PEMBINA institute

Yukon Energy, Mines and Resources Energy Branch

Renewables in Remote Communities

2017 Conference Proceedings

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Photo: Roberta Franchuk, Pembina Institute

About the Pembina Institute

The Pembina Institute is a national non-partisan think tank that advocates for strong, effective policies to support Canada's clean energy transition. We employ multi-faceted and highly collaborative approaches to change. Producing credible, evidence-based research and analysis, we consult directly with organizations to design and implement clean energy solutions, and convene diverse sets of stakeholders to identify and move toward common solutions.

Our work with Indigenous communities is driven by our belief that improving the quality of life in communities is necessary and possible, and that advancing clean energy and supporting the leadership of Indigenous communities in their own clean energy transition has tremendous health, environmental, social, economic and community benefits to everyone.

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We would also like to thank all of our sponsors who made the event possible, and especially to the Government of Yukon for co-hosting the event with us.

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Renewables in Remote Communities 2017 Conference Proceedings

October 23 – 26, 2017

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Summary

The Renewables in Remote Communities 2017 conference saw over 250 people come together in Whitehorse to discuss various aspects of human capacity and financial capacity for renewable energy projects in remote communities. While the conference tackled the two issues separately, dedicating a day to each, it became clear that the two are strongly interconnected and can't be dealt with in isolation.

Bringing together Indigenous leaders and communities, territorial, provincial and federal government representatives, utilities, private business, knowledge experts and the non-profit sector fostered great discussions, sharing and insights into how to better advance diesel reductions in remote communities. Even though much work remains, there are already some very rich experiences to draw from, heartening and powerful community stories and a passionate gathering of people who have converged around this topic. Everyone has a vital role to play in this work.

There are many deeper motivations behind this work: reducing the negative environmental impacts related to diesel transportation, storage, combustion and contamination from spills; reducing acute and chronic health impacts associated with diesel fumes and combustion; and loosening the economic liability and grip diesel reliance has on remote Indigenous communities and all Canadians (through federal taxes). A deeper, genuine motivation is about being part of a resurgence of Indigenous culture and linkages to Aboriginal rights and title, self-determination and self-government. These efforts are working to further the autonomy and leadership for the Indigenous People of Canada that was taken away during colonization. Looking at the United Nations Declaration on the Rights of Indigenous People and Canada's Truth and Reconciliation Commission, and

Canada's obligation to both, shows connections between advancing renewable energy and social justice for Indigenous People. However, caution is suggested on how far to use the notion of reconciliation to advance renewable energy. The idea should never transform into mere rhetoric and must be held sacredly and carefully as we all move forward.

Throughout the conference, we learned the complexities of the clean energy transition in northern remote communities. Those include project development, technology adaptation, capacity development, financial challenges, policy and regulatory considerations, partnerships, and the relationships between Indigenous governments and Crown governments, their utilities and industry as a whole. Northern and isolating factors — geography, remoteness, climate and economies of scale — add to the challenges. Remoteness makes building human capacity all the more difficult and creates challenging economic conditions resulting in unique business case solutions. Government support must continue, for both program design and good policy instruments, but emphasis needs to shift from direct financial support to attracting financing from the private sector.

Attendees say they appreciated conference time dedicated to Indigenous culture, values and voice, as well as the space provided for sharing leadership ideas. This appreciation and respect for culture will help guide this work; real progress will only happen when communities are ready to lead in their own energy transition and have the necessary continuous and transparent support to do this.

Another key piece of feedback was that community education plays a very important role, with youth engagement, government funding and good partnerships being critical components of project development.

Human capacity highlights

Information collected during the conference suggested two of the most important aspects of human capacity development in a renewable energy project are early planning (community energy planning, resource assessment) and technical skills development and training. There was the sense that this is where attention needs to be focused for human capacity in remote communities, and that they require even more support relative to historical trends.

Words used to describe the essence of human capacity included *future, diversity, trust, connection, listening, relationships, community, youth,* and *people*. Youth are highly valued and an important aspect of capacity development. Along with youth, the importance of including Elders in this work was also stressed. These are two critical bookends: Elders represent a community's traditional knowledge and history, while youth represent the

future and untapped potential in a community. Involving youth in hands-on, experiential renewable energy projects is a way to engage, excite and create nurturing opportunities for this group, who desperately need more attention and care.

Finally, participants asked that efforts put forth on capacity building be authentic, meaningful, relevant, continuous and multi-year, and that funding be independent of political cycles.

A framework model for evaluating community capacity presented at the conference could potentially be used to help identify where communities are strong and where they are weak on the capital spectrum (human, institutional, natural, social and financial). This model and the framework presented needs some testing and piloting to see if it indeed can be a tool in the growing toolbox for strategic planning and comprehensive community planning. One message was clear during the sharing of this model: *protect your social capital* (the formal and informal relationships between community members and the social network and web within a community), as it is the only type of capital that cannot be imported. In other words, investing in people and their ability to feel valued and connected to community work is vital.

As mentioned above, the critical starting point for diesel reduction solutions is with communities. Direct capacity building into communities has typically been overshadowed by grants for capital equipment purchasing and programs that pay for energy planning, or pre-feasibility studies completed by external consultants. But our collective knowledge and past experiences now emphasizes that investment must begin with and be directed to communities, with special attention to *made in the North* solutions that focus on the human and social capital in a community and then build from that foundation. Special attention must also be paid to identify smaller and less resourced communities that don't have the means to stay informed and apply for government funding opportunities. These communities are in a cycle of being understaffed and overburdened, thus missing out on important opportunities.

Community stories of Atlin, Whitesand and Teslin emphasized the perseverance, passion and patience these projects require as they can take a long time to make a reality. Equal to this is the empowerment these projects foster. *Driving our own bus* is a phrase that brings a strong message of encouragement, confidence and equality that these communities deserve. And with project success comes the skills, employment and revenue, and the recognition and pride extending outward. Government funding and support for these projects was crucial and positive constructive relationships were formed through these projects.

Finally, much attention has been paid to providing capacity support *to* remote Indigenous communities with the default assumption that that is where capacity is needed. Although this is true, increased human capacity is also needed for non-Indigenous people, to bring an understanding of culture, protocol, history, how Indigenous governments are advancing and exercising self-governing agreements, and how this work is tied to a broader Canadian adoption and full support of UNDRIP and Canada's TRC, Aboriginal Rights and Title. We are at an important time and all Canadians, business and industry also require a better understanding of our shared history. This work must be done together collectively and for this, Canadians need relevant education.

Financial capacity highlights

All market-based business development plans need good project economics — investment, upfront capital, long-term revenue and a mixture of equity and debt financing. The economics for renewable energy projects in remote communities are currently challenging: geography, logistics, climate, renewable resources and economies of scale are considerably different than similar projects in southern Canada. This makes project financial data comparison difficult. For these reasons, there has been little market attention to these projects where a profitable return on investment can be realized. Instead, this industry has relied mostly on government funding to build commercial and demonstration projects. Although this government funding is critical, over-reliance has hampered projects' ability to stand on their own.

A combination of several things are needed to advance. Technology needs to be continually fine-tuned for remote applications; overall project costs need to come down (with the understanding there will always be a cost associated with doing business in the North); long-term revenues must become a standard component of project financing; and a financing shift is needed such that public money is strategically deployed to attract private investment. Leveraging public funds to attract private financing will help reduce dependency on public dollars and the limitations that often come with this type of funding.

A framework was presented at the conference to serve as a starting point to consider how such a transformation shift could be facilitated. The framework was rooted in two principles and provided three main components — a long-term power purchase agreement (PPA), a PPA rate equal to the avoided cost of diesel and a federal funding entity that provides guaranteed loans in order to attract private investment — are all essential pieces that work together to provide a platform to advance renewable energy project financing in remote communities. Experience with Green Banks and the Alaska Renewable Energy Fund were

brought to the conference to give insight into how public funding could be used to begin the process of drawing investor attention and equity to the North. A long-term PPA and PPA contract rate equal to the avoided cost of diesel require substantial effort to advance and are linked to territorial IPP policy commitments. They require a richer understanding and convergence of not just the definition of avoided cost of diesel, but also the marginal cost of diesel, the world of hidden subsidies that suppress the real economic cost of diesel reliance, and the need to stretch beyond limiting economic decision-making principles and instead encompass the socio-economic benefits that arise when partnering with Indigenous power proponents on renewable energy projects. Partnerships, long-term PPA and PPA rates were the focus of a separate Indigenous power proponent / utility session the day after the main conference; information will be shared by Pembina in the near future on the outcomes and next steps of this research.

The other pieces of information shared on financial capacity — businesses types (sole proprietor, corporation), partnership types (general partnership, limited partnership, joint venture), project risk and schedule — are also useful dimensions of project governance, business structure, accountability and the unique aspects of doing business in the North. This information is extremely important for Indigenous communities beginning their ventures in renewable energy projects and a more thorough dissemination of this information would likely be helpful.

Final thoughts

The recipe for reducing diesel reliance in remote communities requires energy conservation, energy efficiency, renewable energy, energy storage and smart grids – and encompass all areas of energy consumption including power, heating and transportation. There will be a time when all energy efficiency and renewable energy solutions economically beat out diesel systems, but it's going to take time and changes in the technical, regulatory and policy mechanisms, and underlying structures currently restricting easy change. It will also require changes to the underlying economics, including complementing government programming with private financing and sorting out detractors like hidden and obscure subsidies. Relationship building, genuine engagement with communities, and further integrating traditional knowledge into decision-making process are all required to achieve the social impact this work can bring.

Progress is happening. Small and medium-scale renewable energy projects continue to be developed and commissioned in remote communities. Specifically in the North, territorial governments are advancing policies to support Indigenous involvement in renewable

energy projects and the federal government has invested heavily with new funding programs to support energy transformation in remote communities. With this investment comes the responsibility to all of us to ensure funding programs are co-ordinated and communicated clearly, programs are designed sensibly, Indigenous communities are put first, money is used efficiently, outcomes are achieved and learnings are shared.

Yet, true momentous progress will be hard to achieve without the recognition that solutions and project leadership needs to come from Indigenous communities; this is where the most attention and support is required. Remote communities and Indigenous governments — not industry, utilities or other players — need direct financial support to equip them with the knowledge, practices and resources to inspire them towards full participation in this growing economy. They need this support so they can indeed lead, nurture their community champions and stimulate community members so they can in turn support and provide direction on what is most important to them. Communities need be in the driver's seat of this process, feel empowered and have the tools to accomplish their work.

1. Conference overview

Overview and motivation

The 3rd biennial Renewables in Remote Communities (RiRC) 2017 conference was held in Whitehorse from October 23 – 26, 2017. The Pembina Institute's RiRC conferences are designed for story sharing, innovative thinking, providing a platform for collaboration and networking to seek opportunities and solve issues facing renewable energy deployment in remote Indigenous communities across Canada.

RiRC 2017 focused on two critical dimensions to advance clean energy systems in remote communities: **financial capacity** and **human capacity**. We explored what kinds of important human capacity programs and financial mechanisms will enable the continued success of clean energy deployment in this setting. The Pembina Institute's continued research, clean energy policy advocacy and direct work with remote Indigenous communities has discovered human and financial capacity are two of the biggest challenges to clean energy deployment. There are indeed technical, regulatory and other barriers that deserve attention and pragmatic solutions. Yet there are considerable roadblocks for remote communities to lead in their own clean energy transition. They require knowledge and skillset development and the financial mechanisms to transition from purely grant funded projects to clean energy business plans.

The following summarizes the focus of the two-day main plenary conference.

Human capacity – Developing and operating clean energy projects in communities requires human capacity on many fronts. For Indigenous communities, this means support to champion their own energy transition. Success requires upfront engagement and sharing traditional and western knowledge to ensure projects are developed in line with Indigenous values. Capacity doesn't end there. Projects will be successful when the community is integral to the project. The type of leadership role the community plays, what types of partnerships are developed, whether they have an ownership stake, receive revenue or provide skilled workers that maintain the system are all important aspects of human capacity.

Financial capacity – Community clean energy projects require novel financing approaches. This is especially true for northern energy projects that often entail unique business cases and economic solutions. Too often these projects are not economical compared to status quo fossil fuel systems and are incorrectly compared to grid-tied clean energy projects in

the south. We need to change our approach and develop better financing systems so Indigenous communities have the necessary equity and long-term revenue to make these projects work for them.

Conference objectives

The following objectives were defined for the conference:

Maintain growth – Clean energy deployment in remote communities continues, but there is a lot of work to do. Success stories, lessons and adopting proven technical, regulatory, economic and social strategies to advance renewable energy projects in remote communities across Canada need to be shared to ensure growth continues.

Support Indigenous leadership – Authentic solutions can only be found when Indigenous communities are supported to lead their own clean energy evolution. Hearing from communities that have implemented projects – their challenges, successes, needs and perspectives, and hearing from communities that want to venture into their own clean energy future, is critically necessary to develop holistic and appropriate solutions.

Leverage federal investment –Budget 2017 and the Pan Canadian Framework on Clean Growth and Climate Change has made significant investments in funding to Indigenous communities to advance their clean economies. Program support for research, capacity building, capital investment for infrastructure funds and clean energy technologies and new funding mechanisms are becoming available. Communication and dissemination of these programs is necessary to assist the Indigenous communities, governments, utilities, industry and other collaborators who want to access these programs.

Deeper motivations

The motivations for advancing clean energy systems and reducing reliance in remote communities are obvious: transition to clean energy systems and reducing reliance on diesel fuel for heat and power reduces greenhouse gases (GHG) and the other environmental impacts of diesel. The impacts of climate change from GHG emissions have global consequences; climate change is happening two to three times faster in the north, creating significant environmental hardships for people living and relying on traditional ways of life. Reducing diesel transportation and in situ diesel storage reduces the risk of spills and the

associated environmental devastation, as well as the economic burden on communities and governments to remediate these spills.

Diesel dependency, combustion and spills also have negative health and social impacts. These include increased cancer risks, respiratory issues, and detrimental impacts of diesel contamination on the land, air and water. Social impacts include unaffordable energy prices; quality of life impacts from power outages, power and load restrictions; noise pollution from diesel generators; and the overall emotion connected to a reliance on old technology, status quo and perpetually depending on fossil fuel imports to heat and power communities.

Diesel is also an economic liability. Despite subsidies from provincial, territorial and federal governments intended to keep prices relatively affordable, energy costs for heating and electricity are high in remote communities. These subsidies continue to distort the true cost of diesel systems, making it difficult for clean energy to compete. These subsidies are also economic burdens for governments and Canadians. As an example, with its population of roughly 36,000, diesel subsidies in Nunavut are calculated at $60 million per year.[1]

Supporting clean energy transition, specifically in remote Indigenous communities, has the potential to positively affect efforts around improved nation-to-nation relationships with Indigenous peoples in Canada. A revived effort to this improved relationship was made in December 2015 by the federal government, stating "it is time for a renewed, nation-to-nation relationship with First Nations one that understands that the constitutionally guaranteed rights of First Nations in Canada are not an inconvenience but rather a sacred obligation."[2] Tied to this is Canada's adoption of the United Nations Declaration on the Rights of Indigenous Peoples, and Canada's Truth and Reconciliation Commission. How far clean energy adoption goes towards Indigenous self-determination and reconciliation is something only time will tell. For now, we should perhaps view it as a potential, not a guarantee.

This work has the potential to empower and enable Indigenous people and communities across Canada to self-govern, lead and decide if and how to reduce their dependency on legacy fossil fuel systems imposed on them by colonial structures, powers and regulations. This work can transition them into a leadership position to control their energy future; supporting them further in skill development, decision-making, partnership development

[1] IISD , 2017, *Tracking fossil fuel subsidies in the territory of Nunavut*, http://assets.wwf.ca/downloads/costing_fossil_fuel_subsidies_in_nunavut.pdf

[2] https://pm.gc.ca/eng/news/2016/12/06/prime-minister-justin-trudeaus-speech-assembly-first-nations-special-chiefs-assembly

and economic opportunities and rewards with a clean energy economy. Self-determination of their energy systems based on local values and traditional knowledge will lead to local control and leadership and better environmental stewardship and care for their lands.

Conference details

Agenda and presentations

The overall agenda and session details are available in Appendix C.

All presentations given at the conference are available on the Bullfrog Power website at https://www.bullfrogpower.com/communities2017/presentations.html

Conference attendees

There were approximately 250 attendees at the conference. For a listing of those who agreed to have their information shared, please see Appendix A. As seen in Figure 1, the conference was attended by Indigenous governments, communities and leaders (16%), federal government representatives (16%), utilities and electricity industry (16%), provincial and territorial government representatives (Yukon, Northwest Territories, Nunavut, British Columbia, Alberta and Ontario) (8%), and municipal government representatives (5%).

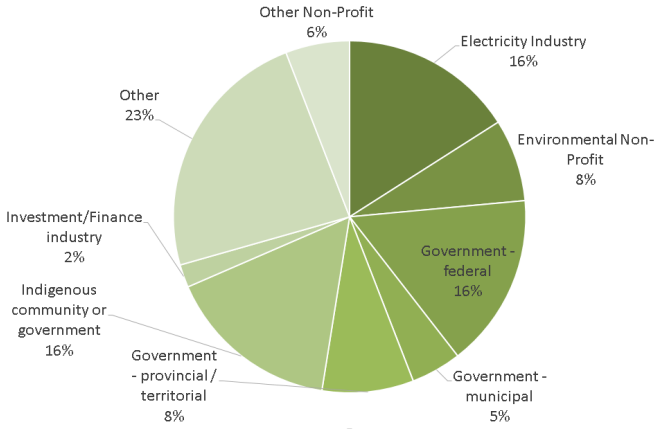


Figure 1. RiRC 2017 conference participants

Indigenous survey

Indigenous leaders who attended the conference completed a survey about their participation in clean energy projects and their reflections of the conference. The results of this survey are summarized at the end of Section 2.

This report

This report is intended to summarize key conference information and provide relevant information compiled since the conference. It concludes with highlights, reflections and opportunities for the necessary steps to advance this work.

2. Remote communities – background

Remote communities

There are approximately 265 remote communities throughout Canada.[3] Their locations are summarized in Table 1, and the majority of them are in B.C, Ontario, Quebec, Newfoundland and Labrador and the three territories of Yukon, NWT and Nunavut. Remote communities in Canada include both non-Indigenous and Indigenous communities. The combined population of these communities is approximately 185,000.

Approximately 171 of the 265 remote communities in Canada are comprised of and led by Indigenous people. There are approximately 110,000 people living in remote Indigenous communities, which is 59% of the population of all the remote communities.

Table 1. Remote communities in Canada by jurisdiction

Province / territory	Non-Indigenous	Indigenous	Total	% of total
Yukon	3	18	21	8%
Northwest Territories	3	31	34	13%
Nunavut	0	24	25	9%
B.C.	45	26	71	27%
Alberta	2	4	6	2%
Saskatchewan	0	1	1	0%
Manitoba	1	4	5	2%
Ontario	5	25	30	11%
Quebec	22	22	44	17%
Newfoundland and Labrador	13	15	28	11%
Total	94	171	265	100%

[3] There are a variety of resources in the public domain that state different numbers of remote communities. This report uses the Remote Community Energy Database by Natural Resources Canada (NRCan) available at http://atlas.gc.ca/rced-bdece/en/index.html

Figure 2 is a map of Canada's remote communities and their primary energy source (hydro, diesel, other) for electricity. Industry sites such as remote mines are also included in this graphic.

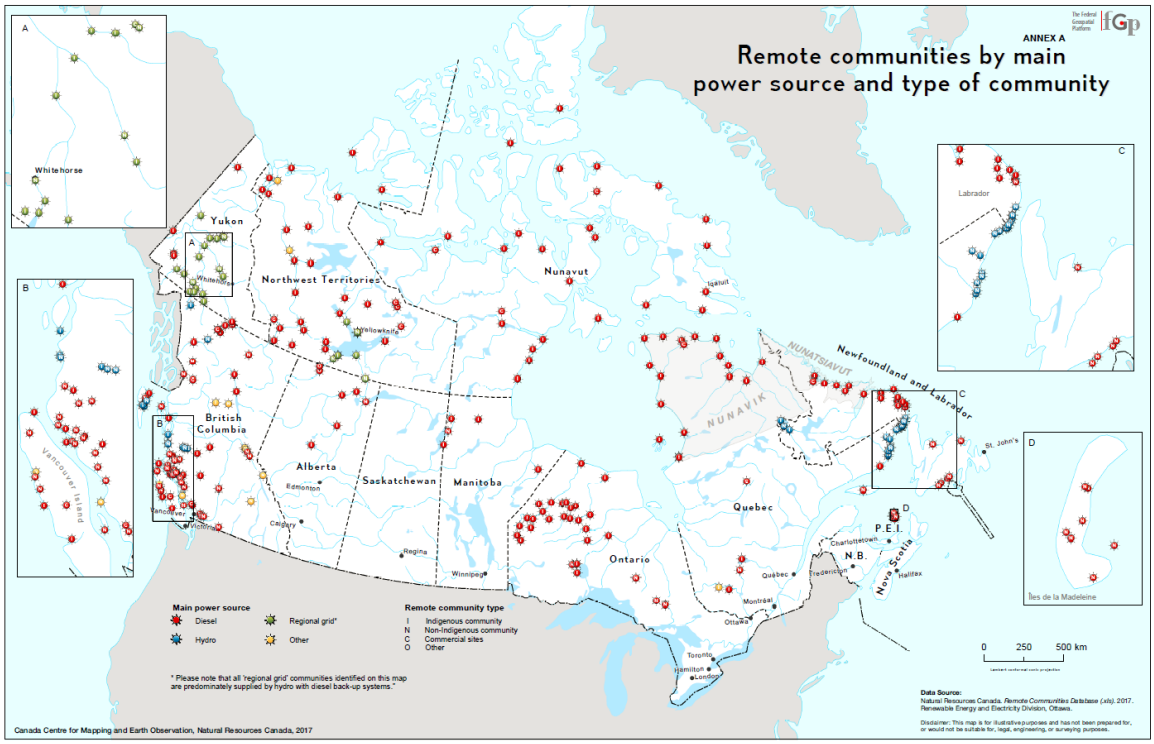


Figure 2. Remote communities in Canada

Source: Modified from NRCan's Remote Community Energy database[4]

Electricity

The majority of remote communities rely on diesel fuel as their main source of electricity generation as well for heat. Approximately 188 of these remote communities (71%) rely exclusively on diesel for their electricity needs. Hydro power is directly supplied to 34 communities, and territorial grids provide 25 communities with power.[5] Only a small number of communities use natural gas (three communities) and heavy fuel oil (seven communities).

[4] NRCan Remote Community Map and Database, http://atlas.gc.ca/rced-bdece/en/index.html

[5] These territorial grids are predominantly powered by hydro and have diesel backup generators

Table 2. Primary electricity source in remote communities

Province / territory	Non-Indigenous	Indigenous	Total	% of total
Hydro	25	9	34	13%
Territorial grid (Yukon, NWT)	6	19	25	9%
Natural gas	1	2	3	1%
Diesel	48	140	188	71%
Heavy fuel oil	7	0	7	3%
Unknown	7	1	8	3%
Total	94	171	265	100%

Heating

Information is limited and incomplete for heating in the NRCan remote community database. Information compiled by the Waterloo Global Science Initiative[6] suggests that 84% of heating in remote communities is by fuel oil (diesel, heavy fuel), 14% by wood and 2% unknown sources.

Remote communities in the north

A significant portion of the conference focused on remote Indigenous communities in Canada's north. *The North* is an ambiguous term and does not necessarily refer specifically to the three territories, as there are many northern communities in B.C., Alberta, Quebec (Nunavik) and Labrador (Nunatsiavut).

Northern remote communities are unique and have specific challenges. It is not possible to have meaningful discussion on human and financial capacity without understanding some of the physical conditions that dictate the pace, scale and challenges of development in northern Canada. The experiences and expertise of those in the North must be respected and solutions must be generated accordingly.

The sections below highlight some of these unique characteristics to consider in regards to renewable energy project development.

[6] Michael Brooks and Nigel Moore, "Energy access – the Canadian context," *Open Access Energy Blueprint* (Waterloo Global Science Initiative, 2017). http://wgsi.org/sites/wgsi-live.pi.local/files/OpenAccess_Energy_Blueprint_WGSI_2017.pdf

Geography and remoteness

Many remote communities are situated a great distance from main populations and infrastructure. For example, Nunavut's 25 communities are spread across almost two million square kilometres. Remoteness greatly affects the technical, logistical, and financial feasibility of renewable energy systems and the human and community capacity to develop or support projects. Securing technical expertise for establishing and maintaining renewable energy systems can be a challenge. If local expertise is not available, human capacity from outside communities must be brought in and there always comes the risk that that capacity will leave the community, potentially draining the community of knowledge.

Logistics-wise, transporting equipment and supplies over great distances and varied terrain can be difficult, technically challenge and expensive. Infrastructure and equipment taken for granted in the south is often limited in the north or not available. Transportation options can also be limiting factors, especially when communities are connected by winter roads that are only open for short periods through the year. Delays and lack of equipment can drive up costs significantly because of the impact to project schedule. With this, project risk increases and becomes a major consideration in project financing. Project financing and unique challenges in the North are discussed in more detail in Chapter 4.

Climate

Northern Canada's climate is experiencing a rapid change and many of the country's remote communities are particularly sensitive to climate change. Global climate model simulations predict that even if the average global temperature increase were limited to 2°C, the North will experience an increase of 3.2°C to 6.6°C.[7] This is due to the amplification effects of the positive feedback loop called the *ice albedo effect*: white snow and ice reflect much of the sun's energy, but rising temperatures melt this snow and ice cover, revealing darker land masses that absorb more solar energy, causing further temperature increases and snow melt.

Permafrost (ground that is permanently frozen year-round) also presents a challenge. Melting permafrost affects the development of renewable energy infrastructure; wind turbine and solar PV foundations require special design considerations.

[7] WWF International Arctic Programme (2005), *2°C is too much! Evidence and Implications of Dangerous Climate Change in the Arctic*, http://assets.wwf.org.uk/downloads/dangerousclimatechange.pdf

Renewable resources

The unique geography of the North presents challenges and opportunities for renewable energy technologies. For example, a common misconception is that there is not enough sunlight in the North to justify investment in solar installations. In the North, many regions experience extreme seasonal variation in daylight hours, from full sunlight to full darkness. So, this is a valid concern during the winter but with continued commercialization and availability of battery storage technologies, solar PV also presents an excellent solution for large reductions in diesel fuel during the summer and shoulder seasons of spring and fall.

Wind turbine projects must consider blade ice loading, wind shear and other installation challenges, but these can be overcome, as shown in Alaska's successful wind turbine deployment.[8] As well, many northern communities are located near large bodies of water where wind speeds are typically greater. Colder, denser northern air is also favourable for wind generation.

Finally, biomass energy systems present a challenge in some parts of the North simply because biomass resources may be limited or non-existent (e.g. in Nunavut). Yet in other areas, bioenergy heating solutions have been pursued with positive outcomes, such as the Fort McPherson biomass district-heating project in the NWT.[9]

Economies of scale

Typically, renewable energy projects have good project economics when they are sized at about 200–300 MW for wind; 50–100 MW for solar; and greater than 10 MW for small-scale hydro. With these larger systems comes economies of scale: project management, permitting and other tasks have to be done regardless of project size and hence are more efficient for larger projects. Also, ordering more components (i.e. bulk purchasing of solar PV panels) is more cost effective. For remote communities, systems are generally an order of magnitude smaller (i.e., a few hundred kW to up to 20 MW), which makes the economics challenging; remoteness amplifying this factor. Smaller systems have higher relative development and engineering costs. This creates an added challenge of attracting private financing because most lending institutions are not that interested in smaller projects.

[8] Ian Baring-Gould, *Wind Energy Deployment In Isolated Islanded Power Systems: Challenges & Realities* (National Renewable Energy Laboratory, 2014). https://www.nrel.gov/docs/fy14osti/61253.pdf

[9] Bullfrog Power, *Fort McPherson Biomass District Heating Project.* https://www.bullfrogpower.com/wp-content/uploads/2015/09/Fort_McPherson-Biomass.pdf

Project costs

All of these factors influence every aspect of a project's lifecycle. The associated cost and conversations around the economics of renewable energy projects in the north cannot ignore this nor be equated or compared to projects in Canada's south. This uniqueness also extends to regulations around energy prices and forthcoming renewable energy policies and regulations.

It is very difficult to give precise estimates of renewable energy prices in the north. There is not enough empirical data available on renewable energy deployment, technology costs differ greatly (even among commercialized systems) and each situation is unique. Solar photovoltaic (PV) systems are one renewable technology where full project cost data is becoming more publicly available. For example, the Government of the Northwest Territories recently released a Solar PV Report Card of solar PV installations in the NWT from 2012–2017.

Progress over the past two years

Much progress has occurred over the years with more clean energy projects being installed, many further along in the feasibility and engineering phase, government policies and programs being implemented, training and networking opportunities created.

Too numerous to mention, but many small, medium and large-scale clean energy projects have been developed in remote communities across provinces and territories over the past few years –noticeably BC, Yukon, NWT, Ontario and Quebec. A compiled list of all types and sizes of install projects is currently a gap, along with complete project costs of these projects. There have been a few recent advancements in mapping and databases that summarize some remote communities and their energy sources, as well as renewable energy projects, including NRCan's remote community database[10], the Government of Canada's map of clean energy resources and projects (CERP)[11], the Indigenous Clean Energy map listing 140 clean energy projects in Canada greater than 1 MW.

[10] http://atlas.gc.ca/rced-bdece/en/index.html

[11] http://atlas.gc.ca/cerp-rpep/en/

Territory policy progress

Each of the three territories provided an update on policies supporting renewable energy development in their jurisdiction.

The Yukon government has focused in three main areas: significantly expanding energy efficiency initiatives and actions; growing the renewable micro-generation market (resulting in 125 systems totalling just under 1 MW) and advancing First Nation government-led renewable energy projects through direct support; and advancing Yukon's soon-to-be-legislated IPP policy[12] that will enable power projects to be developed by First Nations. These First Nation projects include 180 kW solar, a district heating system in Teslin (consisting of 10 biomass boilers) and 8 MW of planned wind along with 500 kW of planned solar.

The NWT developed both a Solar Energy Strategy[13] and Biomass Energy Strategy[14] back in 2012 and has helped with advancing both of these industries in the territory. More recently, the GNWT finalized and released their 2030 Energy Strategy[15] and their 2030 Climate Change Strategic Framework[16] to define their vision for addressing energy and climate change issues. The GNWT's Energy Strategy announces a shift away from an official government IPP policy while the Energy Strategy emphasizes collaboration with Indigenous communities and a target reduction of diesel use in remote communities by 25%.

In Nunavut, the government has spent significant time reviewing community energy plans and considering renewable energy alternatives in the territory. The government has developed and released a net metering policy[17] in 2018 and is currently working on changes to the Qulliq Energy Corporation Act to enable third-party power production through an IPP policy. Their IPP policy is currently targeting implementation within the 2018/19 fiscal year.

[12] Yukon's draft IPP policy - http://www.energy.gov.yk.ca/pdf/independent-power-production-policy-201510.pdf. The Government's policy is forecasted to be legislated by January 2019.

[13] http://www.enr.gov.nt.ca/sites/enr/files/strategies/solar_energy_strategy_2012-2017.pdf

[14] http://www.grrb.nt.ca/pdf/forestry/NWT_Biomass_Energy_Strategy.pdf

[15] https://www.inf.gov.nt.ca/en/energystrategy

[16] http://www.enr.gov.nt.ca/sites/enr/files/resources/128-climate_change_strategic_framework_web.pdf

[17] https://www.qec.nu.ca/customer-care/net-metering-program

Federal budget initiatives

Over the past two years, through Budget 2016 and Budget 2017, the federal government has announced further commitments to improving the lives and well-being of Indigenous peoples in Canada, with an increase in funding for culture, language, health, education, housing, environment and climate change mitigation and adaptation. Altogether, $3 billion has been allocated in addition to the $11 billion to support Indigenous people of Canada.

Some of the federal investments identified through Budget 2016 and Budget 2017 provide a whole-government approach to reducing diesel in remote communities. Some of these investments provide direct support for diesel reduction in communities and some investments provide ancillary support for reducing diesel consumption and mitigating the impacts of climate change through clean growth innovation, green infrastructure and low carbon technologies. The direct investments presented in Budget 2017 have intentional focus on Indigenous community engagement, energy literacy, planning, efficiency and the technology deployment of renewable energy systems, both heat and power.

Pan Canadian Framework on Clean Growth and Climate Change

Within Budget 2017 was a commitment to $650 million over four years to support the Pan Canadian Framework on Clean Growth and Climate Change (PCF).[18] This funding framework includes investments focused on reducing diesel use in remote communities.

Under the Pan Canadian Framework, various ministries have programs to support clean energy and diesel reduction in remote communities across Canada. The main Budget 2017 funding programs directly supporting diesel-based remote communities include:

Natural Resources Canada

- *New* Clean Energy for Rural and Remote Communities (CERRC) Program – $220 million over six years to reduce the reliance of rural and remote communities on diesel fuel, and support the use of more sustainable, renewable power solutions.

The CERRC launched two calls for proposals in late February 2018 – the main CERRC program for bio heat, demonstration and deployment projects[19] and a stream dedicated directly towards building capacity within communities[20]

[18] https://www.canada.ca/content/dam/themes/environment/documents/weather1/20170125-en.pdf

[19] https://www.nrcan.gc.ca/reducingdiesel

- ***New*** Impact Canada Initiative (ICI) – $75 million over four years for new innovative Challenge-based approaches for clean technologies. A portion of this will go towards the Off-Diesel Challenge.
- ***Continued*** Indigenous Forestry Initiative (IFI) – $10 million over three years to support indigenous communities to use and manage biomass resources for heat and power for economic development opportunities.

Indigenous Affairs and Northern Canada

- ***Continued*** Northern Responsible Energy Approach for Community Heat and Electricity Program (REACHE) Program – $53.5 million over 10 years and $5.4 million ongoing to continue supporting remote communities north of the 60th parallel on energy efficiency and renewable energy technologies for heat and power.

Infrastructure Canada

- ***New*** Arctic Energy Fund – $400 million over 10 years to address energy security for communities north of the 60th parallel, including Indigenous communities. Funding will be delivered through integrated bilateral agreements with territorial governments.

In the past, government funding has typically funded research, feasibility studies, pilot systems and provided capital to implement renewable energy projects. Since 2006, the federal government has provided over $75 million to fund research and development of off-grid energy systems.[21] One of the largest funding sources has been from INAC's ecoENERGY for Aboriginal and Northern Communities program, which contributed over $24 million between 2007 and 2016, but expired on March 31, 2016. These new programs under the PCF collectively represent approximately $750 million – an impressive increase compared to previous funding and an indication of the federal government's commitment to reducing diesel consumption in remote communities.

CERRC, ICI and REACHE programs are focused on diesel reduction in remote communities through energy efficiency and renewable energy technology deployment, with dedicated funds also applied to building capacity in remote communities. The Arctic Energy Fund (AEF) applies to remote communities in all three territories and focuses on energy security and diesel infrastructure with renewable energy integration

[20] http://www.nrcan.gc.ca/energy/science/programs-funding/20477

[21] Conference Board of Canada (September 2016), *Power Shift. Electricity for Canada's Remote Communities*.

as a possible aspect of increasing energy security. The $40 million per year for the territories will be transferred through bilateral agreements and each territory will determine the use of the AEF fund.

There are other ancillary support programs under the PCF from various federal departments that support diesel reduction, energy innovation and green infrastructure projects – these are summarized with more information in Appendix B. Example programs include the Rural and Northern Communities Infrastructure Program, Green Infrastructure Program (energy efficiency buildings), Clean Growth Program, Clean Energy Innovation and the Low Carbon Economy Fund.

Government portal for rural and remote communities

A government portal was created and launched in February 2018 along with the opening of the CERRC program. The portal *Reducing Reliance on Diesel for Electricity and Heat in Remote Communities* (https://www2.nrcan-rncan.gc.ca/es/diesel) is an access point to submit a project idea to the federal government and to receive feedback on what government programs are best suited to support the project.

Indigenous survey results

Feedback from Indigenous leaders who attended the conference and completed the survey indicated that the event was well received and quite applicable to their current work on clean energy, as highlighted in Figure 3; all leaders who responded ranked the conference seven or higher.

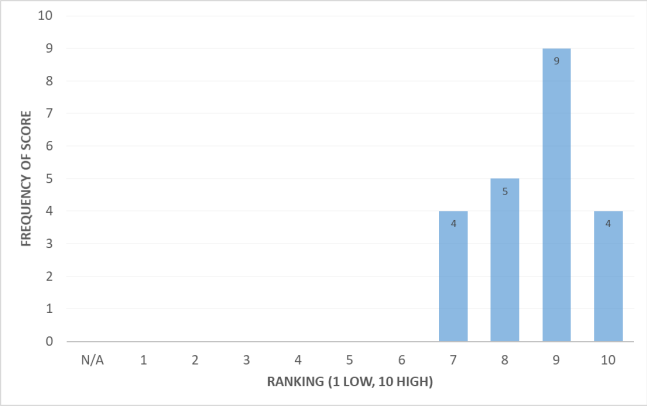


Figure 3. Rating of overall conference and applicability to your work

Human capacity had the highest interest amongst leaders, with 82% responding they found the information presented on this topic more useful to their work. Comments included: human capacity should take priority over financial capacity since that (building and maintaining capacity) is what they are struggling with most in their communities. A few noted that meaningful relationships developed over the years with government and experts have helped build capacity in their community and this has helped members to stay in their communities. This social capital — meeting new people, sharing stories and developing relationships — is vital to successes.

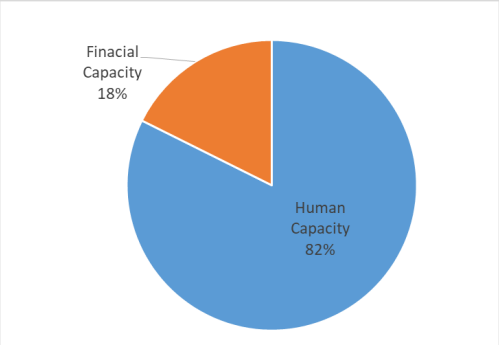


Figure 4. Interest in human capacity vs. financial capacity

What was the most important thing you learned at the conference?

There were many comments on the value and importance of hearing Indigenous stories, sharing experiences (both positive and lessons learned), networking, and becoming more aware that many communities are in the same situation (i.e., struggling with community development, understanding what options might work best for the community and determining the best way to begin). Hearing about other communities' successes, journeys and how long the process can take was helpful in demonstrating how renewables can provide solutions and opportunities for communities. Information sharing, training and education were also noted as extremely important aspects of human capacity and in turn, the critical importance to build capacity within communities and how some communities are responding to this.

What areas of energy work are you involved with in your community?

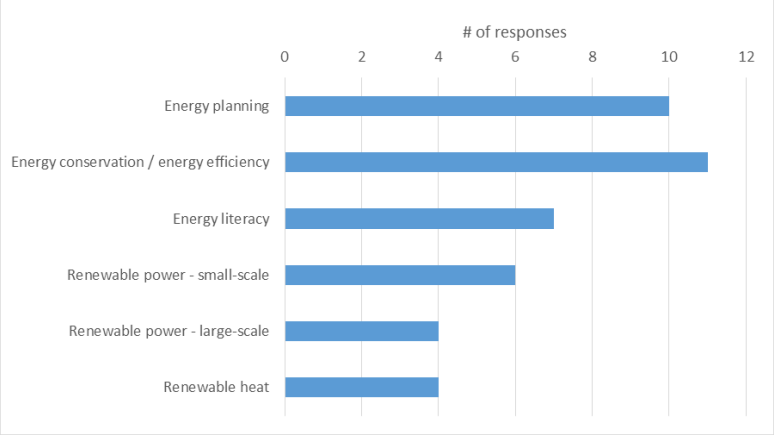


Figure 5. Types of energy work being done

There was good representation on the different areas Indigenous communities were working on: energy planning, energy conservation/efficiency and energy literacy were well represented. Small-scale and large-scale renewable projects as well as renewable heat projects were also being explored.

What is the biggest opportunity for renewable energy or energy efficiency in your community that you are exploring?

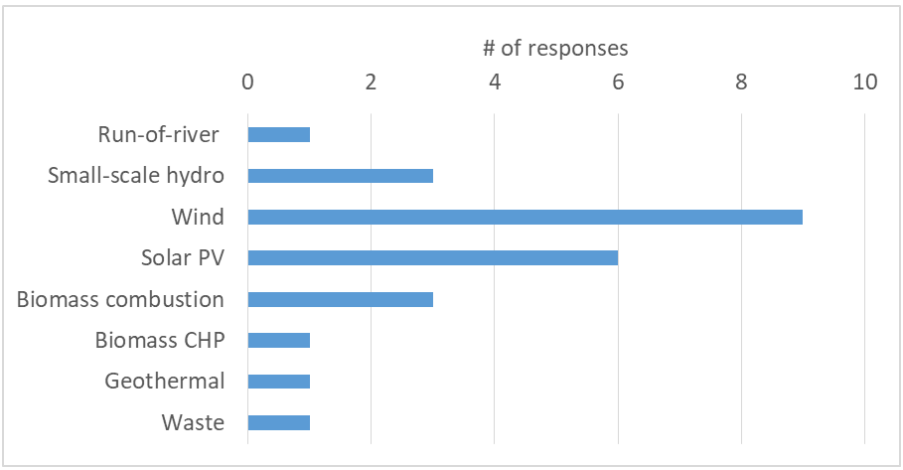


Figure 6. Energy opportunities being explored

Solar PV and wind power are the opportunities communities are exploring most. A few communities are also exploring small-scale hydro and biomass combustion.

Overall feedback

Overall, four key elements were identified by Indigenous leaders as essential for the success renewable energy projects and communities' sustainable development: education, youth engagement, governance structures, and partnerships.

The role of **education** in building human capacity is well understood. It is necessary to develop local expertise that understands and can tackle the unique northern challenges, but currently barriers exist including funding for developing educational programs and the lack of access to higher education for youth.

Youth engagement is important because young people can maintain the knowledge and experience of how to successfully undertake renewable energy projects. Engagement also helps keeps young citizens in communities and reduces reliance on expensive external expertise.

Community leaders said that it is important for municipal, territorial, provincial, and federal **governments** to include Indigenous communities more in the planning, budgeting and decision-making.

Finally, opportunities for **partnerships** were highlighted not only because they are important for developing experience and knowledge bases, but also because southern communities need to learn about the unique challenges that exist for northern communities developing community-specific solutions. There is great eagerness among Indigenous leaders and communities to continue sharing experiences and learning together.

For next steps, Indigenous leaders expressed keenness to take back and share what they learned with their community. Case studies and materials from the stories they heard would be helpful. Also highlighted by Indigenous leaders was the need for expert guidance and economic development planning to help consider the different approaches available and identify the areas communities could explore. For the Renewables in Remote Communities conference in 2019, Indigenous leaders would like to see more youth, women and financial sector representatives present and for more workshops, specifically around energy planning and Arctic climate change awareness.

Further feedback on specific questions in the survey can be found in Appendix A.

3. Human capacity – highlights

Overview

Human capacity is the ability of individuals to solve problems and perform their job using knowledge, training, expertise and skills. Building human capacity in remote, especially Indigenous, communities, enables people to seek out economic and social opportunities, and increases employment within communities. This leads to increased social well-being for individuals and healthier communities. A high level of human capacity within remote communities nurtures self-reliance and provides a level of independence in the face of these communities' remoteness. This subject is complex and highly qualitative, rather than measured or achieved through sound engineering.

External forces, such as government initiative or industrial activity often drive capacity building in remote communities. These external forces are often the catalyst to support capacity building. But in order to develop genuine capacity, the communities themselves must want and value human capacity development. A root problem is that for many communities, even the initial efforts of identifying human capacity goals and resources and finding funding support is challenging. This creates a cycle where communities can't even get out of the gate when it comes to increasing human capacity. It is not uncommon for remote communities to be over capacity just dealing with day-to-day challenges keeping community infrastructure functioning, facing community stresses and handling finances. Often communities do not have the opportunity to increase their human and community capacity due to these limited community resources and skillsets. They need assistance even in this first phase of identifying and scoping required skills training, economic and business opportunities and support.

Clean energy and diesel reduction projects face similar human and community capacity challenges. There are many examples of remote communities that have implemented clean energy projects, energy efficiency programs and other aspects that have supported the development of clean energy businesses and companies. Yet some communities have not even had the opportunity to venture into the space of clean energy development because they are dealing with higher community priorities or do not have the social capital in their community to contemplate and explore ideas.

Clean energy development offers many opportunities for increasing capacity in communities; energy assessments and energy management, a comprehensive energy vision and planning approach, energy conservation and energy efficiency programs, and

renewable energy technologies are all unique areas that require specific knowledge and skillsets. Each of these areas offer business opportunities for communities to explore that have the potential to employ community members, generate revenue for members and/or the community, and improve the overall economic and social condition in communities.

Polls

Several polls were taken during the conference to get initial input on various aspects of human capacity as it relates to remote communities. These were:

Question 1 - What does human capacity or capacity building mean to you?

Figure 7. Responses to Question 1

Prominent words reflected include community, skills, sustained, people, pride, youth, people and future. The word “youth” was repeated several times in one particular response. Although this is a valid point, that repetition was removed in order to not skew results in favour of one response.

Question 2 - What type of capacity building do you think is most useful?

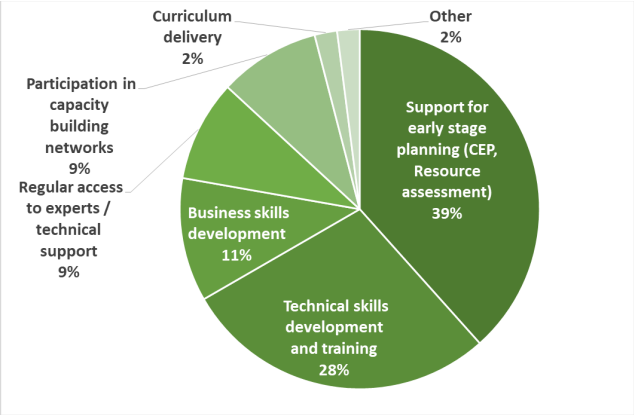


Figure 8. Responses to Question 2

Results indicate capacity building support was most useful for the initial stages of renewable energy project exploration, namely for community energy planning and resource assessments. There was also support for more technical skills development and training (28%) and business skills development (11%).

Question 3 - What stage of project is support most critical?

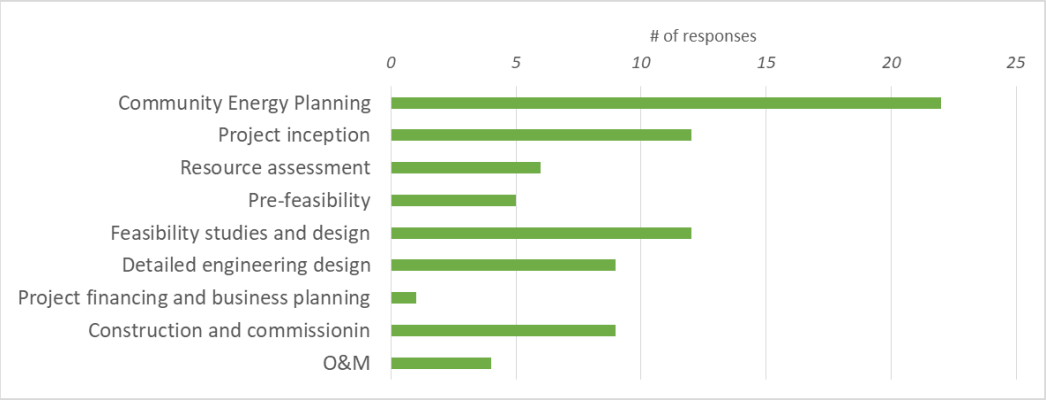


Figure 9. Responses to Question 3

Again, results indicated that the early stage in a project lifecycle — community energy planning, is the most critical. Other stages of project development — project inception, feasibility studies and design, detailed engineering design and construction and commissioning, also received high ratings. Collectively, community energy planning and project inception received 43% of the total votes.

Responses to Questions 1 and 2 strengthen the overall message that capacity building is most important in early project development stages and this is where the majority of support is desired.

Model for capacity evaluation

The five types of capital

Several frameworks for capacity evaluation have been researched, developed, and proposed as they related to sustainable development.[22,23] One of these is the concept of capital. Early references of the concept defined capital as the potential to produce something that is economically desirable.[24] As sustainable development becomes more prevalent in conversations and these conversations now include environmental, social and corporate responsibility characteristics, the concept of capital is evolving beyond the economic bottom line approach. Capital is now being defined as the potential to produce desirable development outcomes considering various dimensions of sustainable development and the incorporation of non-economic principles.

The five types of capital presented at the conference by the Government of Yukon[25], described in

Table 3, are: human, institutional, natural, social, and financial capital. All types of capital (other than natural) must be built. Natural capital must be protected. Human capital is directly tied to the importance and need for human capacity within communities. The size, knowledge and skillset of a workforce can be considered human capacity, and as an example, the youth that graduate from educational institutions and join the community workforce are a human capital flow. The inclusion of human, institution, natural and social capital into the default financial capital approach is a necessary evolution to support more progressive decision-making models around the multitude of benefits that come from clean energy projects.

[22] United Nations Development Programme (2008), *Capacity Assessment Methodology User's Guide*, http://www.undp.org/content/dam/aplaws/publication/en/publications/capacity-development/undp-capacity-assessment-methodology/UNDP%20Capacity%20Assessment%20Users%20Guide.pdf

[23] MuSIASEM Modelling Framework, http://iaste.info/musiasem/musiasem-in-depth/

[24] http://www.ase.tufts.edu/gdae/publications/working_papers/03-07sustainabledevelopment.PDF

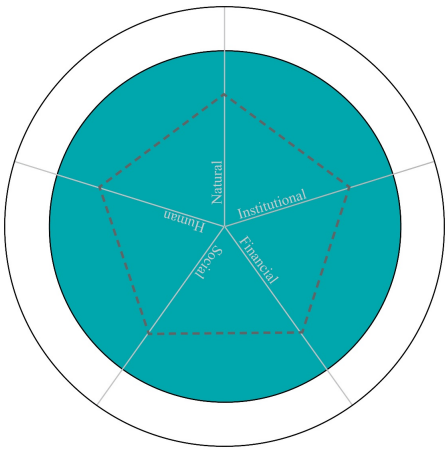
[25] Government of Yukon, Energy Solutions Centre, https://www.bullfrogpower.com/communities2017/2017-day1-Ryan-Hennessey.pdf

Table 3: Five types of capital

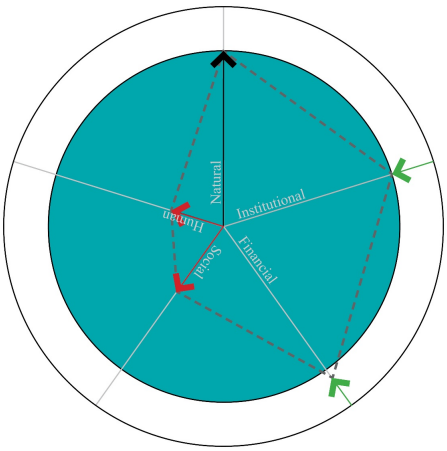
Type of capital	Description
Human	Education, information, knowledge, skill sets and expertise held by people
Institutional	Governance, regulations, strategic planning and administration held by communities
Natural	Natural environment and ecosystem services, non-renewable and renewable resource
Social	Informal and formal relationships between people, and the influence social networks have on community development and direction
Financial	Fixed or liquid assets and ability to attract investment

A capacity evaluation tool

Based on these five categories, an evaluation tool was presented at the conference to help communities better evaluate their capacity using this model. Through consensus, an evaluator works with community representatives to define and then investigate the five types of capital available to them to complete a given objective. Community members are invited to establish which factors form each type of capital and then provide measures for each factor. The end result is a visually accessible "radar diagram" of capital that shows where a community is strong; where it is weak and requires additional support; and how the dynamic interplay between the factors can give insight into opportunities and threats.



Example of *perfect* community – All streams flow outward, enabling a community to accomplish goals using local resources



Example of *less-than-perfect* community: The community draws capital from outside (green arrows) and leverages natural capital (black arrow) from within, resulting in shortfalls in social and human capacity (red arrows)

Figure 10. Five levels of capital in development of community energy projects[26]

One message highlighted during this presentation was *Protect your social capital*. Human capital can be built, financial capital can be resourced, but social capital — the relationships, trust and collaboration of community members — is the only capital that cannot be imported. Investing money in community members, especially youth, can protect social capital. Investment must emphasize training, providing opportunities, making them part of something large and meaningful ("being part of the team") and sending them to other communities to see other types of projects and build relationships. Empower them with opportunity and they will feel empowered in return. Without this investment, people can be lost to the outside, which is often the case in remote communities.

Sharing stories from Indigenous communities

An intentional focus of the Human Capacity day was to hear from Indigenous communities with successful renewable energy projects. Below are the three main community stories, along with a summary of the support NRCan provided Whitesand

[26] From Ryan Hennessey, "The Dynamic Role of Capital in the Development of Successful Community Energy Projects," Renewables in Remote Communities 2017 conference presentation.

First Nation in developing their bio-economy over the past several years and the various NRCan programs that are available.

Old Crow Solar Project, Old Crow Yukon

Community

The Vuntut Gwitchin First Nation became a self-governing Nation in 1993 through a modern land claim agreement. This community is exercising their inherent right to self-governance and putting the welfare of community members first. Old Crow is the only community in the Yukon that is not connected to any roads; it is accessible only by air. Old Crow is approximately 800 km northwest of Whitehorse, above Canada's Arctic Circle, and has approximately 240 community members. The electricity system in the community consists of three diesel generators (totalling 1.1 MW capacity) operated by ATCO Electric Yukon that consume approximately 650,000 litres of diesel per year. The cost to produce electricity in Old Crow is around $0.80 / kWh. All diesel for the community is transported by air.

Solar project work completed

The Vuntut Gwitchin Government (VGG) considers Diesel both an environmental and economic liability, and the community has been exploring renewable energy opportunities for many years. In 2016 a detailed study that investigated the technical and economic viability of a large-scale solar PV project in Old Crow was completed. The community already has 21.1 kW of grid-tied solar, and the VGG is developing a 450 kW solar PV array with a battery energy storage system. This system would be connected through a micro-grid controller to the diesel-powered micro-grid owned and operated by ATCO Electric Yukon. The project is expected to displace 150,000 litres of diesel per year, reduce GHG emissions at the diesel plant by 420 tonne CO_2e per year and avoid transportation emissions of 105 tonnes CO_2e per year. The diesel plant will be shut off completely 17% of the time, and the solar energy penetration to the electrical grid will be 24% (of 2.6 GWh per year). The project will improve air quality and lessen noise pollution in the community, along with reducing other environmental and social impacts. To ensure grid reliability, VGG is working with the Yukon Research Centre on a grid impact study. The Old Crow Solar Project has been assessed by the Yukon Environmental and Socio-economic Assessment Board, and has the necessary permits to proceed. The remaining tasks include final detailed engineering and design, and completion of a Power Purchase Agreement (PPA). Construction is planned for the summer 2018.

Partnership model

The partnership model being explored is a PPA between the Vuntut Gwitchin First Nation and ATCO Electric Yukon. To advance this, a Memorandum of Understanding was signed among Vuntut Gwitchin, ATCO, the Government of Yukon, Energy Branch. The memorandum of understanding describes the joint objectives for the project and outlines the roles and responsibilities of each party involved. The partnership model is one of joint ownership: Vuntut Gwitchin would own, operate and maintain the solar PV panels (through their Community Development Corporation) and ATCO would own, operate and maintain the battery energy storage system and micro-grid controller. Through the PPA, ATCO would purchase electricity from the community at a set price. The revenue generated for the community would then stay in the community to support community initiatives and local economic development.

The direction from Old Crows Elders was to work with respect with other people and that is the approach the community has been taking.

Progress

VGG is in the final stages of reaching an Electricity Purchase Agreement with ATCO Electric Yukon. The grid impact study undertaken by the Yukon Research Centre is finished, and the project design is complete. Procurement of solar PV panels and racking is underway, and the on-site electronics building has been purchased. Ground breaking is planned for late spring 2018, with the solar PV array constructed by the end of the summer. The battery energy storage system and micro-grid controller will be installed early 2019.

What it is doing for the community

Advancing this solar project in the community has sparked many discussions and it has been the right thing to do. The community has learned a lot, increasing their capacity and knowledge on what it takes to develop a solar PV project in a remote community. There has been good youth interest and engagement in the community as a result of this project.

Figure 11. Youth engagement in the Old Crow Solar Project[27]

The community is further exploring renewables, looking at wind, biomass, energy efficiency retrofits and waste heat recovery.

Small-scale hydro project – Atlin, B.C.

Community

Atlin is one of many remote communities in B.C and is home of the Taku River Tlingit First Nation (TRTFN). The community has a population of approximately 400 people and is located in the far north of B.C. Atlin is in the territory of the Taku River Tlingit people which also extends into Yukon and Alaska.

Small-scale hydro system and ownership model

Atlin wanted to explore alternative energy opportunities, and developed a vision based on three goals:

- revival of cultural values and sustenance
- responsible resources management
- sustainable economic development

The sustainable economic development goal had further goals, including creating employment, investing in training and capacity building, making money (and stopping money from leaving the community), and using local natural resources that are environmentally beneficial. This vision allowed the community to explore the viability of a small-scale hydro project that eventually came to reality. In 2009, the community's diesel plant was replaced by a small-scale hydro system on Pine Creek that provides all

[27] William Jose, "Old Crow Solar Project," Renewables in Remote Communities 2017 conference presentation.

of the community's power. The capacity of the system is 2.1 MW and is 100% operated by the Xeitl Limited Partnership (XLP) – which in turn is 100% owned by the community. A 25-year Energy Purchase Agreement (EPA) was signed between XLP and BC Hydro and they are in their 10th year of selling power to BC Hydro. The negotiated contract rate in the EPA was based on the small-scale hydro operating costs, debt payoff and interest rates and additional revenue to benefit the community as a whole.

Capacity building and economic benefits from project

The project has seen direct involvement, participation and employment of local community members. The construction phase created $333,000 in salaries for TRTFN members and injected $1 million into the local economy. Employment resulting from this project exceeded expectations by 58% forecasted. Revenue from the project for the past four years is also at just under $1 million — 88% higher than predicted.

One of the significant economic benefits from the project is the Skills and Training Program (STEP), which was developed and implemented by the community. This is a flexible training program that supports people where they are at in their lives and needs, allowing them to participate multiple times. So far, the community has invested $500,000 of the revenue from the hydro project into its people. With this seed money, they have also been able to double the investment from provincial and federal governments. A key benefit in developing these training programs and using locally generated revenue is the flexibility: unlike government funding programs, the community decided to minimize and limit the amount of reporting and guidelines necessary; they wanted to focus specifically on spending money that most benefits community members.

Key messages and learnings

- Patience is an important characteristic when working with Indigenous communities. The fast financial timelines and time constraints of the western or business world don't necessarily work with Indigenous communities. Have patience and have grace, respecting the traditional history of community members from remote communities.
- Perseverance and passion prevail to bring the vision to reality. Many setbacks, obstacles and challenges will undoubtedly be faced, but the belief and confidence in the vision will keep things going. This requires community champions to lead and believe in the long-term benefits of these projects.
- The ability to design the funding and limit the reporting requirements can increase the effectiveness and positive impact of the money invested.

- Hands-on experience and physical work is very aligned with Indigenous experience and history. For community members that desire continued connection to the earth, getting involved in hands-on projects such as small-scale hydro or other renewable projects can provide an outlet where people can excel.
- Empowerment of communities and their members is a product and outcome of these efforts. Supporting, investing and contributing to the leadership of remote communities will empower them to craft their own energy future: "Us driving our bus." Empowerment can also be viewed as a great instrument to reconcile collective history.
- TRTFN's hydro project is leading to more opportunities. The community is looking at an expansion project — both selling power to Yukon and perhaps expanding the capacity of hydro. Initial forecast estimate that up to 46,000 MWh of new electricity could be produced and sold. Using the economic metrics from the current project, this project could produce $1.6 million for TRTFN community members and $3.1 million for non-TRTFN members.

Bioenergy economy – Whitesand First Nation, Ontario

Community

Whitesand First Nation is an Ojibwa community and one of many remote communities in northern Ontario, located approximately 250 km northeast of Thunder Bay. The community has an on-reserve population of approximately 400 people. It is a diesel-dependant community and is currently one of the four remote communities identified in the Ontario Long Term Energy Plan that will not be connected to Ontario's provincial grid.

The community has a high unemployment rate (around 70%). Its location is in an established forestry area where historically, most economic revenue generated from forestry went south and did not benefit the community. When the forest industry collapsed in the mid-2000s, Whitesand First Nation saw an opportunity.

Bioenergy project

Whitesand had been exploring bioenergy and sustainability issues since 1992 through a community vision and a long-term energy independence commitment through a proposal for a community forest which included a biomass cogeneration (CHP) facility. Significant advancement in sustainability efforts came in 2009 through the Community

Sustainability Initiative (CSI) which consisted of five pillars (society, culture, economy, ecology and capacity) as shown in Figure 12.

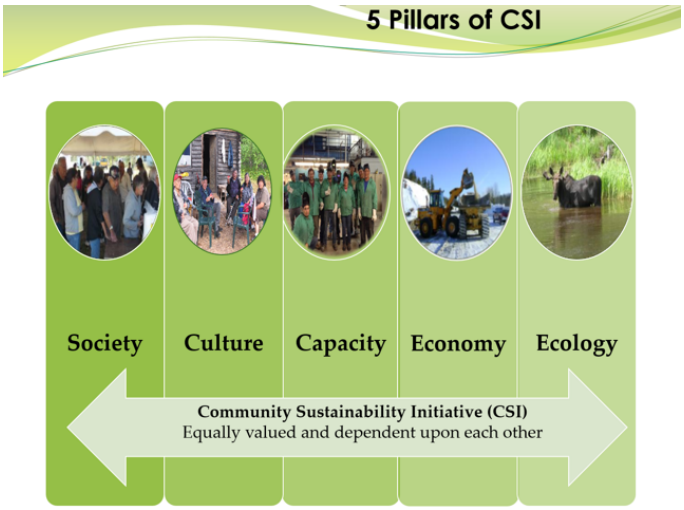


Figure 12. Five pillars of Whitesand's Community Sustainability Initiative[28]

The proposed project includes a 5 MWh CHP facility which will provide electrical power to the Hydro One Remotes local distribution grid to supply Whitesand First Nation Reserve and the communities of Armstrong and Collins. Additionally, the CHP will supply a new wood pellet facility, which will produce 90,000 metric tonnes of ENplus certified premium bagged residential pellets. It is anticipated there will be 1 MW of additional capacity that can be utilized for future growth. The project also includes a wood merchandising yard to provide full stand utilization and value-added opportunities.

Together these facilities create the Bio-Economy Centre, located on a 36-hectare former forestry camp site now owned by Whitesand First Nation. The site development work has been completed included clearing, site lighting, roads, fire protection, and building pads (compacted gravel). The $4.4 million dollar project was completed through funding from Whitesand First Nation and federal and provincial programs.

Their vision of the bio-energy community was not just about getting off diesel but was also about creating jobs and revenue in the community. Once implemented, it will be the first remote community in Ontario to completely transition off diesel. Their vision was also built on the five types of capital as highlighted earlier in this chapter. Through

[28] David Mackett and Craig Toset, "Whitesand First Nation – Building an Indigenous Bio-Energy Community," Renewables in Remote Communities 2017 conference presentation.

their process, the community identified their natural capital (their forests), social capital (vision and commitment), institutional capital (efforts to reduce impacts from climate change), financial capital (funders, partners) and human capital (people in the community who want to be part of the vision and obtain jobs).

The vision, commitment and progress was recognized at the provincial level when Ontario nominated the project to the federal Low Carbon Economy Leadership Fund as an Ontario priority. If awarded, this fund will be ground breaking to support a capital investment which will strengthen the project's ability to reinvest revenue and into housing, social programs, education and infrastructure.

Partnership model and PPA contract

Whitesand First Nation first began power purchase negotiations with the Ontario Power Authority. Initial conversations did not recognize the social and environmental benefits this bioenergy project could provide. In 2015, the Ontario Ministry of Energy released a provincial directive[29] exercising its statutory power of direction to the Independent Electricity System Operator under the 1998 Electricity Act. The directive recognized the unique situation of Whitesand First Nation (not having the option to be connected to Ontario's grid), the benefits of eliminating diesel fuel from the community through renewable energy, efforts towards climate change mitigation, carbon reductions, jobs and economic development in the community. The directive established a base PPA rate of $0.257 per kWh of electricity produced with an escalation percentage over the 20 years of the project. Additional to the base rate was an economic development "adder" of $0.184 per kWh of electricity produced to recognize the economic and social benefits the transition to renewables and development of a wood pellet facility will have for the community. This resulted in a total PPA price of $0.442 per kWh.

This ministerial directive and social "adder" were massively influential in making a strong business case for the project and allowing the project to have a guaranteed favourable PPA. The work and efforts to analyze, quantify and incorporate this social "adder" included reviewing carbon cap-and-trade policies and carbon offsets.

[29] Ontario Ministry of Energy, *Non-Utility Generator Projects, Combined Heat and Power Standard Offer Program 2.0, Chaudière Falls Hydroelectric Generation and Whitesand First Nation Biomass Cogeneration,* December 14, 2015. www.ieso.ca/-/media/files/ieso/document-library/ministerial-directives/2015/directive-nug-chpsop-20151214.pdf?la=en

Capacity building and economic benefits from project

The bioenergy project is expected to create 70 full-time jobs within the bio-facilities and related forestry activities. Revenue from the operations will be used to repay debt loans and be sent back into the community.

As a result of Whitesand's efforts, youth and students have become interested in forestry and are staying in school and attending post-secondary education. Two women in the community have entered into forestry programs. Other students have gone into power engineering programs, forest ecosystem technician programs, environmental technician programs, welding and fabrication.

Whitesand's efforts have also been recognized by Ryerson University and the Ontario Centre for Workforce Innovation. Both entities are committed to supporting workforce development and human resource specialities in the community — lining up training and jobs so the community can excel in their bioenergy economy.

Key messages and learning

- The advancement of renewable energy projects should not and cannot be strictly based on economics; environmental, social and socio-economic benefits must be part of the vision and decision-making. Visioning cannot be a silo approach.
- Capacity building is not just about capacity, but about creating vision and commitment. Only a well-established vision brings commitment and this commitment builds your champions.
- Government policy leadership is key to advancing projects like this. The leadership in the Ontario Ministry of Energy to mandate the inclusion of a social "adder" to the PPA contract showed true innovation to unlock the business case for Whitesand.
- "Carbon reductions can transform to poverty reductions" – establishing an equitable PPA rate and transitioning a community off diesel onto renewable energy has the potential to significantly and positively benefit communities at large.

NRCan program support

Programs

Summarized in the *Federal budget initiatives* section in Chapter 2 are several current and upcoming NRCan programs that are focused on diesel reduction in rural and remote communities. Of significance are the $10 million Indigenous Forestry Initiative (IFI),

$220 million Clean Energy for Rural and Remote Communities (CERRC) program (including the CERRC Capacity Building Stream) and the $75 million Impact Canada Initiative.

Specific to the IFI program, NRCan has collaboratively worked with Canadian Forestry Services, INAC, CanNOR, and FedNOR and funded 15 bioenergy projects over the past seven years to the amount of $7 million. IFI recently went through a review process with communities to see how the program could be improved. Feedback from this process that will be taken into account for future program includes:

- Communities want to see less of a *silo approach* to funding opportunities and more collaboration towards a holistic approach.
- Acknowledgement that energy security is fundamental, and the importance of linking energy security with economic development and community capacity.
- Projects needs to be community led, which means building capacity through workshops, skills training, business planning and project management.
- The funding to support capacity building support also needs to be more flexible, to allow training for collective groups (e.g. economic development corporations, business entities, board, community groups) instead of only individuals.

Supporting Whitesand First Nation

NRCan has provided over $1.25 million in support to Whitesand First Nation as the community has explored their bioenergy opportunities, starting with their First Nation Forestry Program through support for land tenure for their community forest.

Over the years and through NRCan's IFI program, they have worked closely with Whitesand in several areas:

- Funding support for business planning, PPA negotiations and capital investment in the larger bioenergy project
- CFS staff providing human capital and resources not available in Whitesand; for example, CFS staff helped the community with the GHG calculations to support their Low Carbon Economy Fund application.
- Collaboration support and working closely with the Ministry of Natural Resources and Ministry of Energy
- Supporting the establishment of a Funder Table which was a key component that provided federal and provincial funders an opportunity to openly discuss what activities they could fund under their contribution programs. The Funder Table met quarterly with the federal department and Ontario Ministries to keep the momentum of the project and helped target funding to where it was needed with maximum flexibility.

- Supporting feasibility studies and business planning. NRCan is currently supporting the research on wood ash and whether this by-product from biomass combustion could be redistributed back to their forests for ecological and nutrient recycling.
- CFS scientists now engaging to support multi-national/-lateral forest science with a focus on caribou and GHG monitoring on the Armstrong Forest. The IFI program is providing funding to increase Indigenous participation in forest management planning.

Other capacity building training programs / collaborations

Arctic Remote Energy Networks Academy (ARENA) program

The ARENA program was started in 2017 and addresses the need to develop community energy experts in Arctic communities to ensure affordable, reliable, renewable energy solutions. It seeks to increase human capacity and promote leadership through the creation of a knowledge exchange program emphasizing the development, operation, and management of remote energy networks (micro-grids) incorporating renewable resources.

20/20 Catalyst Program

The 20/20 Catalyst Program is beginning its third year. It is an intensive summer program designed to provide leaders from Indigenous communities across Canada with the skills and resources to maximize the social and economic benefits their communities can gain through participating in clean energy projects. Participants gain tangible experiences and learnings they can bring back to their communities to begin or continue developing a project.

4. Financial capacity – highlights

Overview

In the broad sense, financial capacity is the collection of knowledge, skills and resources related to money management and the ability to advance economic development, raise equity and make investments. Financial capacity and economic development are foundational components for Indigenous communities — especially Indigenous governments moving towards self-governance and more financial independence. Self-governance requires access to education, training and skills development around governance, good budgeting and fiscal management.

Building financial capacity enables remote Indigenous communities to seek and find opportunities to advance economic development. Without financial capacity, reliance on external government funding will continue and Indigenous communities will be challenged to advance their own local economies and businesses, find and form partnerships and attract external investment. Remote Indigenous communities are challenged by the simple fact that they are remote and have limited economic diversity and local opportunities for economic development. Their economies are relatively small with only occasional prospects of industrial or resource development. With a small economy comes a small tax base, limiting the ability to raise money through taxes. And quite often, a community's borrowing capacity is controlled by the federal government — most obviously for Indigenous communities that are still under the Indian Act. Similar to human capacity challenges, remote communities have limited capability to develop, attract and retain skills and talents in financial capacity and hence more support is needed.

The business case

In order to successfully implement renewable energy projects and transition away from fossil fuels, a shift is needed in how projects are funded and built. One critical aspect of this shift requires moving from relying on public funding to developing a strong business case where companies, lenders and the private sector invest in projects. This requires an economic incentive: a profitable business case with an adequate return on investment. Finding this profitable business case for renewable energy projects in remote communities so these projects *stand on their own feet* is a necessary step to

increase the deployment of these projects. The more a project's business case relies on private investment dollars and secured long-term revenue, the less the project requires government financial support.

The challenge of the business case in remote communities

Even with proven renewable energy technologies, projects in remote communities are expensive and often come with higher risk than standard renewable energy projects. The reasons for the high costs of projects in northern remote communities are outlined in Chapter 2: climate, renewable resource seasonal variation, geography and remoteness. In addition, systems that rely on intermittent renewables will also require energy storage, and will need to be integrated with the existing diesel systems. Some qualitative commentary at the conference suggested that building a micro-grid renewable energy project in the North could be three to ten times more expensive than comparable projects in the south that are connected to provincial grids. These factors make a project risky and schedules long and thus make it extremely challenging to find investors who are willing to take on this risk for and provide necessary equity to a project. Estimating the return on investment is hard; return is not guaranteed and comes at the whim of project schedule and unforeseen costs.

Financial institutions like banks like to deal with big projects. Smaller investments come with higher risks and banks often take a lot of time and effort to determine if the risk is worth their investment. Renewable energy deployment has a short track record compared to other industries — even shorter in remote communities with micro-grids. There is no track record or data to access the level of risk. To deal with this, banks will have higher interest rates (i.e. beyond 10%). Banks also don't want to deal with smaller, distributed projects such as renewable energy systems in remote communities. Instead of bank financing, partnerships and private financing can be used to attract and raise capital. There will be similar challenges to project risk and costs, but private investment comes with more flexibility in partnership terms and appetite for risk.

For all of these reasons, it's appropriate to say that the market for renewable energy systems in remote communities still has some maturing to do. Systems require innovative financial solutions, de-risking and a combination of public and private investment. Large industry has not invested substantially yet in these types of projects; as a result, they lack of economies of scale, financial institutional investment and low cost installations. Utilities that are interested in building renewable energy projects themselves typically don't have their own equity to build new projects and will have the same challenges. As projects continue to get built with support from federal

investments, the industry will continue to mature, innovate, attract private investment and bring overall project costs down. Certain costs will always be higher in the North because of remoteness and geography. But with replication, it will be easier to determine cost and performance data and overall project economics, which will lower project risks.

Project risk and schedule

As mentioned above, project risk is a decision driver for most investors. These investors want to understand the risks associated with the project, particularly with schedule and large costs, in order to define their return on investment. Continually assessing and de-risking a project is an essential aspect of project management. Project scheduling is absolutely critical, depending on resource assessment, baseline data collection, project support, assessment and permitting, construction constraints, procurement process and seasonality constraints (migratory species, vegetation, geotechnical). Permits and approvals are also critical; investors want to know all the proper authorizations are in place before they will commit. The most expensive time in project development is from infrastructure procurement and construction until commissioning – any schedule delays due to permit and approvals can be costly. Other aspects of a project's risk are the business relationships and partnerships in the project, project plan, budget, and community project support. Addressing all of these will dramatically help with a project.

Business and partnership types

Types of businesses

Several different types of businesses and partnerships for developing energy projects can be explored to gain access to experience as well as equity. One of the first steps is choosing the type of business to operate and then deciding who is going to own and run the business and carry the risk and liability; if there are advantages to opening up the business to partners; and how to form the partnership. These main different types of businesses and partnerships were presented at the conference.

Sole proprietor

A sole proprietorship [30] is the simplest form of a business. This is where someone operates a business in their personal capacity and carries all the risk and liability with running that business. There is not a formal company or business entity; the business is the person themselves. This type of ownership is the simplest arrangement with the main downside being if the business goes bankrupt then so does the individual. This personal liability is the main factor in why this type of ownership model is not suited for larger and more complex businesses.

Corporation

A corporation (or company) is another form of business. These are created pursuant to Canadian law (Canada Business Corporations Act[31]) that allows them to exist and sets the rules for how they operate. A corporation can own property, bower money, enter into contracts, own other companies and more. Corporations are tasked with providing a return on the capital invested by shareholders. Shareholders in corporations are not personally liable for the debts, obligations, or actions of the corporation. This protection makes a corporation particularly useful for businesses: if the company goes bankrupt, the individuals who own the corporation do not go bankrupt personally.

Many Indigenous governments have an economic development arm or economic development corporation (EDC). This corporation may own and/or manage businesses that are effectively subsidiaries of the EDC. When the community is the primary project proponent, it may choose to own the project through its EDC. Most of these EDCs are Indigenous organizations that have been around a long time in Indigenous communities, and whose success is measured not just by growth of the corporation or activities and number of projects, but how well they serve the community in terms of economic and social benefits. Typically, their biggest problem is cash flow management and accessing capital for projects.

[30] Government of Canada, *Sole proprietorship, partnership, corporation or co-operative?* (2016). http://www.canadabusiness.ca/eng/page/2853/

[31] http://laws-lois.justice.gc.ca/eng/acts/C-44/index.html

Types of partnerships

General partnership

In cases where there is not sufficient community capacity to own and operate a project, a commercial interest (e.g. mining operation or renewable energy developer) may be the project proponent in partnership with another business or entity. A partnership is created when two or more businesses agree to carry on business together to make a profit. A partnership agreement sets the rules of their relationship, defining things like business responsibilities and which businesses get what share of the profits (or suffers what share of financial loses if it loses money). In a partnership, partners contribute money, property, labour or skills to a common business venture, and expect to share in the profits and losses of the business endeavour. All jurisdictions in Canada have a Partnership Act that sets out the rules on how partnerships are to be operated.

A significant aspect of general partnerships is they do not protect the businesses in partnership from liability. Because of this exposure to liability, general partnerships are not normally used for big energy projects.

Limited partnership

A special kind of partnership is a limited partnership (LP). LPs are normally created pursuant to Limited Partnership Acts and are useful because they allow for a business to be owned by a combination of a general partner (who manages the business, carrying the risk and the liability) and limited partners (who have no management control and are not subject to liability for what the LP does). Limited partners put money into the LP and then are able to benefit from the profits of the LP and "pass through" its losses.

LPs are frequently used for energy businesses because they encourage investment (by limited partners) who get to invest without being exposed to liability. Limited partners also benefit as the general partner is usually someone or a company with lots of business experience in the renewable energy (or other) business.

Joint venture

One other business arrangement to discuss is a joint venture (JV). JVs are essentially an agreement of two or more businesses (sole proprietor or corporation) to do something together; often undertaking a specific task or discrete activity, like a renewable energy project, for a limited period of time. A JV does not protect any of the businesses from liability and does not have any preferred tax benefits (like the LP does). JVs are common in the mining business for activities that relate to exploration and sometimes

development but are not used often for large energy projects because they lack tax benefits or liability protection.

Summary

The different types of businesses and type of partnership and the benefits and drawbacks of various approaches were only touched upon at the conference. Most businesses are organized in one of the ways listed here or using a combination of approaches. It is not unusual to see companies owning partnership interests, owning share in other companies or even entering into JVs. The needs and business goals of the people and companies owning and investing in the business will determine which approaches are most effective.

A financial framework for Nunavut – WWF Canada

Wild Wildlife Fund (WWF) Canada has been advancing their Arctic Renewable Energy Program[32] since 2015. By working with communities, energy and policy experts, utility companies and governments, they aim to accelerate the transition to renewable energy in northern communities and demonstrate that habitat-friendly renewable energy is a reliable and robust replacement to diesel fuel that can power remote communities across the country. As part of this effort, they have completed the following work:

- **Pre-feasibility and feasibility studies** – a two-step procedure to assess the opportunities for renewable energy integration into Nunavut communities. In the pre-feasibility[33] assessment, the 25 Nunavut communities were analyzed for wind and solar and 13 were selected for further study. In the feasibility assessment,[34] the HOMER model was used to simulate renewable energy deployment in the selected communities and results were ranked on select criteria to come up with the top five communities that have the best opportunity for a renewable energy project.
- **Power purchase policies for remote Indigenous communities in Canada**[35] - a research report that reviewed past and current government policies that support clean power projects in Canada with a goal to understand effective

[32] http://www.wwf.ca/conservation/science_innovation/arctic_renewable_energy/

[33] http://awsassets.wwf.ca/downloads/summary_and_prefeasibility_report.pdf

[34] http://assets.wwf.ca/downloads/full_report_feasibility.pdf

[35] http://assets.wwf.ca/downloads/pembina_final_report.pdf

policies and how and by whom they are currently implemented. The policy research focused on price-based mechanisms including feed-in tariffs (standard offer programs), request for proposals (call for power), production incentives and contract for differences.

- **Tracking fossil fuel subsidies in the territory of Nunavut**[36] - a research study to clarify the cost of fossil fuels and create a more reliable business case for future investments in renewable energy and energy efficiency projects. The research shows well over half ($36.6 million) of the money spent on diesel subsidies in Nunavut is spent on electricity subsidies.
- **Reducing barriers to financing and accelerating the deployment of renewable energy projects**[37] – a research study aimed at identifying a viable and cost-effective framework to accelerate the deployment of renewable energy projects in remote northern communities. The study focuses on Nunavut, but the findings are applicable across the Canadian territories and remote northern regions of Canadian provinces.

Further to WWF's latest research piece, the goal of developing this framework was to present some solutions that would address some economic challenges currently experienced in northern projects. The framework presents some mechanisms that could be put in place so other barriers can be focused on and to help solve some of the business case challenges of northern projects. A key component to the framework was to identify a strategic use of the public money including the creation of a Green Bank. This framework is presented below.

Framework for accelerating the deployment of renewables in the Arctic

Core principles

The following two core principles were defined for this framework with consideration of the unique energy context in the North.

Energy prices cannot increase – Both electricity prices to end consumers and costs to utilities to produce the electricity cannot increase in the short term. Ideally, electricity prices would decrease in the long term as renewable energy is integrated. This reflects the already high cost of energy in northern remote

[36] http://assets.wwf.ca/downloads/costing_fossil_fuel_subsidies_in_nunavut.pdf

[37] http://assets.wwf.ca/downloads/Financing_Renewable_Energy.pdf

communities and the inability for customers to absorb higher costs. Utilities also have to support this framework; if a framework adds financial burden by raising electricity costs, utilities will likely not support it (with a plausible end result of the increased utility costs simply being passed on to customers).

Public funding is limited and combined investment is needed – Public funding (federal or provincial/territorial) is finite and limited. Full reliance on government funding to advance an industry is not practical, considering there are commercially available technologies that can be applied to remote communities. A transition to a market-based system that uses a combination of both public funding and private investment is necessary. Ideally, as this industry develops and matures, government funding should decrease and be used to leverage and attract more private investment and equity over time.

Main elements in framework

Three main elements in this framework, presented in Figure 13, are proposed to provide an economic foundation for more renewable energy projects to be built in the northern remote communities.

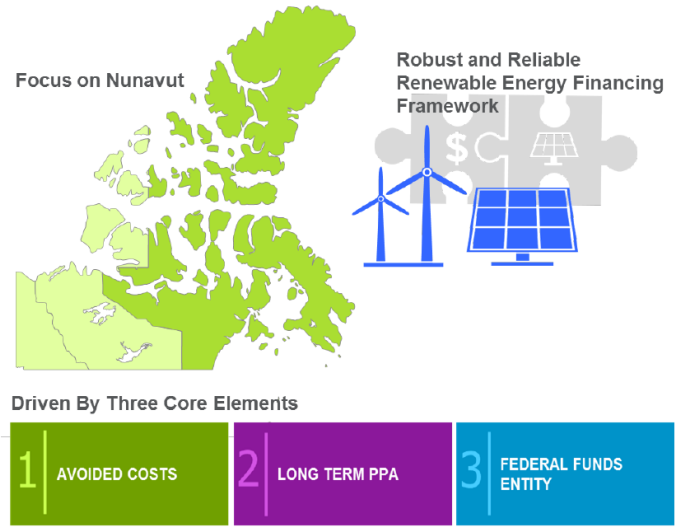


Figure 13. Main elements of framework

Long-term PPA – A long-term PPA contract enabled through a government IPP policy securitizes long-term revenue for a project. A long-term PPA with a regulated utility is an economic instrument and a financial guarantee that a developer (Indigenous community, Indigenous company or a renewable energy development company) can take to a lender (commercial bank, investment bank / company, insurance company or

brokerage) or investor (company, angel investor, venture capitalist or personal investor) to secure the upfront capital necessary to develop a project. It is possible to build projects without a long-term revenue mechanism using available equity, but this is usually not the case and much harder to do considered the high cost of development in the North.

PPA price equal to the avoided cost of diesel – A PPA price that is equal to (and no lower than) the cost to utilities to produce the energy is a necessary component to a strong business case. Equating the PPA price to the *avoided cost of diesel* should not increase the overall cost to the utility and could have support of the utilities as it does not affect their bottom line — they are essentially paying the same price for energy, it is just coming from a different source.

The term *avoided cost of diesel* can be challenging to understand and the term is often misused and misunderstood. Two definitions below provide clarity.

Marginal cost of diesel

This term is based on the commodity price of diesel fuel (which is often variable) plus transportation costs to community, service charges and any applicable taxes (including any carbon tax applied by the jurisdiction selling the fuel). Sometimes this cost is expressed as dollars per litre and sometimes it is expressed as dollars per kilowatt-hour. *The marginal cost of diesel* is also commonly referred to as the *displaced cost of diesel* or *landed cost of diesel*.

Avoided cost of diesel

This term captures the *marginal cost of diesel* plus specific costs of diesel system operation and maintenance (O&M), related amortization capital costs and financing-related costs. If the integration of renewable energy results in O&M savings on diesel generators, these savings could be reflected in the avoided cost of diesel. Whether the addition of a renewable energy system increases or decreases O&M costs is a complex question, depends on several factors and is very specific to each situation.

Current trends indicate that PPA rates are currently set at the lower bar of the marginal cost of diesel and or even less.

Even with a PPA price equal to the avoided cost of diesel, the business case and economics for renewable energy projects in the North may still not be met; even the committed long-term revenue that can be used to finance a project may not raise enough equity to develop the project (i.e. all banks and lenders will have limit the

financing they will provide, based on risk tolerance and return on investment). The last component of the framework is the need for another financial mechanism to provide further equity for all stages in the project development phases.

Federal funding mechanism (Green Bank)

As presented above and related to the second core principle of this framework, a financial lending structure that uses public dollars to attract private investment is needed. This can be accomplished by a Green Bank. A Green Bank uses public funding to issue loans or loan guarantees to engage and attract the private sector to also invest in a project. A recent 2016 report by the Canadian Coalition for Green Finance[38] reviews the 12 Green Investment Banks currently operating worldwide and the further 13 in development.

Canadian government programs in the past have typically provided capital dollars for renewable energy deployment through granting programs. This is helpful as it provides direct money to reduce upfront capital costs of projects or help with different development stages of a project (research, resource assessment, feasibility, business planning) but such programs are not as flexible or as useful as providing loans and loan guarantees if more equity is required through debt financing.

Green Banks can use public (government) money to start out the bank and then use federal investments to attract and leverage private capital to get projects built. Although it would be a government initiative, it would be run like a bank with a goal of attracting money, circulating money and making money over time. A Green Bank would focus specifically on funding energy efficiency and renewable energy projects while other federal institutions like the Canada Infrastructure Bank[39] (CIB) could focus on infrastructure projects (roads, bridges) but operate under the same principles. Standard banks still see northern energy projects as risky, resulting in increased interest rates and shorter loan repayment schedules. An advantage of a Green Bank is that risk tolerance can be increased, offering lower interest rates and longer paybacks in order to support development.

A Green Bank component within the CIB is also a possibility; the five-year investment plan of the CIB is around $17.7 billion and a national Green Bank focusing specifically on energy efficiency and renewable projects could easily fit within the larger entity.

[38] Bryan Becker (2016), *Green Bank Alternatives for Policy Makers,* http://cc4gf.ca/wp-content/uploads/2016/10/CC4GF_GIB_ComparativeAnalysis_ExecSummary_v207.pdf

[39] http://canadainfrastructurebank.ca/

Another option is to consider creating the Green Bank from the AEF, which is what is proposed in this framework.

Lessons learned from the Connecticut Green Bank

As noted in the Green Bank Alternatives for Policy Makers report, a number of Green Banks have been developed by different governments. The Renewable Energy Alaska Project has been working with the Connecticut Green Bank to understand their approach and has provided input on the possible options for a Green Bank under the AEF. The Connecticut Bank is a good example of a successful Green Bank — it operated as a regular bank from 2000 to 2011, providing $350 million in investment and raising $350 million in private funds (a 1:1 ratio). The Bank shifted to a Green Bank and from 2012 to 2017 (five years), they attracted on average $1 billion dollars with an average investment of $185 million. By the end of the sixth year, the Bank was making a net profit of $5 million per year. This represents three times the financing in half the time (8.7:1 average ratio) and is testament to the value add of Green Banks.

Smart use of the Arctic Energy Fund

Recommendations

There is a tremendous opportunity to take advantage of the $400 million AEF committed in Budget 2017. The following recommendations were made by WWF Canada on how to strategically use the AEF.

- **Split investment to support both energy security with diesel and clean energy** – WWF Canada recommends that $20 million (50%) of the annual AEF fund goes towards diesel infrastructure and ensuring energy security and $20 million (50%) of the annual AEF fund goes towards supporting clean energy development. This $20 million per year (on top of current government programs such as CERRC and REACHE programs) directed towards clean energy will go a long way to advance renewable energy development in the North.
- **Territorial Green Bank** – WWF Canada recommends that of the $20 million, $5 million per year (25%) be used to start the Green Bank and continue to provide financial support while the Green Bank grows, providing debt financing through either direct loans or loan guarantees.
- **Capacity building** – WWF Canada recommends that of the $20 million, $2 million per year (10%) be invested in culturally accessible training and capacity building related to energy efficiency and renewable energy development. This dedicated funding should be directed towards energy efficiency and energy

storage technologies as well as general bookkeeping, technical and office training — other important aspects of renewable energy project development.

Financial research and Indigenous projects

True cost of diesel

Providing transparency in information and a common level of understanding was the driving goal in the research report *Diverging from Diesel*.[40] This research used publicly available cost data, specifically from utilities' general rate applications for fossil fuel thermal power generation in specific northern remote communities in the territories: two communities in Yukon, three in the NWT and four in Nunavut. The research framework quantified the actual avoided cost of diesel fuel which included the following components listed below.

Marginal cost of diesel

- **Fuel costs** – commodity fuel prices, transportation, taxes including pending carbon tax.

Avoided cost of diesel

- **Margin cost of diesel** plus
- **Non-fuel operation and maintenance (O&M)** – engine overhaul and other non-fuel O&M (plant operator salary, mechanical / electrical maintenance of diesel systems, maintenance of powerhouse)
- **Capital costs** – depreciation and amortization expense, financing cost (related to debt and equity repayments)

The research revealed that the total quantified avoided cost of diesel ranged from $0.41 / kWh to $0.76 / kWh with on average, $0.31 / kWh (55% of the total avoided cost of diesel) being the fuel costs (the marginal cost of diesel). The balance of the avoided cost of diesel was attributed to the non-fuel O&M and the capital costs and on average, was $0.25 / kWh. A carbon tax at $10 / tonne adds an additional $0.01 / kWh to the overall cost.

This research makes a very important point: in these nine communities the avoided cost of diesel is approximately twice the marginal cost of diesel, as it includes additional costs associated with operating and maintaining diesel systems. This is a very important

[40] Gwich'in Council International (2017), *Diverging from Diesel*, https://gwichincouncil.com/diverging-diesel

consideration when PPA rates are being discussed. There are potential cost savings in transitioning from diesel fuel to renewables and these savings could be considered when negotiating power prices. Another outcome of this research was publicly available data on both the marginal and avoided cost of diesel that can be shared and further discussed when collaborating on projects. It also offers a building block to further investigate and compare utility-stated marginal and avoided costs of diesel with true marginal and avoided costs. There is clearly a difference between what we *think the cost of diesel is* and *what the cost of diesel actually is*.

Social and health costs associated were also looked at in this study, but references used were not specific to the territories and greatly ranged from $0.03 / kWh to $0.50 / kWh.

Gitxsan Development Corporation

Gitxsan Nation has the largest First Nation population in B.C., with approximately 13,000 members. 70% of them live on the traditional territories (approximately 33,000 square kilometres) and the same percentage is under 30 years old. Most members live in either the five Gitxsan villages (Gitwangak, Gitsegukla, Gitanmaax, Glen Vowell, Kispiox) or the two B.C. municipalities of Hazelton or New Hazelton.

Gitxsan and the Gitxsan Development Corporation (GDC) have been exploring bioenergy opportunities for several years. They have explored bio-power but recently abandoned a 34 MW biomass power plant proposal that was submitted to B.C. Hydro's Call For Power as it only considered the pulp mill and affiliated businesses.

The community turned to bio heat and district heating applications for a few reasons. The capital costs of bio heat systems are significantly lower compared to other renewable energy technologies, resulting in a payback of three to ten years. Also, bio heat applications are four to five times more efficient than bio-power. Finally, the successful recognition by the Supreme Court of Canada in 1997 of the Gitxsan's Aboriginal Title (ending the 13-year legal case known as Delgamuukw[41]) provided the Gitxsan with a solid basis for moving forward in asserting stewardship over their traditional territory, which included a renewable, 387,000 m^3 forest license. This provided the GDC with a fuel supply to build their bio heat vision.

Their success is highlighted by three areas:

[41] http://www.thecanadianencyclopedia.ca/en/article/delgamuukw-case/

1) Fuel supply – the fuel supply is their critical component and is managed sustainably. Using a locally available resource was the best use of their natural capital. Firebreak programs, residuals and low-end logs provide feedstock for the fuel supply.

2) Business model and partnerships – the GDC relies on their successful partnerships and they manage partnerships like valued relationships. Focusing on the partnership is key.

3) Project scope – it's important to keep track of project scope (especially fuel delivery and the technical design) as it can be intricate and easily get out of control. With bio heat systems in Canada still far behind other jurisdictions (i.e. Europe), systems can often be over-engineered, rendering the projects economic non-starters.

Kluane N'tsi wind energy project

Kluane First Nation (KFN) is approximately three hours northwest of Whitehorse. KFN is a self-governing First Nation and has two communities located within the traditional territory, Burwash Landing and Destruction Bay, with a total population of approximately 150 people. The communities have a combined electricity demand capacity of around 1 MW.

KFN aims to be self-sufficient with the ultimate end goal of getting completely off diesel fuel. They have been exploring and implementing energy efficiency and renewable energy projects (biomass district heating, geothermal exploration, solar PV) for almost 20 years. During this time, KFN created Kluane Community Development LP (KCDLP) and Kluane Energy LP. Their wind energy project has been in development for approximately five years. The project is a 300 kW three turbine system that will produce 560 MWh of electricity annually and displace 160,000 litres of diesel (25% of annual consumption).

The wind project has taken an incredible amount of work over the five years and has received significant support and funding from the INAC's ecoENERGY and REACHE programs and the Government of Yukon Energy Branch. Having access to the 20/20 Catalyst and ARENA programs was very helpful for staff involved in the wind project; the connections, information, network and resources made available through the programs was valuable. The project has had tremendous support from past and current Council and strong leadership has been present throughout the project, creating champions in the community.

Lessons learned from the project include the need for collaboration and as much sharing of information as possible; economy of scale even applies to research and background information gathering; more co-ordination on information sharing will result in more efficient project costs. Group purchasing was suggested (whether by communities or governments) to reduce the capital cost of equipment. Finally, standard contingency budgets are around 10% of project costs; it was suggested that contingency for northern remote projects should at least be double that to account for the unknown and the unique situation of the North.

The project has all the necessary permits and approvals and is shovel ready. A MoU with ATCO Electric has been developed and signed (for future energy storage) and the last stages of project funding were secured and announced during the conference. Construction will begin in the summer of 2018 and a celebration of this project will occur on National Aboriginal Day, June 21, 2018.

Appendix A. Participant list

Name	Title	Organization
Abercrombie, Shirley	Assistant Deputy Minister	Yukon Government
Ackerman, Amanda	Managing Consultant	Navigant
Adams, Sheena	Energy Project Coordinator	Arctic Energy Alliance
Aldersley, Stephanie	Planner	Independent Electricity System Operator
Anderson, Graham	Financial Strategist	Ecotrust Canada
Andre, Kathleen	Environment Officer	INAC
Archer, Lora	Economic Development Officer	Canadian Northern Economic Development Agency
Ardiel, Jennifer	Senior Policy Analyst	Indigenous and Northern Affairs Canada
Asselstine, Colin	General Manager	KCDLP/KELP
Babatunde, Kazeem Wale	Special Assistant on Community Development	Surulere Local Government Council
Ballegoyen, Kate	Environment & YESAA Coordinator	Kluane First Nation
Banjoko, Nurudeen Ibikunle	Programme Manager, Sustainable Energy	Climate Change Network Nigeria
Baruwa, Adewale Lawal	Special Adviser on Energy	Surulere Local Government Council
Baxter, Jamie	Professor	University of Western Ontario
Bazett, Jacqueline	Director	Yukon Development Corporation
Beaudoin, Pierre	Project manager	TechnoCentre Éolien
Beauvais, David	CEO	SG2B Inc.
Behrens, Fred	Senior Administrative Officer	Hamlet of Aklavik
Bellem, Nuno	Senior Policy Advisor	Canadian Northern Economic Development Agency
Bennett, Meaghan	A/Assistant Program Director	Natural Resources Canada
Berrub, Myra	Manager, Energy Services	Northwest Territories Power Corporation
Binnie, Angela	Manager, Indigenous Relations	ATCO Electric
Bishop, Jarod	Business Development Manager	EWT Direct Drive Wind Turbines
Blum, Susan		Saskatchewan Polytechnic

Bodiguel, Ashley	Information Systems Administrator	Pembina Institute
Borins, Dave	Director, Community Renewable Projects	Bullfrog Power
Bowman, Stephan	Environmental Policy Analyst	INAC - Northern REACHE
Bradley, Joe	Senior Economic Development Officer	CanNor
Broek, William	Operations Coordinator	Northern Energy Capital
Brothers, Carl	General Manager	Frontier Power Systems
Brown, Rosa	Lands Manager	Vuntut Gwitchin Government
Campbell, Hector	Chair	NNDDC (First Nation of Na-Cho Nyak Dun)
Carroll, Donna	Natural Resources Technician	NunatuKavut Community Council
Carter, Michael	Corporate Development Manager	Canadian Solar Inc.
Castleden, Heather	Associate Professor	Queen's University
Chamberlain, Adam	Partner	Gowling WLG
Cheetham, Bob	Economic Development Officer	Hamlet of Gjoa Haven
Chettiar, Teddy	Application Director	S&C Electric Canada
Christie, Susan	Senior Administrative Officer	Hamlet of Fort Providence
Codzi, David	President	Ayoni Keh Land Corporation
Cooke, Robert	Science Officer	Polar Knowledge Canada
Coulter, Kraemer	Managing Director	Hydro One Remote Communities
Creyke, Christine	Lands Director	Tahltan Central Government
Crick, Jackson	Housing Manager	Yunesit'in Government
Crowley, Paul	Vice President, Arctic	WWF-Canada
Curzon, Norm	Generation Tech	ATCO Electric Yukon
Dares, Matthew	Manager, Technology Development	Aurora Research Institute, Aurora College
Derochie, Ben	Researcher	Yukon Research Centre
Dohring, Klaus	Principal	Green Sun Rising
Druillet, Amelie	Administrative Manager	Carcross/Tagish Development Corporation
Drukis, Shailyn	Climate Change Community Liaison	Council of Yukon First Nations
Dufresne, Julie	Research Analyst	Yukon Chamber of Commerce
East, Tom	Engineer	ATCO Electric Yukon

Ebel, Thomas	Sales Manager	Saft America, Inc.
Ehrlich, Miki	Climate Change Community Liaison	NWTAC
Elanik, Lori-Anne	Community Energy Coordinator	Hamlet of Aklavik
	Energy, Mines and Resources, Energy Branch	Government of Yukon
Esquiro, T J	Hydro Plant Operator/monitor	ATELP
Ferbey, Justin	President & CEO	Yukon Development Corporation
Fitzgerald, Eryn		University of Victoria
Fleming, Sean	General Manager	Solar Global Solutions
Foster, Al	President	Lorne Mountain Community Association
Gall, Jenna	MES Student / Community Energy Project Coordinator	USask / FNPA
Gilday, Douglas	President	NGC Builders Ltd.
Gillis, Darlene	Vice-President	Sentrex Wind Services
Go, Grahame	Sales	Fink Machine Wood Biomass Boilers
Grunfeld, Benjamin	Managing Director - Energy	Navigant
Harding, Anne	Senior Advisor, Stakeholder & Aboriginal Relations	Suncor Energy
Harris, Melissa	Senior Policy Advisor	IISD
Heigl, Samantha	Lead, Alberta Services	QUEST
Hilts, Jamie	Dean	Saskatchewan Polytechnic
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Hogan, Doug	Executive Director	Teslin Tlingit Council
Hopkins, Mark	Director General	INAC
Horner, Jamie	Director	Innergex Renewable Energy
Hunt, Kyle	Senior Project Manager	Savanta Inc.
Isaac, David	President	W Dusk Energy Group
Josie, William	Direction of Natural Resources	Vuntut Gwitchin Government
Kelly, David	CEO	SkyFire Energy Inc.
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Kenway, Daniel		Global Microgrid
Kilcoyne, Shaina	Energy Efficiency Director	Renewable Energy Alaska Project
Kornelsen, Derek	Assistant Professor	University of Manitoba

Kosten, Mike	Account Manager	On Power Systems
Laing, Rodd	Director of Environment	Nunatsiavut Government
Lauer, Michael	Director	Yukon Development Corporation
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Leitch, Aletta	Student	University of Edinburgh
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Lightburn, Patricia	Advisor	Innergex Renewable Energy
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Little, Eric	President and CEO	Dynamic Microgrids Corp.
Loots, Derek	General Manager	Iyon Kechika Contracting Ltd.
Lovekin, Dave	Senior Advisor	Pembina Institute
Luk, Senwung	Partner	Olthuis Kleer Townshend LLP
Mackay, Makenzie		University of Alberta
MacKinnon, Sean	Senior Energy Advisor	Energy branch, Energy Solutions Centre
Maissan, John		self
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Malla, Michelle	Director of Community Development	Hamlet of Arviat
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Martineau, Daniel	Environmental Policy Analyst	INAC-REACHE program
Martos, Zoe	A/Director, Climate Change Secretariat	Government of Nunavut
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McKenzie, Michele	Board Member	Nivviti Development Corporation
McNeil, Susan	ICEDO Manager	Inuvialuit Regional Corporation
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Middler, Anne	Energy Analyst	Yukon Conservation Society
Milner, Chris	Chief Executive Officer	CNLP - Chu Niikwan LP
Monegro, Alex	Co-Founder	ReWatt Power
Mooney, Stephen	Director, Clod Climate Innovation	Yukon College

Moorhouse, Andy	Vice President, Economic Development Dept.	Makivik Corporation
Muller, Michael	Business Leader, Northern Projects	Hemmera
Mumford, Bob	Councillor	Tsiigehtchic Charter Community
Murray, Glen	Executive Director	Pembina Institute
Neron, Marie-Eve	Director, Climate Change and Clean Energy	Indigenous and Northern Affairs Canada
Nickerson, Kinsey	Market Analyst	National Energy Board
Norwegian, Gladys	Chief	Jean Marie River First Nation
Nuske, Tanja	VP Marketing	Green Sun Rising
O'Brien, Rick	Chair	Chu Niikwan Development Corporation
Okada, Yuho	Vice President	Barkley Project Group
Oler, Andrew	Manager	Tulita Land Corporation
Owen, Morgan	Senior Policy Advisor	Ontario Ministry of Energy
Parent, Matthew	Manager, Climate Change Mitigation	Government of Nunavut, Climate Change Secretariat
Parker, Mathieu	Director General, Operations	CanNor
Paul, Kenneth	Director of Fisheries and Integrated Resources	Atlantic Policy Congress of First Nations Chiefs Secretariat
Pearce, Kenneth	Assistant Foreman	Municipality of Sanikiluaq
Petersen, Karen	Biomass Outreach Coordinator	Southeast Conference
Peterson, Jordan	Vice President	Gwich'in Tribal Council
Peterson, Tim	President	Global First Power
Pinard, Jean-Paul	President	JP Pinard Consulting
Plentovich, Devany	Biomass program manager	Alaska Energy Authority
Poissant, Yves	PV Technology Specialist	CanmetENERGY, Natural Resources Canada
Power, Ben	Vice President	Solvest Inc.
Preto, Fernando	Research Scientist	CanmetENERGY-Ottawa
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Read, Andrew	Analyst	Pembina Institute
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Redfern, Madeleine	Mayor	City of Iqaluit
Renner, Reg	Financing Specialist	Atticus Financial

Rhein, Werner	Energy Consultant	Sourdough Plumbing & Hot Water Heating
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Robinson, Leanne	Energy Management Specialist	Arctic Energy Alliance
Rose, Chris	Executive Director	Renewable Energy Alaska Project
Ross, Michael	Industrial Research Chair	Yukon Research Centre
Rudkin, Michael	SAO	Hamlet of Fort Liard
Scheu, Connor	Renewable Energy EIT	Suncor Energy
Schiling, Christoph	Researcher	FPInnovations
Schmidt, Christian	Technician	Hargassner North Western Canada
Sharifi, Farid	Lead Specialist, Renewable Energy	WWF-Canada
Sheldon, Melaina	Jane Glassco Northern Fellowship, Program Manager	The Gordon Foundation
Shilton, Heather	Manager of Communications	Prowind Canada Inc.
Shouldice, Michael	Councillor	Hamlet of Rankin Inlet
Sibbeston, Darlene	Mayor	Village of Fort Simpson
Smith, Sean	KDFN Councillor	Kwanlin Dun First Nation
Spinu, Oana	Masters Student	Carleton University
Sreckovic, Goran	Director, Resource Planning & Regulatory Affairs	Yukon Energy Corporation
Stewart, Eryn	Program Manager	20/20 Catalysts Program
Sullivan, Grant	Executive Director	Gwich'in Council International
Suppiah, Ananthan	Senior Engineer	INAC
Swanson, Darin	Hereditary Chief	Council of the Haida Nation
Takle, Al	National Sales Manager	Steffes
Tawashy, Malek	Director	Northern Energy Capital
Tenney, Doug	Vice President, Northern Development	ATCO
Thomas, Dale	Director of Operations	Borealis Wood Power Corp.
Thompson, Sara	Program Enhancement Officer	Yukon Research Centre
Thompson, Suzy	Communications Lead	Pembina Institute
Todd, Linda	Program Coordinator	Arctic Energy Alliance
Tourigny, Ryan	Director, Business Development	Canadian Solar
Tutcho, Kyle	Member	Ayoni Keh Land Corporation
Van Heuverswyn, Alexander	Sales Director	XANT / wind power made easy

Vigneault, Alexandre	Principal	3EYOND Consulting
Woodhouse, Geoff	Senior Policy Analyst	Yukon Development Corporation
Woodhouse, Paul	President	Sentrex Wind Services
Wright, Sally	Executive Assistant	JP Pinard Consulting
Young, Adam	Coordinator	Let's Talk Energy
Young, Allen	Retired Ecologist	Water Security Agency of SK

Appendix B. Federal programs supporting remote communities and energy

Table 4. Categories and support areas for programs


Renewable energy for power


Renewable energy for heat


Energy efficiency


Capacity building/community engagement


Environmental stewardship


Transportation

Table 5. Direct support for diesel reduction in remote communities

Program	Amount	Focus	Details
Natural Resources Canada			
Clean Energy For Rural and Remote Communities (CERRC program) 	$220 million over six years Part of PCF	Diesel reduction in rural and remote communities through energy efficiency, renewable energy (both heat and power) and also capacity building.	http://www.nrcan.gc.ca/energy/science/programs-funding/19791 Main focus areas: • Innovative demonstration projects to reduce fossil fuel (heat and power) • Deployment of proven, commercially-available renewable energy technologies (heat and power) • Bio-heating program to reduce fossil fuel use (heating and combined-heat-and-power) • Capacity building to support communities in their clean energy efforts
Indigenous Forestry Initiative (IFI program) 	$10 million over three years Ongoing program	Support the economic development of Indigenous peoples in Canada through forestry initiatives	http://www.nrcan.gc.ca/forests/federal-programs/13125 Three main focus areas: • Clean technology and participation in the forest bio-economy (e.g. a project that promotes using biomass for heat and power to reduce reliance on diesel fuel) • Environmental stewardship (e.g. a project that focuses, on climate change mitigation and adaptation, land reclamation, or environmental/ecological services) • Use and management of forest resources (e.g. a project that gives people in the community training in forest management)
Impact Canada Initiative (ICI Program) 	Partial of $75 million over four years Part of PCF	Diesel reduction in remote communities through energy efficiency, renewable energy (both heat and power) and capacity building.	Outcome-driven, competitive challenged-based program focused on fossil fuel reduction
Indigenous and Northern Affairs Canada			
Responsible Energy Approach for Community Heat and Electricity (Northern REACHE Program)	$53.5 million over ten years with $5.4 million continuous	Diesel reduction in remote communities north of 60º	https://www.aadnc-aandc.gc.ca/eng/1481305379258/1481305405115 Five geographical areas: Yukon, Northwest Territories, Nunavut, Nunavik (Northern Quebec) and Nunatsiavut (Northern Labrador). Focus is on energy efficiency, renewable energy and capacity building.

			Eligible projects will focus on proven, commercial technologies such as solar, wind, energy storage, hydro, biomass heating, residual heat recovery and LED lighting.
Infrastructure Canada			
Rural and Northern Community Infrastructure Stream 	$2 billion over 11 years Part of PCF	Supporting a broad range of infrastructure projects in rural and Northern Canada	http://www.infrastructure.gc.ca/plan/rnc-crn-eng.html Investments in rural and northern public infrastructure supporting local economies and help safeguard the environment and the health of rural and Northern communities. $75 million to each province and $150 million to each territory with remaining funding allocated on a per capita basis. Transferred through Bilateral Agreements ($1.4 billion) and a $600K Challenge Program. Main focus areas: • Improved food security • Improved & more reliable transportation (road, air, marine) • Improved broadband connectivity • Improved education and health facilities (Indigenous communities) • More efficient and reliable energy through deployment of renewable energy
Arctic Energy Fund 	$400 million over 10 years Part of PCF	Supporting energy security in remote communities north of 60º	Further support to address energy security and aging infrastructure. Fund will focus on diesel plants that are coming to the end of life, and the integration of renewables into diesel micro-grids are also within scope. Delivered through integrated bilateral agreements with territorial governments.

Table 6. Additional ancillary support for diesel reduction in remote communities

Program	Amount	Focus	Details
Natural Resources Canada			
Clean Growth Program 	$155 million over four years Part of PCF	Supporting clean technology research and development and adoption of clean technology in Canada's natural resources sectors Focused on industry	https://www.nrcan.gc.ca/cleangrowth/20254 Includes clean technology RD&D in energy, forestry, and mining. Remote communities could be eligible if they partner with industry.
Green Infrastructure Program – Energy Efficiency Buildings 	$120 million over four years Part of PCF	Develop and implement new building codes to retrofit existing buildings and build new net-zero energy consumption buildings across Canada Focused on industry, Indigenous groups, utilities and academia	http://www.nrcan.gc.ca/energy/science/programs-funding/19787 Focused on improving how our homes and buildings are designed, renovated, and constructed. $48.4 million is going to support the development and implementation of building codes for existing buildings and new net-zero energy-ready buildings through R&D initiatives that apply to building net-zero energy consumption buildings.
Low Carbon Economy Fund (LCEF program) 	$2 billion over five years Part of PCF	Cost-effective, incremental projects that significantly reduce GHGs Industry	Directed to provinces that have adopted the PCF to help them deliver on leadership commitments to reduce GHGs. Delivered through bilateral funding agreements with provinces and territories. $1.4 billion base and $600 million through Low Carbon Economy Challenge. Indigenous communities not main focus but could partner with industry or government.
Infrastructure Canada			

Green Infrastructure Program 	$9.2 billion over 11 years Part of PCF	Green infrastructure upgrades	http://www.infrastructure.gc.ca/plan/gi-iv-eng.html For projects that reduce GHGs or build cleaner, better-connected electricity systems. Provided through bilateral agreements to provinces and territories. Possible application to remote communities and adopting renewable energy technologies within the infrastructure.
Canada Infrastructure Bank 	$35 billion over 11 years Part of PCF	New Crown corporation that operates at arm's length from government and is governed by a board of directors Bank will use federal support to attract private and institutional investment to new revenue-generating infrastructure projects that are in the public interest.	http://canadainfrastructurebank.ca/ $5 billion for green infrastructure projects, including those that reduce greenhouse gas emissions, deliver clean air and safe water systems, and promote renewable power. Applicable to Indigenous communities that want to leverage government funding for developing renewable energy projects.

Appendix C. Conference agenda and sessions details

Figure 14 is the main two-day conference agenda. Details on each session are below.

Figure 14. RiRC 2017 conference agenda

Day 1 – Human capacity

Introductions

Two years in review – what has happened? This session provides an overview of significant advances in the deployment of renewable energy systems in remote Indigenous communities over the past two years. Highlights include examples of installed projects, territorial government and non-government policies and programs, commitments in the federal 2017 budget, research projects and other key initiatives including the continued mentoring and establishment of Indigenous peoples leading their clean energy future.

Human Capacity

Human Capacity – Introduction This session provides contextual background for what Bullfrog Power is doing to support human capacity development in communities through sharing examples and a simplified model presentation on different categories of capital and how this relates to human and community capacity.

Story Sharing – Indigenous community stories In this session, we hear from Indigenous leaders about renewable energy projects (developed and in development) that have both created and required an increase in human capacity to successfully advance. Stories will be shared as to how these renewable energy projects have benefitted communities and the people living in them, the challenges they faced in their journey and unique solutions. We also hear from the 20/20 Catalyst Program and how it is working towards increasing energy champions and catalysts.

- Solar PV – Vuntut Gwitchin Government
- Small-scale hydro – Taku River Tlingit First Nation
- Projects in communities – Wdusk Group
- 20/20 Catalyst program – Lumos Energy

A SHARED Future Our partners — Indigenous and Settler governments, organizations, industries, advocates, and scholars — are on the leading edge, moving forward with projects intent on achieving Indigenous strength, health, and autonomy through renewable energy development. But there are knowledge gaps. Accordingly, our team's research goal is to examine, through stories, how Indigenous knowledge systems as applied to inter-sectoral partnerships for renewable energy development have the potential to lead us towards "healthful environments," through reconciling and healing our relations with each other and the land, air, and water around us. This keynote will screen a 15-minute video of this year's inaugural team meeting, take questions, comments and critiques as we embark on our five-year research program.

Capacity building – Presenting sponsor – Natural Resources Canada (NRCan) In this session, we will hear from Natural Resources Canada about initiatives it has worked on with Indigenous communities to increase community knowledge, skillsets and awareness of renewable energy and energy efficiency projects. We will hear about NRCan's Indigenous Forestry Initiative (a program that provides funding to support the economic development of Indigenous peoples in Canada), and pilot to support community energy planning and energy efficiency.

- Indigenous Forestry Initiative – Canadian Forestry Services
- Whitesand First Nation – bioenergy experience
- Office of Energy Efficiency
- Arctic Energy Alliance

Day 2 - Financial Capacity

Financial capacity: Introduction. How do we create a viable business case for remote clean energy projects? Renewable energy project financing should not rely exclusively on government grants and subsidies; that is not a sustainable practice and offers no long-term security for projects. This session offers high-level business perspectives from project developers, utilities, renewable energy experts and Indigenous businesses involved in renewable energy project development. They will provide insight into the unique situation for each player and how to shift attitudes away from the concept that projects need 100% grant funding, to one where projects are financially practical and possible for all involved.

Barriers to Financing Renewable Energy Projects in Arctic Remote Communities. Presenting Sponsor WWF-Canada. WWF-Canada's research on finance is all about enabling renewable energy projects in the Canadian Arctic, using Nunavut as the case study. Currently, Nunavut's communities use diesel to generate 100% of their electricity. In other Arctic jurisdictions, renewable energy is cost-effective, and is being increasingly deployed. Uncovering the financial barriers to deploying renewable energy in Nunavut and coming up with solutions to overcome them is the main focus area of the WWF-commissioned work of Navigant Consulting.

- Fuelling the Change in the Arctic - WWF Canada
- Accelerating the Deployment of Renewables in the Arctic – Navigant Consulting
- Recommendations for Canada's Arctic Energy Fund – Renewable Energy Alaska Project (REAP)

Successful renewable energy projects in Indigenous communities (financial business models, investment strategies, long-term revenue). Hearing from Indigenous businesses and community economic development corporations on

financing approaches, obstacles and solutions to advancing renewable energy projects being developed or in development in Indigenous communities.

- True cost of diesel study – Gwich'in Council International
- Renewables – Bio-heat Energy Financing - Gitxsan Development Corporation
- Our Path to Sustainability – Kluane First Nation

Appendix D. Indigenous survey results

Human capacity details

Human Capacity - Why was it most interesting to you?

Indigenous representatives identified the need for human capacity development, some saying that it should be a priority over building financial capacity. Communities with limited human capacity are looking to form meaningful partnerships that will engage the aboriginal communities and youth in new energy projects. This type of engagement will grow human capital through education, training, and experience. The representatives see the potential of accumulating human knowledge, and say that educating their citizens on energy should be a priority. Communities with sufficient human capital and a high proportion of educated citizens have said that these conditions create jobs that encourage residents to stay in the community. Some concerns were brought up regarding the complexity of governance structures in Indigenous communities and the role that plays in building human capacity.

What is most important about human capacity?

The eagerness to work together is common among all Indigenous leaders. They identified three things as important to building human capacity: social capital, partnerships, and engagement. Through the social capital they meet new people and learn from each other's experiences. Long-term partnerships with other communities allow them to develop their human capital. Many partnerships with communities in southern Canada are working well, but the southern partners need to understand the unique challenges and complexities of remote and northern communities. Engaging the appropriate stakeholders is also important; involving youth and elders in projects helps grow the human capital, while community engagement tactics that develop the social capital such as community buy-in were identified as reasons for project success.

What is the biggest barrier to human capacity?

Several Indigenous representatives cited their geographic location (remoteness, isolation, and Arctic north) as a barrier to building human capacity. This further emphasizes the need for context-specific solutions, and creating conditions that make

community members want to stay and support their community's growth. Multiple representatives say their biggest barrier is maintaining interest. Generating interest might be simple, but fighting skepticism and the fear of change without getting discouraged by failure is difficult. However, the most commonly cited barrier to human capacity is a lack of knowledge and experience. Beyond developing an understanding of what renewable energy is and how it can benefit remote communities, there is a need for local qualified and trained experts who can undertake renewable energy projects. Developing this level of knowledge and experience isn't without cost.

What further information or support do you need?

Indigenous representatives' responses indicate a need to enhance education opportunities. Education on what renewables are should continue for all community members, but engagement should go beyond the general knowledge level. Engaging youth is important to develop and maintain local skills and expertise, while engaging elders improves how traditional knowledge is incorporated into community-specific solutions to development challenges. Four elements were identified to support education in remote communities: funding for training and planning, toolkits or project packages to support education initiatives, access to graduate programs for youth, and more opportunities like RiRC 2017 to share learning opportunities and experiences with other communities.

Financial capacity details

Financial Capacity - Why was it most interesting to you?

Community representatives found it interesting to learn from other communities about financial opportunities available for project development. There were concerns surrounding the lack of access to territorial, provincial and federal funding for projects in the planning and execution stages. One representative said it is almost impossible for smaller communities to get the attention of federal funding, which focuses more on larger communities.

What is most important about financial capacity?

Community representatives understand that there are many funding opportunities available, but what is most important for building financial capacity is gaining a practical understanding of project financing. Developing and sharing case studies that demonstrate cost structures, funder requirements, and partnership frameworks is

important. Similar to human capacity, the gap between southern funder goals and approaches and northern realities and challenges needs to close for financial partnerships to be successful. Representatives show optimism that since the tools exist, by learning how to use them to meet their needs they can successfully execute projects in the way they want.

What is the biggest barrier to financial capacity?

The biggest barrier identified by community representatives is the high cost of undertaking projects in northern communities. One leader said that project costs can be up to ten times as high in the north as they are in the south due to remoteness and difficulty of mobilizing equipment and other resources, as well as the need to outsource technical expertise if the knowledge base doesn't exist in a community. Other responses echoed factors mentioned as important for developing financial capacity: the need to identify funding sources, funding requirements, and the right partners.

What further information or support do you need?

Community representatives felt that institutional capacity needs to be built to maintain financial capacity. They said it is important that the federal, provincial and territorial governments involve aboriginal groups in decision-making processes. They also said all parties involved need education in order for them to be successful financial partners. Communities need experience with proposal writing and local business development; funders and banks need to learn about the unique challenges for renewables in remote communities. One representative said in addition to government financial programs, private investment options should also be explored.

Next steps

What are some of the first things you plan to do when you return to your community?

Community leaders seemed enthusiastic to execute what they learned at the conference in their own communities. Some leaders plan to create a dialogue in their community to share what they learned at the conference. Other leaders intend to develop education materials (case studies) and programs (in and outside of public schools) to expand their community's knowledge of renewable energy. Some are even considering community visits from energy consultants to learn from experts. There was also excitement to share what was learned with RiRC 2017 (need for institutional capacity, funding

opportunities, and success stories) with various levels of government as a first step in the engagement process between governments and communities.

What do you need from outside your community to achieve this?

In order to achieve the next steps, community representatives will need to see funding and partnership opportunities grow. Flexible partners and funding agreements are important for remote communities' sustainable development. Also, representatives mentioned a need for expert guidance in the process of community and economic planning until local capacity exists. Representatives are looking forward to future engagement opportunities to share information with other communities and learn what has worked for them.

What do you want to see discussed at RiRC 2019?

Community representatives are hoping to see an even more diverse representation in RiRC 2019, more youth, women, Indigenous communities, financial institutions, power companies, and funders. They also hope to see focused workshops addressing unique challenges; for example, solutions for small communities (<500 people), strategic energy planning, proven technology, and Arctic climate change awareness.