuit, and Metis participants from Indigenous communities in Canada to learn skills on how to develop solar, wind, and hydro.[72] The hope for the 20/20 Catalysts Program is to build capacity from Indigenous leaders diffusing knowledge to other Indigenous leaders.

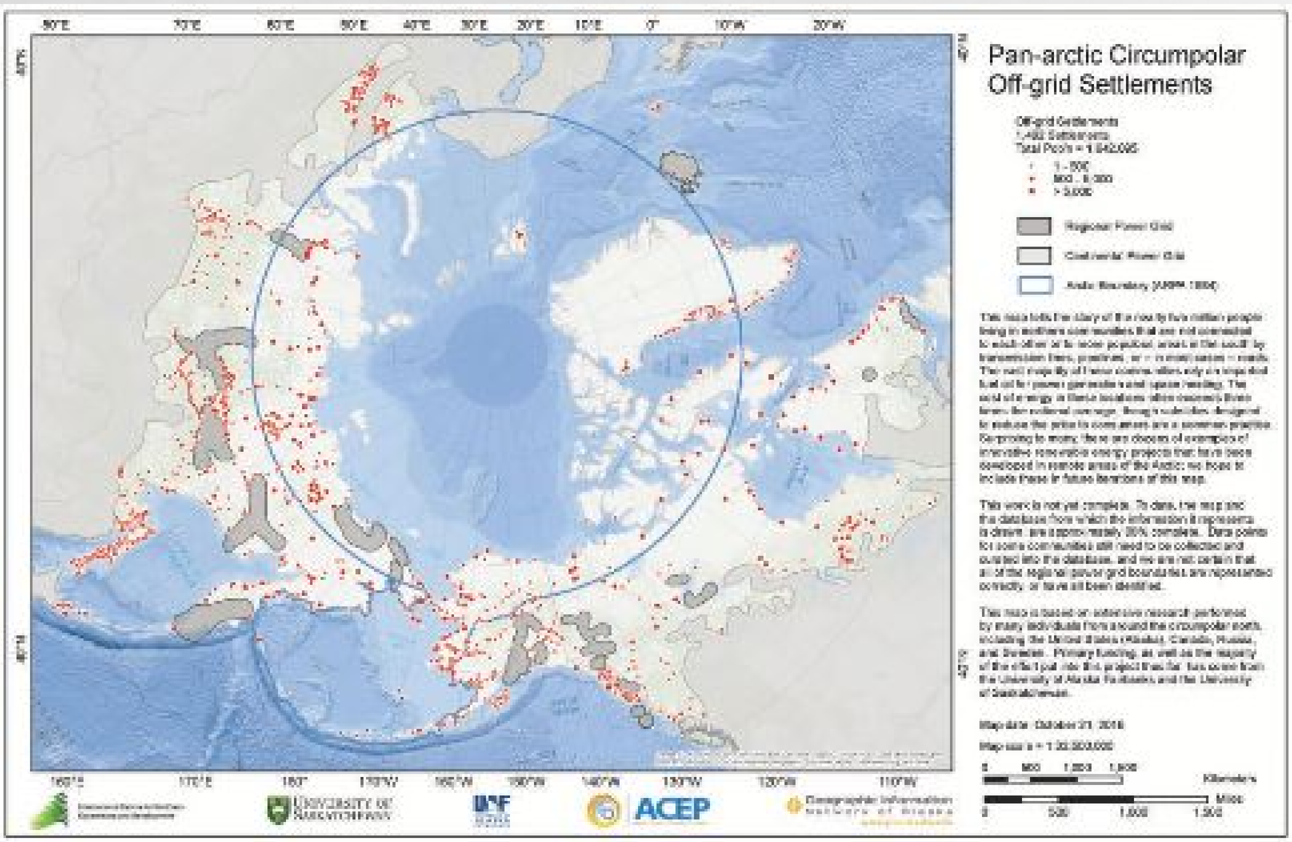
NEXT STEPS

We suggest that the Arctic can play a critical, even pivotal, role in the global transition to carbon neutral forms of energy if we focus on transferring knowledge to other places that can use it to build more sustainable energy systems of their own.

Financial investments, noted earlier, could be made in the area of building capacity for local communities in the Arctic to train its community members to become experts in the community-level renewable energy sector. Further to this proposition, we recommend that part of this investment could be devoted to incentivize knowledge diffusion and export activities. We argue that this investment can cultivate the potential for local Arctic communities to make a novel contribution to the global knowledge economy.

We acknowledge that knowledge diffusion and export constitute a longer-term goal, stemmed from investments to building capacity in local communities in the renewable energy sector. However, efforts can concurrently be taken to identify and compile existing training programs, such as the Global Applications Program or the 20/20 Catalysts Program. Learning about and indexing the pedagogical strategies and resources used by these existing training programs can then be utilized to connect prospective participants to those programs, as well as support Indigenous, Northern, and Remote communities that are interested in establishing their own training programs in the area of renewable energy. This step can be undertaken by an academic research unit that is already active in the area of renewable energy research.

ANNEX A: PAN-ARCTIC CIRCUMPOLAR OFF-GRID SETTLEMENTS



ANNEX B: GLOSSARY

Arctic – The terrestrial and marine areas north of the Arctic Circle (66°32'N), and north of 62°N in Asia and 60°N in North America, modified to include the marine areas north of the Aleutian chain, Hudson Bay, and parts of the North Atlantic Ocean including the Labrador Sea.[i]

Each country with land in the Arctic defines its own arctic regions differently. The following definitions were presented in the Arctic Council's Protection of the Arctic Marine Environment Working Group's Offshore Oil and Gas Guidelines[ii]:

- Canada – all lands north of 60 degrees North latitude, the drainage area of the Yukon Territory, and the costal zone area of Hudson Bay and James Bay.
- Kingdom of Denmark – The Arctic areas of Denmark include the Faroe Islands and Greenland
- Finland – Territory north from the Polar Circle
- Iceland – all of Iceland is considered to be within the Arctic area.
- Norway – In accordance with the Arctic Council's Offshore Oil and Gas Guidelines, 62 degrees North latitude in the Norwegian Sea areas is the delimitation between northern and southern Norwegian areas.
- Sweden – In accordance with the Arctic Council's Offshore Oil and Gas Guidelines, the Arctic Circle has been used as the southern delimitation of the Arctic Area.
- Russian Federation - In accordance with the draft Law of the Russian Federation "On Zoning of North Russia", the Arctic areas of North Russia include:
    - All lands and islands of the Arctic Ocean and its seas;
    - Within the Murmansk region: Pechenga district (coastal areas of the Barents Sea including populated centers located on Sredniy and Rybachiy Peninsulas, as well as Liynakhamareye populated center, and the town-type settlement of Pechenga) Kolsk district (territories administered by the Tyuman and Ura-Guba rural government bodies), Lovozersk district (territory under the Sosnovsk rural government body), territory administered by the Severomorsk municipal government, and closed administrative-territorial entities of Zaozersk, Skalistiy, Snezhnogorsk, Ostrovnoy, and the city of Polyarniy with populated centers administratively Attached to it;
    - Nenets autonomous national area – all territory;
    - Within the Komi Republic – city of Vorkuta, within areas managed by it;
    - Within the Yamal-Nenets autonomous national area; Priural, Tazov, and Yamal District, and territories and administered by the Salekhard and Labytnang Municipal governments;
    - Taimyr (Dolgan-Nenets autonomous area) – all territory;

- Within the Krasnoyarsk territory – areas administered by the Norilsk municipal government;
- Within Sakha Republic (former Yakutia): Allaikhov, Anabar, Bulun, Nizhnekolym, Olenek and Ust-Yan district;
- Chuckchi autonomous national area – all territory;
- Within the Koryak autonomous area -- Olutor district.

- United States of America – All United States territory north of the Arctic Circle and all United States territory north and west of the boundary of formed by the Porcupine, Yukon and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering and Chukchi Seas; and the Aleutian chain.

Biomass – Organic material that comes from plants and animals[iii]. Biomass can be repurposed to useable forms of energy through burning or converting to liquid or gas. Examples of biomass include wood and wood processing waste, agricultural crops and waste materials, animal manure and human sewage.

Consultation – In Canada, the Crown (federal or provincial government) has a duty to consult and, where appropriate, accommodate when the Crown contemplates conduct that might adversely impact potential or established Aboriginal or Treaty rights[iv].

Geothermal – A renewable energy source that comprises heat originating from within the earth. The heat can be recovered as steam or hot water, which can then be used to heat buildings or generate electricity.

Hydro – The natural flow of water in rivers offers kinetic power that can be converted into energy and electricity. To produce hydroelectricity, the water flow is directed to the blades of a turbine, making it spin, which causes an electrical generator connected to the turbine to spin and thus generate electricity[v].

Independent Power Producers (IPP) – A corporation, person, agency, or other legal entity or instrumentality that owns or operates facilities for the generation of electricity for use primarily by the public, and that is not an electric utility[vi].

Microgrid – An electricity distribution system that balances loads and energy sources, and can be connected to larger power networks, or an independently controlled and coordinated remote islanded grid[vii].

Ocean Energy – Technologies have been developed to convert the energy of ocean waves and tides into electricity or other useful forms of power[vii].

Remote community - A community not connected to central energy infrastructure (e.g. natural gas pipeline or statewide electricity grid), which frequently results in a reliance on liquid fuels, lower quality energy supply, and higher energy costs[ix].

Renewable Energy – Energy obtained from natural resources that can be naturally replenished or renewed within a human lifespan[x]. Examples of renewable resources include moving water, wind, biomass, solar, geothermal, and ocean energy.

Run-of-the-River - A type of hydroelectric plant that contains little to no water storage and only harvests the energy from flowing water.

Small-scale Renewables – Localized and decentralized renewable energy technologies that are either connected to an electricity grid, or used as a stand-alone off-grid system[xi]. Small-scale renewables can range from providing electricity or cooling/heating to houses, buildings, communities, or a town. Crudely, these technologies produce less than 10 megawatts of energy[xii].

Solar – Energy from the sun in the form of radiated heat and light[xiii]. Solar energy can be converted into electricity through photovoltaic (PV) or solar cells, which converts sunlight directly into electricity, or solar thermal/electric power plants, which generate electricity by using solar energy to produce steam that is then used to power a generator[xiv].

Strategic Environmental Assessment (SEA) - A systematic process for evaluating the environmental consequences of a proposed policy, plan or program initiative in order to ensure they are fully included and appropriately addressed at the earliest appropriate stage of decision-making on par with economic and social considerations[xv].

Wind – The kinetic energy contained in wind can be converted into forms of energy, such as mechanical energy or electricity. In wind turbines, the blades are connected to a drive shaft which turns an electric generator, which then produces electricity.

GLOSSARY ENDNOTES:

i. Arctic Monitoring and Assessment Programme. 1998. Geographical Coverage of the AMAP assessment. In AMAP Assessment Report – Chapter 2. Arctic Monitoring and Assessment Programme. http://www.amap.no/documents/download/88.

ii. Protection of the Arctic Marine Environment Working Group. 2009. Annex A – Definition of the Arctic. In Arctic Offshore Oil and Gas Guidelines. Arctic Council. http://www.pame.is/images/03_Projects/Offshore_Oil_and_Gas/Offshore_Oil_and_Gas/Arctic-Guidelines-2009-13th-Mar2009.pdf.

iii. U.S. Energy Information Administration. 2016. Biomass Explained. U.S. Energy Information Administration. http://www.eia.gov/energyexplained/?page=biomass_home.

iv. Minister of the Department of Aboriginal Affairs and Northern Development Canada. 2011. "Aboriginal Consultation and Accommodation: Updated Guidelines for Federal Officials to Fulfill the Duty to Consult". The Department of Aboriginal Affairs and Northern Development Canada. http://www.aadnc-aandc.gc.ca/DAM/DAM-INTER-HQ/STAGING/texte-text/intgui_1100100014665_eng.pdf.

v. Natural Resources Canada. 2016. Hydroelectricity. Natural Resources Canada.http://www.nrcan.gc.ca/energy/renewable-electricity/7295#hydro.

vi. U.S. Energy Information Administration. 2016. Glossary. U.S. Energy Information Administration: U.S. Department of Energy. https://www.eia.gov/tools/glossary/index.cfm?id=I.

vii. Alaska Center for Energy and Power. 2015. Microgrids. University of Alaska Fairbanks. http://acep.uaf.edu/media/158027/Microgrids-6-26-15.pdf.

viii. Natural Resources Canada. 2016. Ocean Energy. Natural Resources Canada. http://www.nrcan.gc.ca/energy/renewable-electricity/7295#ocean.

ix. International Energy Agency. 2012.

x. Natural Resources Canada. 2016. About Renewable Energy. Natural Resources Canada.http://www.nrcan.gc.ca/energy/renewable-electricity/7295#what.

xi. Sustainability Victoria. 2016. Small Scale Renewable Technology. Victoria State Government. http://www.sustainability.vic.gov.au/publications-and-research/knowledge-archive/small-scale-renewable-technology.

xii. Office of Energy Efficiency and Renewable Energy. 2016. Small- to Medium-Scale Federal Renewable Energy Projects. U.S. Department of Energy. http://energy.gov/eere/femp/small-medium-scale-federal-renewable-energy-projects.

xiii. Natural Resources Canada. 2016. Solar Energy. Natural Resources Canada. http://www.nrcan.gc.ca/energy/renewable-electricity/7295#solar.

xiv. U.S. Energy Information Administration. 2016. Solar Explained. U.S Energy Information Administration. http://www.eia.gov/energyexplained/index.cfm?page=solar_home.

xv. Protection of the Arctic Marine Environment Working Group. 2009. Arctic Offshore Oil and Gas Guidelines. Arctic Council. http://www.pame.is/images/03_Projects/Offshore_Oil_and_Gas/Offshore_Oil_and_Gas/Arctic-Guidelines-2009-13th-Mar2009.pdf.

ANNEX C: ENDNOTES

1. The International Renewable Energy Agency. (2015). REthinking Energy: Renewable Energy and Climate Change. p. 10

2. The International Renewable Energy Agency, 2015.

3. International Energy Agency. (2011). World Energy Outlook 2011. International Energy Agency: France. http://www.iea.org/publications/freepublications/publication/WEO2011_WEB.pdf

4. Arriaga, M., Canizares, C. A.,, and Kazerani, M. 2012. Renewable Energy Alternatives for Remote Communities in Northern Ontario, Canada. IEEE Transactions on Sustainable Energy, 4(3), 661-670.

5. Arrigia, Canizares, and Kazerani 2012; Knowles, J. 2016. Power Shift: Electricity for Canada's Remote Communities. The Conference Board of Canada: Ottawa.

6. Hoogensen Gjørv, G., D. R. Bazely, M. Goloviznina and A. J. Tanentzap, Eds. (2014). Environmental and Human Security in the Arctic. London, Routledge.

7. Hoogensen Gjørv, G. (2017). Tensions between Environmental, Economic, and Energy Security in the Arctic. Northern Sustainabilities: Understanding and Addressing Change in a Circumpolar World. G. Fondahl and G. Wilson. Cham, Switzerland, Springer International Publishing.

8. Whiteman, G., and Mamen, K. 2002. Meaningful Consultation and Participation in the Mining Sector? A Review of the Consultation and Participation of Indigenous Peoples within the International Mining Sector. The North-South Institute: Ottawa. http://metisportals.ca/MetisRights/wp/wp-admin/images/Meaningful%20Consultation%20in%20the%20Mining%20Sector.pdf.

9. Tsoutsos, T. D., and Stambouslis, Y. A. (2005). The Sustainable Diffusion of Renewable Energy Technologies as an Example of an Innovation-focused Policy. Technovation, 25, 753-761; Walker, G., Devine-Wright, P. Barnett, J., Burningham, K., Cass, N., Devine-Wright, H., Speller, G., Barton, J., Evans, B., Heath, Y., Infield, D., Parks, J., Theobald, K. 2011. "Symmetries, Expectations, Dynamics and Contexts: A Framework for Understanding Public Engagement with Renewable Energy Projects." In Renewable Energy and the Public: From NIMBY to Participation. P. Devine-Write, ed. Abington: Earthscan; Wallace, S. 2016. Dodging Wind Farms and Bullets in the Arctic. The National Geographic. http://news.nationalgeographic.com/2016/03/160301-arctic-sami-norway-reindeer/.

10. Noble, B., Ketilson, S., Aitken, A., and Poelzer, G. (2013). Strategic Environmental Assessment Opportunities and Risks for Arctic Offshore Energy Planning and Development. Marine Policy, 39, 296-302.

11. Udofia, A., Noble, B., and Poelzer, G. (2015). Community Engagement in Environmental Assessment for Resource Development: Benefits, Enduring Concerns, Opportunities for Improvement. The Northern Review, 39, 98-110.

12. Fundigsland Tetlow, M., and Hanusch, M. 2012. Strategic Environmental Assessment: the State of the Art. Impact Assessment and Project Appraisal, 30(1): 15-24.

13. Nenasheva, M., Bickford, S. H., Lesser, P., Koivurova, T., & Kankaanpää, P. (2015). Legal tools of public participation in the Environmental Impact Assessment process and their application in the countries of the Barents Euro-Arctic Region. Barents Studies 1(3): 13-35.

14. Nenasheva et al. 2015.

15. Nenasheva et al. 2015.

16. Indigenous and Northern Affairs Canada. 2013. Government of Canada and the Duty to Consult. Government of Canada. https://www.aadnc-aandc.gc.ca/eng/1331832510888/1331832636303#sec1.

17. Hilden, M., Karvosenoja, N., Koskela, S., Kupiainen, K., Laine, A., Rinne, J., Seppälä, J., Savolahti, M. & Sokka, L. 2008. Environmental assessment of the national long-term climate and energy strategy. (In Finnish). Finnish Environment 50/2008. Helsinki: Finnish Environment Institute.; Government of Ontario. 2016. Aboriginal Consultation Guide for preparing a Renewable Energy Approval (REA). https://www.ontario.ca/page/aboriginal-consultation-guide-preparing-renewable-energy-approval-rea#section-5.

18. International Energy Agency. 2016. Renewables Information 2016. Paris: OECD/IEA; Nordregio. 2010. "Generation of Electricity in the Nordic Countries." Nordregio: http://www.nordregio.se/en/Maps/05-Environment-and-energy/Generation-of-electricity-in-the-Nordic-Countries/.

19. Cherniak et al. 2015.

20. Thompson, Shirley and Bhanu Duggirala. 2009. "The Feasibility of Renewable Energies at an Off-Grid Community in Canada." Renewable and Sustainable Energy Reviews, 13: 2740-2745; McDonald, Nicole C. and Joshua M. Pearce. 2013. "Community Voices: Perspectives on Renewable Energy in Nunavut." Arctic, 66(1): 94-104; Boute, Anatole. 2016. "Off-grid Renewable Energy in Remote Arctic Areas: An Analysis of the Russian Far East." Renewable and Sustainable Energy Reviews, 59: 1029-1037; Cherniak et al. 2015.

21. Cherniak et al. 2015.

22. Boute 2016.

23. St. Denis, Genevieve, & Paul Parker. 2009. "Community energy planning in Canada: The role of renewable energy," Renewable and Susatinable Energy Reviews, 13, pp. 2088-2095. http://ac.els-cdn.com/S1364032108001767/1-s2.0-S1364032108001767-main.pdf?_tid=e7701bd8-7f74-11e6-8375-00000aacb361&acdnat=1474405255_f036ea1eab24dda2fdda00c68a2d27a6.

24. Johnston, Peter F. 2010. "Arctic Energy Resources and Global Energy Security." Journal of Military and Strategic Studies, 12 (2). http://jmss.org/jmss/index.php/jmss/article/view/298.

25. Cherniak et al. 2015.

26. McIntyre 2013.

27. National Energy Board. 2015. Energy Use in Canada's North: An Overview of Yukon, Northwest Territories and Nunavut- Energy Facts. https://www.neb-one.gc.ca/nrg/ntgrtd/mrkt/archive/2011nrgsncndnrthfct/nrgsncndnrthfct-eng.html.

28. Arriaga, Cañizares, & Kazerani, 2012; the Standing Senate Committee on Energy, the Environment and Natural Resources. n.d. Powering Canada's Territories. http://www.parl.gc.ca/Content/SEN/Committee/412/enev/rep/rep14jun15-e.pdf.

29. Zhu, T., Huang, Z., Sharma, A., Su, J., Irwin, D., Mishra, A., Menasche, D., and Shenoy, P. (2013). Sharing Renewable Energy in Smart Microgrids. Paper presented at the ACM/IEEE 4th International Conference on Cyber-Physical Systems, Philadelphia, PA.

30. Vyyryläinen, V. 2015. What are Mankala Corporations. Presentation at the Wind Finland 2015 seminar, 29th October 2015, Helsinki. http://www.tuulivoimayhdistys.fi/filebank/814-VilleVyyrylainen.pdf.

31. Delgado, M., Porter, M. E., Stern, S. 2014. Clusters, Convergences, and Economic Performance. Research Policy, 43(10): 1785-1799.

32. Midttun, A., and Koefoed, A. L. 2005. Green Innovation in Nordic Energy Industry: Dynamic Patterns and Institutional Trajectories. Paper for the Conference: Innovation in Europe: Dynamics, Institutions, and Values. Roskilde University, Denmark, May 8-9, 2003.

33. For examples, see Sokka, L., Pakarinen, S., and Melanen, M. 2011. Industrial symbiosis contributing to more sustainable energy use – an example from the forest industry in Kymenlaakso, Finland. Journal of Cleaner Production, 19(4): 285-293; Korhonen, J., & Snakin, J-P. 2005. Analysing the evolution of industrial ecosystems: concepts and application. Ecological Economics, 52(2): 169-186; Karlsson, M., & Wolf, A. 2008. Using an optimization model to evaluate the economic benefits of industrial symbiosis in the forest industry. Journal of Cleaner Production, 16(14): 1536-1544.

34. Sokka et al. 2011.

35. http://ccemc.ca/project/gphh-integrated-biorefinery/

36. International Institute for Sustainable Development (IISD). n.d. "Re-Arctic: Promoting renewable energy, eliminating fossil fuel subsidies and benefitting communities in the North." http://www.iisd.org/library/re-arctic-promoting-renewable-energy-eliminating-fossil-fuel-subsidies-and-benefitting.

37. United Nations Development Programme. 2016. "Sustainable Development Goal 7 – Affordable and Clean Energy". United Nations Development Programme, New York. http://www.undp.org/content/undp/en/home/sdgoverview/post-2015-development-agenda/goal-7.html.

38. Boute 2016.

39. OED, Meld.St. 25 Kraft til endring: Energipolitikken mot 2030, Olje- og Energidepartement, Editor. 2015-2016: Oslo.

40. Halvorsen, K.W., et al., Sektoranalyse av fornybar energi i Nord-Norge. 2013, Multiconsult: Oslo.

41. Halvorsen et al., 2013.

42. Arctic Institute of North America (AINA), University of Calgary. n.d. "Sustainable Energy Development." http://arctic.ucalgary.ca/sustainable-energy-development.

43. Johnston, Peter F. 2010. "Arctic Energy Resources and Global Energy Security." Journal of Military and Strategic Studies, 12 (2). http://jmss.org/jmss/index.php/jmss/article/view/298; Arent, D. J., Tol, R. S. J., Faust, E., Hella, J. P., Kumar, S., Strzepek, K. M., Toth, F. L, Yan, D. 2014. "Key economic sector and services". In: Climate Change 2014: Impacts, Adaptation and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, USA, pp. 659-708.

44. Schaeffer, R., Szklo, A. S., de Lucena, A. F. P., Soares, B., Borba, M. C., Nogueria, L. P. P., Fleming, F. P., Troccoli, A., Harrison, M., Boulahya, M. S. 2012. Energy sector vulnerability to climate change: A review. Energy 38: 1-12.

45. Schuessler, R. 2015. Alaska Island Goes Renewable Amid Rising Electricity Prices. Aljazeera America. http://america.aljazeera.com/articles/2015/7/30/in-alaska-an-island-goes-renewable-amid-rising-electricity-prices.html.

46. Office of Indian Energy Policy and Programs. 2010. Chaninik Wind Group – 2010 Project. U.S. Department of Energy. http://energy.gov/indianenergy/chaninik-wind-group-2010-project.

47. Das, I., & Canizares, C. 2016. Renewable Energy Deployment in Canadian Arctic: Phase I: Pre-Feasibility Studies and Community Engagement Report for Nunavut. World Wildlife Fund Canada. http://awsassets.wwf.ca/downloads/summary_and_prefeasibility_report.pdf.

48. Johnston 2010.

49. Arent et al. 2014.

50. Frankfurt School – UNEP Collaborating Centre for Climate and Sustainable Energy Finance. 2012. Global Trends in Renewable Energy Investment. Frankfurt School of Finance and Management. http://fs-unep-centre.org/sites/default/files/publications/globaltrendsreport2012final.pdf.

51. Henderson, 2013.

52. U.S. Energy Information Administration. 2016. Glossary. U.S. Energy Information Administration: U.S. Department of Energy. https://www.eia.gov/tools/glossary/index.cfm?id=I.

53. Jämtkraft is a power company of which Östersundom community owns 98% and the Communities of Krokom and Åre each own 1%.

54. OX2 2016. Skanska, Jämtkraft and OX2 in a unique partnership. On-line document. http://www.ox2.com/en/wind-power/references/business-sector/skanska/.

55. Skanska 2016. The Sjisjka wind farm. On-line document. http://group.skanska.com/projects/57331/The-Sjisjka-wind-farm.

56. Ministry of Energy. 2016. Ontario Selects Wataynikaneyap Power to Connect Remote First Nation Communities to Electricity Grid. Queen's Printer of Ontario. https://news.ontario.ca/mei/en/2016/07/ontario-selects-wataynikaneyap-power-to-connect-remote-first-nation-communities-to-electricity-grid.html.

57. Wataynikaneyap Power. 2012. About Us. Wataynikaneyap Power. http://wataypower.ca/node/5.

58. Swedish Energy Agency. 2015. About Us. Swedish Energy Agency. http://www.energimyndigheten.se/en/about-us/.

59. Innovation Norway. (2016a). Start ups. Innovation Norway. Retrieved from http://www.innovasjonnorge.no/en/start-page/our-services/start-ups/.

60. Innovation Norway. (2016b). Innovation Norway gets half a billion Norwegian kroner to the green shift. Innovation Norway. Retrieved from http://www.innovasjonnorge.no/en/start-page/our-services/sustainability/innovation-norway-gets-half-a-billion-norwegian-kroner-to-the-green-shift/.

61. Natural Resources Canada. (2016). ecoENERGY Innovation Initiative Background. Natural Resources Canada. Retrieved from http://www.nrcan.gc.ca/node/17903/.

62. Alaska Energy Authority. (2014). Emerging Energy Technology Fund. Alaska Energy Authority. Retrieved from http://www.akenergyauthority.org/Programs/EETF.

63. Startup Energy Reykjavik. (2016). About. Startup Energy Reykjavik. Retrieved from http://www.startupenergyreykjavik.com/en/about.

64. Alaska Center for Energy and Power. 2015. Williams Flywheel Energy Storage System Testing through ACEP. Alaska Centre for Energy and Power.

65. Tugliq Energy Co. 2015. Aeolian. Tugliq Energy Co. http://www.tugliq.com/fr/eolien.html.

66. European Commission. 2016. Sustainability Criteria. European Commission. https://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/sustainability-criteria.

67. The accepted schemes include ISCC (International Sustainability and Carbon Certification), RSB EU RED (Roundtable of Sustainable Biofuels EU RED), 2BSvs (Biomass Biofuels voluntary scheme), among others (See: http://biofuelstp.eu/biofuels-certification.html).

68. Johnston 2010.

69. For example, community resistance to wind power in Oaxaca, Mexico.

70. Martinson, Erica. 2016. "Alaska's Rural Energy Microgrids Offer a Prototype for Powering the World." Alaska Dispatch News, February 15: http://www.adn.com/energy/article/alaskas-microgrids-offer-prototypye-powering-world/2016/02/15/.

71. International Energy Agency. 2015. "World Energy Outlook 2015." International Energy Agency: http://www.iea.org/bookshop/700-World_Energy_Outlook_2015.

72. Rice, Waubgeshig. 2016. "Gathering Aims to Spark Green Energy Projects in Indigenous Communities." CBC News, July 12: http://www.cbc.ca/beta/news/canada/ottawa/indigenous-renewable-energy-program-wakefield-1.3675849.

GREG POELZER

University of Saskatchewan

Greg Poelzer is the Founding Director of ICNGD, as well as a Professor in the School of Environment and Sustainability (University of Saskatchewan). He holds a PhD in Political Science from the University of Alberta (1996). Greg is a former Dean of Undergraduate Studies at the University of the Arctic (2003-2008), and currently leads the UArctic international Northern Governance Thematic Network—a research group consisting of 22 member organizations from seven Arctic states. Greg is a political scientist by training, and his research focuses on comparative politics and policy as it relates to northern circumpolar regions and to Aboriginal-state relations, and sustainable development in the north. His first book, Arctic Front: Defending Canada in the Far North (2008), was awarded the Donner Prize for excellence and innovation in Canadian public policy writing. Off-campus, he can be found canoeing in the many lakes and rivers of Saskatchewan or hunting with his Large Munsterlander, Gus, for Saskatchewan's finest game birds.

GUNHILD HOOGENSEN GJØRV

The Arctic University of Norway

Dr. Gunhild Hoogensen Gjørv is a Professor of Political Science at the University of Tromsø - The Arctic University of Norway, as well as Research Associate at the Norwegian Institute of International Affairs (NUPI). She is also a member of the Norwegian Royal Commission on Afghanistan investigating the Norwegian efforts in Afghanistan from 2001-2014. Gjørv was the International Principal Investigator for the International Polar Year project "The Impacts of Oil and Gas Activity on Peoples of the Arctic using a Multiple Securities Perspective", funded by the Norwegian and Canadian Research Councils, and is currently co-leader of the Arctic Extractive Industries Ph.D./Master's program that examines the impacts of extractive resource development on Arctic communities. She is also a partner in two projects examining the physiological, social and economic impacts of resource industries on Arctic communities from a human security perspective (and the resulting policy implications). Gjørv writes about international relations theory, security theory, security in the Arctic, and civil-military interaction (both in Arctic as well as complex operations settings such as Afghanistan). She is the author of "International Relations, Security and Jeremy Bentham" (Routledge, 2005), and "Understanding Civil-Military Interaction: Lessons Learned from the Norwegian Model" (Ashgate, 2014), as well as co-editor (and contributing author) to "Envrionmental and Human Security in the Arctic" (Routledge, 2013). She has also written articles in Review of International Studies, Security Dialogue, and the International Studies Review, among other journals.

GWEN HOLDMANN

University of Alaska Fairbanks

Gwen is the Director of the Alaska Center for Energy and Power (ACEP), which is an applied energy research program based at the University of Alaska Fairbanks focusing on both fossil and renewable/alternative energy technologies. ACEP is a highly interdisciplinary program with over 30 affiliated faculty spanning a wide range of energy-related disciplines. Prior to joining the University of Alaska, Gwen served as the Vice President of New Development at Chena Hot Springs Resort near Fairbanks. While at Chena, Gwen oversaw the construction of the first geothermal power plant in the state, in addition to numerous other innovative energy projects ranging from hydrogen production to cooling a 10,000ft2 ice museum year-round using 150°F hot water. Gwen moved to Alaska in 1994, shortly after graduating from Bradley University with a degree in Physics and Mechanical Engineering. Gwen is the mother of three children – Leif, Marais, and Lael. She is married to Iditarod and Yukon Quest musher Ken Anderson, and the couple maintain a kennel of about 50 dogs outside of Fairbanks, Alaska. They live off grid in a house they built themselves, and generate their own power through a combination of solar PV, wind, and diesel generator. Gwen has been the recipient of several awards throughout her career, including an R&D 100 award, Project of the Year from Power Engineering Magazine, the Alaska Top 40 Under 40 Award.

NOOR JOHNSON

Brown University

Noor Johnson is a Research Scientist with the Exchange for Local Knowledge and Observations of the Arctic (ELOKA) project at the National Snow and Ice Data Center, Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado Boulder. Her research examines knowledge politics and environmental governance, with a particular focus on Inuit involvement in climate change research and policy in the Canadian Arctic. Noor's recent work focuses on knowledge and consultation practices in relation to multiple uses of the Arctic offshore, including oil and gas development. She previously served as Senior Advisor in the Office of International Relations at the Smithsonian Institution, where she supported the development of global initiatives on cultural heritage and biodiversity conservation. Noor has a Ph.D. from McGill University (Cultural Anthropology), an M.A. from American University (Public Anthropology), and a B.A. from Brown University (Development Studies). She previously served as a junior Fulbright Scholar in Sri Lanka, where she studied conflict and development.

BJARNI MÁR MAGNÚSSON

Reykjavik University School of Law

Dr. Bjarni Már Magnússon is an assistant professor at Reykjavik University School of Law, Iceland. His teaching and research interest lies in public international law, especially the law of the sea. He holds a cand.jr degree in law and MA in international relations from the University of Iceland, LL.M in ocean and coastal law from the University of Miami and Ph.D in international law from the University of Edinburgh. Dr. Magnússon acted as a junior counsel for Bangladesh in the dispute concerning delimitation of the maritime boundary between Bangladesh and Myanmar in the Bay of Bengal. He is the author of the book: The Continental Shelf beyond 200 Nautical Miles Delineation, Delimitation and Dispute Settlement, published in 2015 by Brill/Niljhoff.

LAURA SOKKA

VTT Technical Research Centre of Finland

Dr. Laura Sokka works as a senior scientist in the Energy Systems team of the VTT Technical Research Centre of Finland. She has a Ph.D. in environmental science and policy from the University of Helsinki. She is specialized in climate and other environmental impact assessment applying life cycle assessment (LCA) and other life cycle based methods. Her work mainly concerns environmental impacts of energy production solutions and systems. During the past years her research has particularly focused on the assessment of forest and other bioenergy sources, and local energy systems. In 2012-2014, Laura participated in the preparation of the IPCC AR5 WG3 report as a contributing author and chapter science assistant in Chapter 6 (transformation pathways). She is also a member of the Finnish national IPCC contact group. Moreover, she was an expert member of the Finnish delegation in the UNFCCC climate negotiations in Warsaw and in Lima, and in the IPCC meetings in Stockholm in 2013, and in Berlin and Copenhagen in 2014. Presently she is contributing to the ongoing preparation of the report "Adaptation Actions for a Changing Arctic (AACA)" commissioned by the Arctic Council.

MARIA TSYIACHNIOUK

The Center for Independent Social Research

Dr. Maria Tysiachniouk holds a Master of Science in Environmental Studies from Bard College, N.Y., a Ph.D. in Biology from the Russian Academy of Science, and a Ph.D. in Sociology from Wageningen University, the Netherlands (2012). She has taught at Herzen Pedagogical University, Ramapo College of New Jersey, Wageningen University, University of Lapland, and the University of Erfurt. Since 2004, she has studied global governance through FSC certification and published a book "Transnational governance through private authority: the case of Forest Stewardship Council Certification in Russia." In 2012, she started extensive research on transnational oil production chains in Russian Arctic, focusing on the interactions between oil companies and indigenous communities. Maria Tsyiachniouk has written more than 180 publications on topics related to transnational environmental governance, edited several books, and has fieldwork experience in several countries and regions. She is currently the chair of the Environmental Sociology group at the Center for Independent Social Research, St. Petersburg.

STAN YU

University of Saskatchewan

Stan Yu, M.A., is a research associate at the International Centre for Northern Governance and Development. Previously, he taught as a sessional lecturer in the department of Sociology, and was the program evaluation and research analyst at the Gwenna Moss Centre for Teaching Effectiveness at the University of Saskatchewan. His research interests include the use of program evaluation in the work of non-profit organizations; engaged scholarship and public sociology; and the scholarship of teaching and learning.


EXIT

UNIVERSITY OF SASKATCHEWAN
School of Environment
and Sustainability
USASK.CA/SENS

International Centre for Northern
Governance and Development