



Canadian Small Modular Reactor (SMR) Roadmap
Feuille de route pour les petits réacteurs modulaires (PRM) au Canada

Workshop 3: Off-Grid Northern and Remote Communities

Iqaluit, May 10-11, 2018

June 12, 2018

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The Strategic Review Group Inc.
Le groupe des examens stratégiques

Executive Summary

This report provides a summary of discussion from the third workshop associated with the Small Modular Reactor Roadmap. The workshop was held in Iqaluit on May 10th and 11th, 2018 and focused on potential applications within Off-Grid Northern and Remote Communities.

Purpose of the Workshop

The purpose of the workshop was to initiate preliminary discussions with representatives from Nunavut and northern communities about their future energy needs and explore whether nuclear energy, from small modular reactors (SMRs), could be an option in addressing those needs. No site or project has been selected for an SMR in Nunavut, or in any northern community. The workshop was seen as the beginning of a longer discussion – perhaps over the next 10 to 15 years – about the potential use of nuclear energy in the North.

Introduction to the Small Modular Reactor Roadmap

A **Small Modular Reactor (SMR)** is an advanced nuclear reactor that produces electric power up to about 300 MWe, designed to be built in factories, and shipped to a site for installation as required. SMRs provide a range of benefits including reduced greenhouse gas emissions, improved affordability, shorter construction and installation times, a wider range of potential users and applications, site flexibility, and integration with renewables.

In October 2017, the federal government committed to bringing together stakeholders to initiate a dialogue and develop a **Canadian Roadmap for SMRs** (“SMR Roadmap” or “Roadmap”). The need for a Roadmap originated from the following:

- SMRs are a promising potential source of non-emitting power for various applications;
- The technology is at an early stage of development, with many questions that still need answers;
- Future success involves risks and costs, involving both the private and public sectors across Canada; and
- A pan-Canadian approach would help guide important decisions and reduce uncertainty.

Initial research and analysis undertaken to assist in establishing the scope and approach for the Roadmap identified three potential applications for SMRs domestically.

- 1) **On-grid power** generation to replace fossil fuel plants in the existing electric power grid system (Power output of approximately 150 to 300 MWe).
- 2) Replacing existing diesel power generation for electricity, district heating, and desalination in **off-grid northern and remote communities** (Power output of less than 10 MWe, with many requiring less than 2.5 MWe).
- 3) Providing non-emitting heat and power for **heavy industry** sites such as resource extraction operations (Power output of approximately 10 to 170 MWe).

Approach to the SMR Roadmap

The approach to developing the SMR Roadmap involves a series of workshops with stakeholders to gain their needs, priorities, and perspectives. Four workshops have been

scheduled between March and June 2018. The first of these workshops was a Visioning Session, held in Toronto in March 2018, which focused on establishing an overall vision for SMRs in Canada, and on setting the overall foundation for the Roadmap process. The second workshop was held in Saint John on April 19-20, 2018, and focused on on-grid applications. Following the third workshop in Iqaluit, the final workshop will be held in Calgary, Alberta on June 19-20, where the focus will be on heavy industry applications.

The SMR Roadmap, and in particular the workshops, are also supported by five Working Groups that have been tasked with conducting analysis and providing insight into key aspects that will impact a future pan-Canadian SMR industry. The areas of study for the five working groups are: Technology; Economic and Finance; Indigenous and Public Engagement; Waste; and Regulatory Readiness.

Results from the Off-Grid Northern and Remote Communities Workshop

The workshop included multiple roundtable and plenary discussions that were used to collect input from the participants on multiple topics. These topics included current and future power generation in the North, and future engagement regarding SMRs. A brief summary of results from topics is presented below.

Brief Summary of Discussion: Current and Future Power Generation in the North

With respect to current and future power generation, concerns were raised by participants related to:

- **Reliability:** Outages in the North are considered a liability and can be challenging to fix in some circumstances, particularly during winter storms. Further, there is also a limited window every summer to bring in the diesel needed for a year into the Territory. Not receiving this diesel prior to winter would have a significant impact on reliability.
- **Demand Growth:** Population is increasingly rapidly and the mining industry has increased operations in the Territory in recent years. This has resulted in increased energy demands and stresses on the current system.
- **Energy Conservation:** Currently, energy costs are highly subsidized for many in the Territory. This seems to have led to little concern about energy generation and conservation.
- **Climate Change:** Northern communities see more impacts of climate change than the rest of Canada. Though any action taken by the Territory would have little impact on climate change overall.
- **Renewables:** Some communities have explored the use of renewables to supplement their power supply, though this is still in the early stages.
- **Potential Environmental Impacts:** The potential impacts to the environment of any proposed energy project will need to be considered and scrutinized. Impacts of a potential disaster to the land, water, and wildlife will be a major concern to the Inuit. Fisheries make up one of the larger industries in the North, and wildlife such as seal, whale, and caribou have always been, and are still, critical to Inuit survival.
- **Ownership/Partnership:** In the past, investments made in the North, and resulting benefits, have left the area. Any new project or initiative should look for ways to ensure

the Inuit people have an ownership or partnership stake so that benefits will remain in the region.

Brief Summary of Discussion: Future Engagement Regarding SMRs

With respect to future engagement regarding SMRs, the following guidance was provided by participants:

- **Preparation:** Participants need to prepare themselves prior to the engagement. In particular, Southerners should read the Truth and Reconciliation Commission Report before the meeting. Further, prepare materials and information that is clear, relevant, respectful, and in Inuktitut. Also, be aware of historical context and legacy concerns.
- **Engage within the Communities:** Reach out to the hamlets' councils and plan a visit directly to the communities. Though be prepared to have a broader discussion about community priorities and energy needs, and present SMRs as a potential option. There may be apprehension about nuclear in some communities.
- **Build Trust:** Building trust with Northern people would be the most critical factor in successful engagement. Look for ways to connect and partner with the communities, and have the right person who is fluent in Inuktitut speaking in the communities. Also, ensure the terminology and language being used is clear and honest.

1.0 Purpose of the Workshop

The purpose of the workshop was to initiate preliminary discussions with representatives from Nunavut and northern communities about their future energy needs and explore whether nuclear energy, from small modular reactors (SMRs), could be an option in addressing those needs. While the workshop was part of a broader initiative led by the federal government titled the SMR Roadmap, representatives from Qulliq Energy Corporation (QEC) and Natural Resources Canada wanted to use the event as a means to listen to northern communities to hear their views and priorities, and to share perspectives.

No site or project has been selected for an SMR in Nunavut, or in any northern community. The workshop was seen as the beginning of a longer discussion – perhaps over the next 10 to 15 years – about the potential use of nuclear energy in the North.

Further, QEC is currently looking at reducing its use of diesel to supply energy to Nunavut. Many see diesel fuel as expensive and “dirty.” QEC is looking at all options to reduce the use of diesel including wind, solar, hydro, deep geothermal, tidal, and nuclear. Even so, any decision about energy sources (including nuclear) would not be made without community consultation and consent.

More information about SMRs and the SMR Roadmap is provided in Section 2.0 of this report, and a list of participants is included in Appendix A.

2.0 Background Context

On the first day of the workshop, two presentations were provided around various topics applicable to the SMR Roadmap. First, Diane Cameron, Director of the Nuclear Energy Division at Natural Resources Canada and the Co-Chair of the SMR Roadmap Steering Committee provided an overview of the current energy mix in Canada, energy generation in remote communities, SMRs, and the Canadian SMR Roadmap.

Second, Bronwyn Hyland, Program Manager of Small Modular and Advanced Reactor Technologies at the Canadian Nuclear Laboratories and Co-Chair of the Technology Working Group discussed nuclear technology, SMR technologies, potential application for SMRs, and why Canada may be well positioned to move forward on SMRs.

This section provides a summary of the information presented during the two presentations.

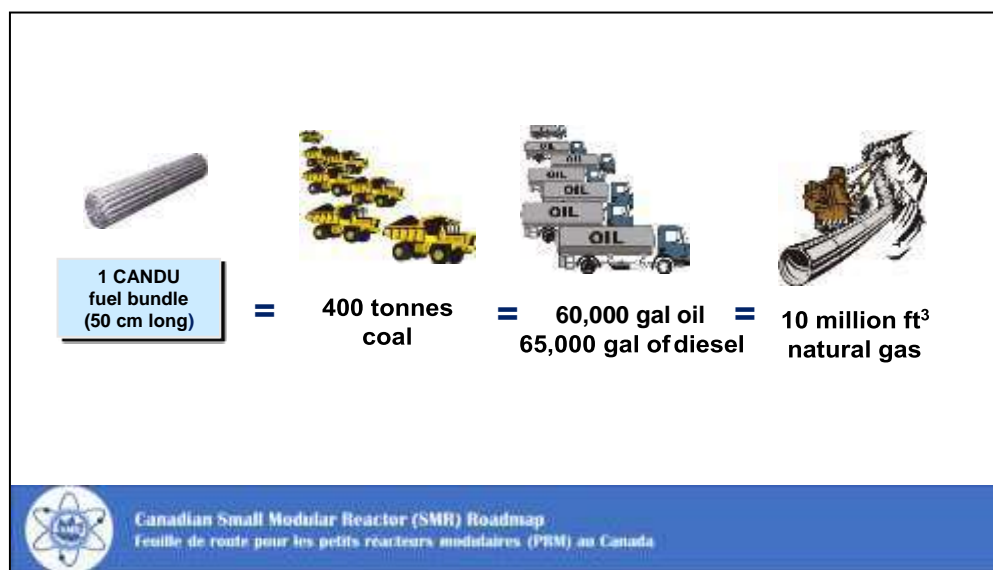
2.1 Energy in Canada Today (Including Nuclear)

Canada today has a vast array of energy options. For example, 59% of Canada’s electricity is produced by hydro. Canada is the second highest producer of hydropower in the world, but also has several renewables sources (e.g. wind and solar) of energy. Canada is eighth in the world in power generated by wind, and in the past five years, solar power generating capacity in Canada has grown 2.5 times. Although power from renewable sources is fast growing, it still provides a relatively small output overall. Further, there are some challenges with storage of energy from these sources.

Canada also produces a significant amount of power through nuclear sources. A nuclear reactor initiates chain reactions at a sub-atomic level as a means to produce heat; this reaction is also referred to as nuclear fission. The difference between nuclear and other traditional power plants is that the source (or fuel) of the heat is uranium. Uranium, a very heavy element, is capable of undergoing these chain reactions.

Nuclear provides approximately 15% of all the electricity in Canada. This includes 60% of the electricity in Ontario, and 33% in New Brunswick. Canada has over 60 years of experience in the nuclear industry, and a complete supply chain with: stations operating in Ontario and New Brunswick; mining, refining, and fuel fabrication being undertaken in Saskatchewan and Ontario; and research reactors in Saskatchewan, Ontario, and Quebec. Nuclear reactors also produce medical isotopes in Canada that are used to detect and treat certain cancers.

Nuclear provides a means for clean and reliable energy. Canada would not be able to meet its Paris commitments without investments in nuclear power, as nuclear currently allows Canada to displace 50 tonnes /year in greenhouse gas emissions. The following slide demonstrates how the power produced from one uranium fuel bundle compares to that produced from coal, diesel, and natural gas:



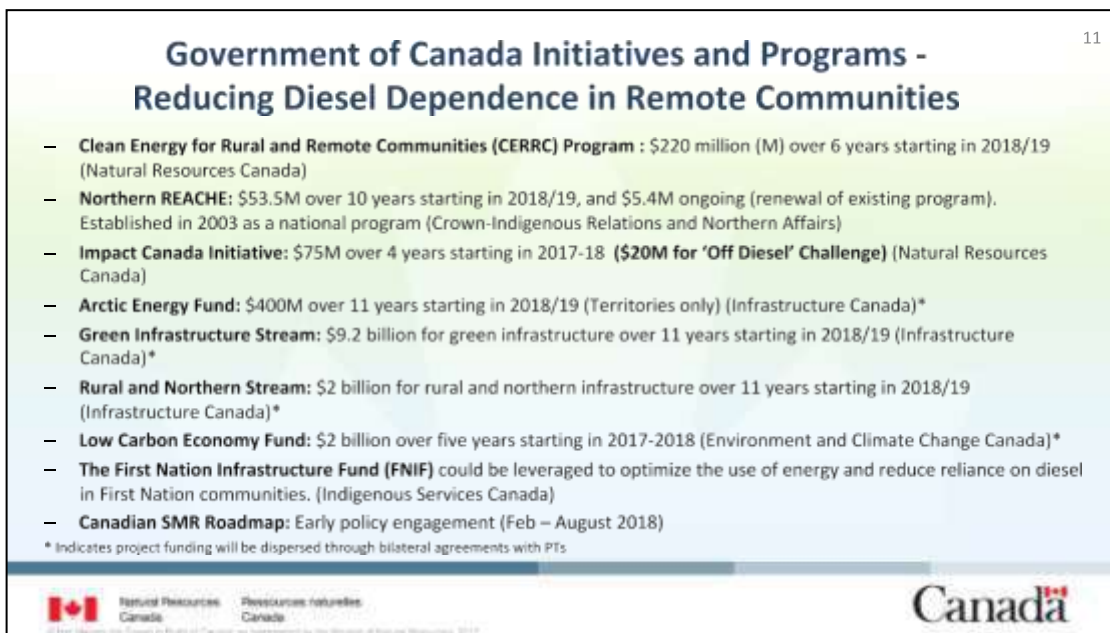
In 2017, the Government of Canada launched Generation Energy, which was tasked to help chart a pan-Canadian vision for energy. The initiative is led by the Generation Energy Council, which consists of 14 thought leaders in the industry. Generation Energy has reached approximately 400,000 Canadians for their input, and hundreds of papers have been submitted. The Council will build on what was heard to develop recommendations for Canada's energy future. Results from this work to date are available online at <http://www.nrcan.gc.ca/20093>.

2.2 Energy Generation in Remote Communities

The majority of remote communities that are off-grid rely on diesel for their energy needs. In many of these communities, energy costs are subsidized. Further, these communities are geographically dispersed with varying needs and resources.

Advances in renewable and energy efficient technologies have made it economically and technically possible for these communities to begin transitioning away from diesel-only systems. However, scientists and policy-makers disagree on how much renewable sources could replace diesel systems (i.e. maybe 20%; or 40%; or even up to 50%). The challenge is having reliable storage technology, which does not exist yet. So other options will need to be explored.

The Government of Canada currently has a number of initiatives and programs focused on reducing diesel dependence in remote communities. The following slide provides information on these initiatives/programs. Please note that the first eight initiatives/programs on the slide are more focused on the near term, while the SMR Roadmap has a longer-term view (i.e. 15 to 20 year focus). For more information about the initiatives/programs, please visit: <https://www.nrcan.gc.ca/energy/science/programs-funding/20542>.



The slide, titled "Government of Canada Initiatives and Programs - Reducing Diesel Dependence in Remote Communities", lists several initiatives. It includes the Clean Energy for Rural and Remote Communities (CERRC) Program, Northern REACHE, Impact Canada Initiative, Arctic Energy Fund, Green Infrastructure Stream, Rural and Northern Stream, Low Carbon Economy Fund, The First Nation Infrastructure Fund (FNIF), and the Canadian SMR Roadmap. A note at the bottom indicates that project funding will be dispersed through bilateral agreements with PTs. The slide features the Canadian flag and the word "Canada" in the bottom right corner.

Government of Canada Initiatives and Programs - Reducing Diesel Dependence in Remote Communities

- **Clean Energy for Rural and Remote Communities (CERRC) Program** : \$220 million (M) over 6 years starting in 2018/19 (Natural Resources Canada)
- **Northern REACHE**: \$53.5M over 10 years starting in 2018/19, and \$5.4M ongoing (renewal of existing program). Established in 2003 as a national program (Crown-Indigenous Relations and Northern Affairs)
- **Impact Canada Initiative**: \$75M over 4 years starting in 2017-18 (**\$20M for 'Off Diesel' Challenge**) (Natural Resources Canada)
- **Arctic Energy Fund**: \$400M over 11 years starting in 2018/19 (Territories only) (Infrastructure Canada)*
- **Green Infrastructure Stream**: \$9.2 billion for green infrastructure over 11 years starting in 2018/19 (Infrastructure Canada)*
- **Rural and Northern Stream**: \$2 billion for rural and northern infrastructure over 11 years starting in 2018/19 (Infrastructure Canada)*
- **Low Carbon Economy Fund**: \$2 billion over five years starting in 2017-2018 (Environment and Climate Change Canada)*
- **The First Nation Infrastructure Fund (FNIF)** could be leveraged to optimize the use of energy and reduce reliance on diesel in First Nation communities. (Indigenous Services Canada)
- **Canadian SMR Roadmap**: Early policy engagement (Feb – August 2018)

* Indicates project funding will be dispersed through bilateral agreements with PTs

2.3 What is an SMR?

Small modular reactors (SMRs) represent a potential nuclear option to meet the need of flexible power generation for a wide range of potential users and applications. More specifically:

The word “small” refers to the power output relative to traditional reactors. Where output from current reactors is typically measured in giga-watts, SMRs produce less than 300 MWe, with some producing less than 15 MWe. The physical sizes of SMRs vary, but are much smaller than current on-grid nuclear reactors.

The word “modular” refers to the technology being manufactured in dedicated facilities and transported to sites for installation as needed. This will lead to reduced on-site installation times, advanced quality assurance controls through standardization at manufacturing facilities, and improved cost efficiencies through economies of series.

The word “reactor” refers to nuclear technology that will supply power within the SMR. There are currently a large variation of reactor types under development within the industry, and large variations of designs within reactor types.

The following slide presents some of the benefits of SMRs.

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There are many potential benefits of SMRs...

SMRs have the potential to be a clean, secure and affordable source of reliable energy

- No Emissions** Like currently operating nuclear power reactors, SMRs do not produce greenhouse gases in the production of electricity that contribute to climate change or air pollution
- Hybrid Systems** Some SMRs could be integrated with renewable energy sources, like wind and solar, to create hybrid energy systems
- Lower Costs** Factory fabrication and modular components can reduce construction costs and duration and help lower costs by producing many similar units
- Strong Safety Features** SMRs are just as safe as current nuclear power reactors, and have new features that ensure designs meet stringent safety requirements

Natural Resources Canada / Ressources naturelles Canada

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Canada

2.4 Why SMRs in Canada?

In recent years, the industry has looked towards Canada to play a leading role in SMR development and deployment. There are many reasons for this attention on Canada including:

- Canada has a world class and respected nuclear regulatory framework. All reactors in Canada are federally regulated by the Canadian Nuclear Safety Commission (CNSC). The regulatory framework in Canada differs from other countries. The robust yet flexible framework is able to accommodate new reactor designs, and has led several designers to engage in discussions with the CNSC. There are currently 10 (international) designers who have had pre-licensing discussions with CNSC;
- An efficient gateway to the North American market;
- There is a pressing domestic need for the technology. Potential domestic applications are discussed in more detail in Section 2.7;
- An existing, capable, and established supply chain. Many countries have lost their supply chains, which is not the case in Canada; and
- A stable political system with a government that is committed to action on climate change.

However, the window for Canada to take action is now, and is very narrow. The SMR landscape is moving very fast and there is a lot of interest worldwide. Four years ago, in 2014, the thought was that SMRs were still 30 years away. As of now, a lot of design work has taken place, so

some of these technologies may now be ready in five to ten years. Though, the technologies that will be ready earlier are expected to be of more interest to on-grid applications in the South.

2.5 Possible Concerns of SMRs (and Nuclear Power)

There are a number of concerns that will need to be addressed before SMRs can be deployed. Some of which include safety, waste management, and economics.

To move forward, SMR designers will have to prove their technologies are safe. Historically, reactors have relied on technical engineering solutions to ensure safety, but these new designs are using various laws of physics. For example, if something changes in the reactor, it will automatically shut itself down. This is not to imply that an operator will not be needed, as there will always be a way to actively shut it down. Regardless, as discussed earlier, all nuclear activities are federally regulated by the CNSC, and any designer will have to demonstrate to them that their technology is safe.

In terms of waste management, there will most likely be some requirements for waste to be stored on-site for a period of time. Currently, in Ontario and New Brunswick waste is stored on-site. Though it is not clear how long the waste would have to remain on-site, and this will likely vary for different reactor technologies and designs (i.e. maybe a year or more). It would not be expected that waste would remain in a community for the long-term. The intent is that it would be shipped to another location.

The economics of SMRs could be challenging, as there will be high initial capital costs. As such, it may not be a viable solution for all communities. More exploration and work needs to be done to develop models that could present possible solutions to making the economics viable for all communities.

This is not to say that these are the only concerns that may exist. A demonstration SMR could be employed to address some of these challenges, including technology, economic, and regulatory risks. In fact, Canadian Nuclear Laboratories (CNL) recently launched an Invitation for SMR demonstration projects (that would be hosted at CNL). This was done to better understand and assess the credibility of the designers and their current technologies. This may lead to one (or more) technologies being selected and used as a prototype or demonstration project.

2.6 What is the SMR Roadmap?

In October 2017, the federal government committed to bringing together stakeholders to initiate a dialogue and develop a Canadian Roadmap for SMRs (“SMR Roadmap” or “Roadmap”). The need for a Roadmap originated from the following:

- SMRs are a promising potential source of non-emitting power for various applications;
- The technology is at an early stage of development, with many questions that still need answers;
- Future success involves risks and costs, involving both the private and public sectors across Canada; and
- A pan-Canadian approach would help guide important decisions and reduce uncertainty.

The Roadmap would be a plan for the development and deployment of SMRs that addresses the collective needs and challenges of all stakeholders.

As such, Natural Resources Canada (NRCan) assembled the Inter-utility Consultative Committee on Nuclear (ICCN) to provide a forum for discussion that supports a collaborative and coordinated approach regarding nuclear power. Membership in the ICCN was open to all provincial and territorial governments, and utility representatives, regardless of the nuclear policy direction in their jurisdiction.

To meet the federal government commitment, the ICCN established the SMR Roadmap Steering Committee. A listing of the Steering Committee organizations is included in Appendix B. The Steering Committee has identified the following objectives for the SMR Roadmap:

- Clarity on needs and priorities of stakeholders and Canadians;
- Understanding of the value proposition of different SMR technology categories;
- Identification of key issues related to regulatory readiness, waste management, and transportation policy;
- Appreciation of risks and challenges; and
- Identification of policy levers that may impact SMR feasibility in Canada.

*In addition, the roadmap process will **seek to encourage and develop broad agreement** among the essential enabling partners on the **way forward** to position Canada for success domestically and for best advantage in the emerging global SMR market.*

The Steering Committee officially launched the SMR Roadmap process in December 2017. The approach to developing the SMR Roadmap involves a series of workshops with stakeholders to gain their needs, priorities, and perspectives. Four workshops have been scheduled between March and June 2018. The first of these workshops was a Visioning Session, held in Toronto in March 2018, which focused on establishing an overall vision for SMRs in Canada, and on setting the overall foundation for the Roadmap process. The second workshop was held in Saint John on April 19-20, 2018, and focused on on-grid applications. Following the third workshop in Iqaluit, the final workshop will be held in Calgary, Alberta on June 19-20, where the focus will be on heavy industry applications.

The SMR Roadmap, and in particular the workshops, are also supported by five Working Groups that have been tasked with conducting analysis and providing insight into key aspects that will impact a future pan-Canadian SMR industry. The areas of study for the five working groups are: Technology; Economic and Finance; Indigenous and Public Engagement; Waste; and Regulatory Readiness.

In terms of timelines, the Steering Committee is committed to provide an update on the SMR Roadmap to the Energy and Mines Ministers' Conference in August 2018. Also, a final SMR Roadmap Report will be available in the fall of 2018.

2.7 Potential Domestic Applications for SMRs

Although it is expected there will be interest in SMRs internationally, the focus of the SMR Roadmap is on potential domestic applications. Initial research and analysis undertaken to

assist in establishing the scope and approach for the Roadmap identified three potential applications for SMRs domestically. These are listed below, along with the expected power output required for each application.

- 1) **On-grid power** generation to replace fossil fuel plants in the existing electric power grid system (Power output of approximately 150 to 300 MWe).
- 2) Replacing existing diesel power generation for electricity, district heating, and desalination in **off-grid northern and remote communities** (Power output of less than 10 MWe, with many requiring less than 2.5 MWe).
- 3) Providing non-emitting heat and power for **heavy industry** sites such as resource extraction operations (Power output of approximately 10 to 150 MWe).

Although these three potential applications have been identified, the Steering Committee recognizes that the degree of interest and timelines will differ for each application. Most likely SMRs would be first deployed for on-grid and heavy industry applications. It would be expected that if there was interest, off-grid and remote community applications would be furthest out from a timelines perspective.

3.0 Summary of Discussions (What We Heard)

The workshop included multiple roundtable and plenary discussions that were used to collect input from the participants on multiple topics. These topics included current and future power generation in the North, the perceived positives and concerns of SMRs, and future engagement regarding SMRs. The following sub-sections provide a summary from these discussions.

3.1 Current and Future Power Generation in the North

On the first day of the workshop, participants were asked to discuss the following questions (with other participants at their respective table) and report back to the larger group.

- **What is the current situation in the North (and in your community) regarding electric power?**
- **Are there current concerns related to power generation?**
- **What are your thoughts on the future of power generation in the North?**

The following provides a summary of the results from these discussions.

Summary of Discussion Regarding the Current Situation and Concerns

Reliability of Power: Communities are expecting and relying on power being available when needed. Outages are considered a liability and can be challenging to fix in some circumstances. Not all communities have operators readily available to deal with a problem, and if an outage happens during a storm in winter, it can be difficult to get someone to the community. This can potentially lead to enacting emergency plans if the outage is greater than eight hours. Even so, evacuations can be dangerous and challenging.

There is also a limited window to bring in the diesel needed for a year into the Territory. Nunavut requires approximately 15 million litres of diesel per year, and it all has to be received during the sealift season. The sealift season is the short duration in the summer months where the ice has broken up and the Territory can be accessed by boat. Not receiving this diesel prior to winter would have a significant impact on reliability and availability of power.

Infrastructure Needed to Meet Demand Growth: Although the population in Nunavut is still small relative to other Provinces/Territories, population is increasing rapidly. Further, the mining industry has increased operations in the Territory in recent years. This has resulted in increased energy demands and stresses on the current system. Additional infrastructure will be needed soon to address these increased demands. Though it should be noted that not all communities' current energy infrastructure is operating at full demand, so where to place this additional infrastructure will require some thought.

Conservation of Energy: Currently in Nunavut there is little incentive for people to conserve energy, as energy provided to social and government housing is highly subsidized. Only private homeowners in the Territory pay the full costs for energy. In fact, some stated this has led to little concern about energy generation in general. Many participants felt that additional awareness or education is required, as it seems that many people living in the Territory do not equate energy use with any consequence. However, in many people's minds there is a desire to "do better," and "respect for the land" is one of the core values of the Inuit people. Many participants felt that appealing to these values could initiate the consideration of alternative energy sources.

Impacts of Climate Change: Even with greater awareness and action regarding energy conservation, participants agreed that it would have very little impact on climate change. Nunavut contributes approximately 0.1% to 0.2% of Canada's total greenhouse gas emissions. Unfortunately, northern communities see more impacts of climate change than the rest of the country, and it affects their lives directly. For example, they can no longer predict where cracks in the ice will be or when the spring thaw will start. One participant stated, "there would be more impact on climate change if Southerners did something small, than us doing something large."

Potential Role of Renewables: Some communities in the North are exploring and/or are already using renewables to supplement their power supply. For example, Hall Beach has submitted a proposal to the federal government to fund solar and wind technology to power their arena (they are still waiting on a response). However, the idea of using renewable sources in Nunavut is still in the early stages.

Summary of Discussion Regarding Thoughts on Future Power Generation in the North

Environmental Impacts and Legacy: When reporting back to the larger group, it appeared that much of the discussion focused on the past and present, with little consideration given to the future. Participants believed that this was because Nunavut is still dealing with legacy issues caused by decisions made decades ago. For example, there is a pool of aviation gasoline under Iqaluit that was left there during World War II. This has caused issues in development efforts in the city. In another example, there are contaminants running into Baker Lake from local landfills filled with old industrial waste. Participants stated that it can be difficult to look forward when we are still trying to deal with these legacy issues.

Participants also stated that it would be critically important to consider the potential impacts to the environment of any proposed energy project. Past negative experiences in the Northwest Territories (uranium mining) and the Yukon (Faro Mine) will add reluctance to any larger project. Further, impacts of a potential disaster to the land, water, and wildlife will be a major concern to the Inuit. Fisheries make up one of the larger industries in the North, and wildlife such as seal, whale, and caribou have always been, and are still, critical to Inuit survival. These concerns would not just be related to a nuclear project, but also a hydro project. Wind and solar may not have the same impacts, but location of the infrastructure may be a concern (e.g. noise).

Ownership or Partnership in Any Future Initiative: There are significant socio-economic inequalities in the North between Inuit and non-Inuit people. In the four Inuit regions in Canada, the average income for an Inuit person is \$23,000, and \$96,000 for a non-Inuit person. Further, in the past, investments made in the North have left the area through the use of contractors, consultants, etc. Any new project or initiative should look for ways to ensure the Inuit people have an ownership or partnership stake so that benefits will remain in the region, and will help address the socio-economic inequalities. Also, the Inuit people of the region need to play a role in governance and decision-making for the project, to further reinforce their stake in the initiative.

Look at Neighbouring Jurisdictions: Some participants stated that it might be useful to look at what other arctic regions are planning for their future power needs. This could include Alaska or Greenland. In fact, the Alaskan Energy Alliance is currently looking at a range of technologies that could be applied in different environments.

3.2 The Perceived Positives and Concerns Regarding SMRs

Near the end of the first day of the workshop, after the overview of SMRs and the SMR Roadmap was provided, a plenary discussion was held. Participants were asked for their perceived positives and concerns related to what they just heard about SMR technology. The following table provides the results of the discussion.

Positives of SMRs	Concerns of SMRs
1. Ability to provide electricity and generate heat.	1. There will be challenges in obtaining community support.
2. Reduced environment impact with respect to alternatives (e.g. diesel).	2. Ensuring that there is a skilled workforce in place that is able to operate the technology.
3. Further reduction of GHG emissions by reducing the need to transport diesel.	3. Cost (though this could turn into a positive).
4. Canada has a world-class regulatory framework (that helps alleviate safety concerns).	4. Uranium extraction could be more damaging environmentally than the oil sands.
5. Reduces Nunavut’s reliance on imports (i.e. not at the mercy of the sealift season).	5. The fragility of the environment. Building reactors on permafrost may be an enormous concern. Also concerns regarding seismic activity of the region, and the length of time to clean up sites.
6. There is no carbon tax on it.	6. Potential impacts on wildlife and the Inuit way of life (and long term ecological damage).
7. The SMR Roadmap process is providing a great open dialogue (but wish more communities were represented).	7. Inherent safety risks, including those related to the storage and handling of materials (no evidence that these risks have been taken care of yet), and the threat to human safety in the event of a nuclear accident.
	8. Potential threat to human safety in instances of breach/meltdown/explosion.
	9. Additional funding required for capacity building at the community-level (that requires a knowledge transfer bi-laterally between the North and South).
	10. Lack of clarity in the technical viability and capacity to meet demands.
	11. There is a sense of “rush” in responding to the Roadmap (more engagement is required and more information needs to be provided to the communities).

Positives of SMRs	Concerns of SMRs
	12. Mistrust of the CNSC.
	13. Potential psychological impacts on the populations, especially fear.

3.3 Future Engagement Regarding SMRs

On the second day of the workshop, participants were asked to discuss the following questions (with other participants at their respective table) and report back to the larger group.

- **How would you like to be engaged in future discussions related to SMRs?**
- **Are there special considerations about engagements on SMRs in the North?**

The following provides a summary of the results from these discussions.

Summary of Discussion Regarding Future Engagement

Engage Directly in the Communities: Participants urged the SMR Roadmap Steering Committee to engage directly with the communities, if additional engagement sessions are being planned in the North. They stated the importance of reaching out to the hamlet’s council prior to a visit in order to reach the wider community. However, be cautious not to “overengage” on the same topics with the communities.

Further, during the discussions, ask about community priorities and energy needs. Discussions will most likely deviate towards wind, solar, and other energy options. However, presenting SMRs as another potential option may be the best way to introduce them, as there may be some apprehension about nuclear power. Though keep in mind that nuclear may be an option that some communities are already considering.

Also, keep in mind that the hamlet councils are elected officials who may be focused on four years cycles (i.e. focused on shorter-term thinking). Suggestions were made to leave information about nuclear in the schools to begin reducing fears about it in the community and to engage with the Hunters and Trappers Associations.

Further, the Government of Nunavut (GN) is already looking to have discussions with communities on energy through its Community Energy Planning initiatives. As such, the SMR Roadmap Steering Committee will want to coordinate its engagement efforts with relevant local stakeholders such as the Climate Change Secretariats at that GN (as well as potentially others).

Summary of Discussion Regarding Future Engagement (continued)

Preparing for Additional Engagement: Participants stated that both Northern and Southern participants in any engagement should prepare themselves. In particular, Southerners should read the Truth and Reconciliation Commission Report before the meeting. Further, ask Northern participants to create the agenda, and provide them with information that is clear, relevant, respectful, and that can be translated. Use presentations with visuals and that are in Inuktitut. It would also be useful to use Northerners who have spent time in the South to help transfer knowledge. Further, make sure people are engaged – both elders and youth. Finally, do not ignore the connections to legacy issues such as uranium mining in the Northwest Territories.

Focus on Building Trust: Participants also stated that building trust with Northern people would be the most critical factor in successful engagement. Look for ways to connect and partner with the communities. Further, get the right person speaking in the communities, someone who is fluent in Inuktitut. Also, avoid it being a “sales pitch.” Instead, ensure that the terminology used is clear and honest. This will be a rare experience for all these people to be in the same room discussing a topic such as this, so use the opportunity to have a broader conversation about priorities and needs.

Appendix A: List of Participants at the Northern and Remote Communities Workshop

The following presents the participants at the Off-Grid Applications Workshop.

- Atomic Energy of Canada Limited
- Bruce Power
- Canadian Nuclear Association
- Canadian Nuclear Laboratories
- Canadian Nuclear Safety Commission
- City of Iqaluit
- Hamlet of Artic Bay
- Hamlet of Clyde River
- Hamlet of Hall Beach
- Hamlet of Pangnirtung
- Member of the Legislative Assembly for Iqaluit
- Natural Resources Canada
- Northwest Territories Department of Infrastructure
- Nunavut Department of Community and Government Services
- Nunavut Department of Environment – Climate Change Secretariat
- Nunavut Research Institute / Nunavut College
- Ontario Power Generation
- Qulliq Energy Corporation
- Strategic Review Group (Facilitator)
- Yukon Research Centre / Yukon College
- Inuit Tapiriit Kanatami (observer)

Appendix B: List of Steering Committee Organizations

The following organizations are represented on the SMR Roadmap Steering Committee:

- New Brunswick Power
- New Brunswick Department of Energy and Resource Development
- Qulliq Energy Corporation
- Ontario Ministry of Energy
- Ontario Power Generation
- Bruce Power
- SaskPower
- Northwest Territories Department of Infrastructure
- Alberta Ministry of Energy
- Alberta Innovates
- Non-voting: Atomic Energy of Canada Ltd.
- Non-voting: Natural Resources Canada

The Steering Committee is also served by the following non-voting co-chairs:

- Diane Cameron, Director, Nuclear Energy Division, Natural Resources Canada
- Phil Carr, Roadmap Facilitator, Strategic Review Group/Canadian Nuclear Association