Alternative Energy Report

Alternative Energy Options

December 2020

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Executive Summary

Providing Nunavummiut with safe, affordable and reliable energy is a top priority for Qulliq Energy Corporation (QEC). QEC also supports the Government of Nunavut's mandate, *Turaaqtavut,* and the priority area of *Pivaallirutivut*, which incorporates developing and managing our renewable and non-renewable resources for the long-term benefit of Nunavummiut. The need to have a strong relationship with our land so that it is intact for future generations, while providing the necessary energy Nunavummiut require on a daily basis, drives the need to explore alternative energy options that can satisfy both of these requirements.

Alternative energy sources have the potential to supplement current diesel power generation to reduce the territory's reliance on fossil fuel imports. This report provides a review of potential alternative energy sources, with an examination on practical use in Nunavut and the associated strengths and challenges of each technology.

QEC will continue to remain reliant on diesel power generation for the majority of the territory's electricity generation. Power is generated and distributed through the operation of 25 stand-alone diesel power plants in 25 remote communities prone to extreme weather conditions. There is no grid interconnection between communities or from outside the territory of Nunavut; diesel is sealifted annually in the limited shipping season and stored for consumption. With the available technology, diesel generation is still the only on-demand reliable electricity generation source for Nunavut. Until alternative technologies become more reliable and financially viable, diesel generation will remain the most reliable and economic way to generate electricity in the territory.

Diesel power plant replacements and upgrades are key to ensuring a safe, efficient and reliable power supply for Nunavut. Enhancing current and establishing new district heating systems using residual heat from diesel power plants offers considerable potential to reduce the use of heating fuel by supplying residual heat to suitable adjacent commercial, municipal, and territorial buildings. Expansion of these district heating systems represents the highest return on investment for QEC in the short term to improve energy efficiencies and reduce greenhouse gas emissions.

The reliability of some alternative energy sources, which produce intermittent rather than continuous or on-demand power, and the large capital cost to transition to these sources, are the biggest challenges to their implementation in Nunavut. Significant financial resources are required to build alternative energy facilities. Ongoing costs will also be incurred to operate and maintain alternative energy equipment and to recruit, train and employ human resources skilled in these systems on an ongoing basis. QEC's limited financial resources are used to maintain and rebuild aging diesel generation facilities; new sources of funding will be required to incorporate alternative energy into the energy mix.

As such, QEC will need financial support from the Government of Canada to construct alternative energy facilities. Potential sources of funding include, but are not limited to, the Clean Energy for Rural and Remote Communities fund and the Low Carbon Economy Fund. If QEC is successful in accessing these funds, projects can move forward and allow alternative energy sources to be integrated into existing and new power plants.

Following the 2018 amendment of the *QEC Act* to enable the Corporation to purchase power from third parties, QEC is also looking ahead to independent power producers as means to offset the costs of transitioning to renewable energy systems. This report outlines the processes, benefits and what steps QEC has taken to pursue these opportunities and partnerships.

QEC is committed to supporting efforts to reduce Nunavut's carbon emissions and is engaged in a number of alternative energy initiatives, which support the country's Pan-Canadian Framework on Clean Growth and Climate Change. The Framework is a plan, developed with the provinces and territories and in consultation with Indigenous peoples to meet emissions reduction targets, grow the economy, and build resilience to a changing climate.

Regardless of the strategy or opportunity, key stakeholders will be kept informed of alternative energy options and their status. Community consultations will occur to understand the impact of a major project to the people and to the land, as well as ensure QEC is meeting its obligations under the *Nunavut Agreement*.

QEC Position

QEC's mandate is to provide safe, secure, and affordable energy to all Nunavummiut without compromising reliability and quality. As a responsible and accountable utility, QEC employs proven sources to generate energy to fulfill the mandate. Based on present technology, diesel generation is still the only reliable electricity generation source for Nunavut. Until a reliable alternative is established, existing diesel generation systems must be maintained to ensure an on-demand electricity supply.

The desire to transition from fossil fuels to alternative energy generation is driven by environmental considerations, having greater control over fluctuating fuel prices, reducing dependence on fossil fuels and achieving energy independence. As renewable energy technologies continue to mature and become more viable financially, QEC's long-term, strategic direction is to evaluate the renewable options and where technically and financially viable, displace diesel generation.

Like other northern jurisdictions, QEC has an interest in alternative energy development particularly if it can mitigate the high costs of fossil fuel generation and environmental impacts. QEC has not integrated any community-scale alternative energy sources into its electricity grids to date, primarily due to the high cost of implementation. An overview of the electricity cost structure in Nunavut is presented within the report in "QEC Energy Framework: The Cost of Generating Electricity in Nunavut" (Appendix A).

The Government of Canada offers programs that can provide financial support for alternative energy and energy efficiency projects. This may provide QEC with opportunities to improve energy efficiency through District Heating System expansions and to explore alternative energy options. QEC will seek funding through federal programs, and continue to explore options that may result in the addition of alternative energy generation sources to the Corporation's energy mix.

Review of Energy Sources

An examination of current and alternative energy sources follows. The period intended for development is defined by short-term (within 10 years); medium-term (10-20 years) and long-term (longer than 20 years).

DIESEL

Current Status: QEC's current energy production is exclusively through diesel power generation.

Based on current commercial technology, diesel generation remains the only practical, reliable, primary electricity generation source for Nunavut. Efficiency of current diesel generation has been and can be further enhanced by:

- Replacing outdated diesel plants with new energy efficient plants incorporating latest technologies;
- Upgrading existing generator sets with fuel efficient engines; and
- Expanding District Heating Systems to reduce dependence of fossil fuel for heating by institutional and commercial customers.

Challenges: Costs to import, greenhouse gas emissions, fluctuating fuel costs, federal policy on Clean Fuel Standard

DISTRICT HEATING SYSTEMS

District Heating Systems (DHS), also known as residual heat, is the process of harnessing thermal energy from generator sets while generating electricity in the power plant. The thermal energy, heat, is a byproduct of generating electricity, which, if not used, is vented into the atmosphere. The captured thermal energy is supplied to institutional or commercial customers, or to the power plant through a distribution system. In Nunavut, DHS is presently connected to commercial and institutional buildings in five communities. It is a proven system and successful technology that has helped reduce the territory's heating fuel consumption, cut carbon emissions and allows commercial, and municipal and territorial government customers to save on fuel costs. By using residual heat, customers avoid burning their own diesel for heating, lessen their carbon footprint, and get their heat at a discount to market rates.

Current Status: District heating projects are enhancing energy efficiency at a community level by reducing reliance on diesel fuel to heat large community facilities such as Iqaluit's Qikiqtani General Hospital, Nunavut Arctic College, and the Nunavut Court of Justice. With funding through Indigenous and Northern Affairs Canada, QEC expanded the Iqaluit DHS to the city's Aquatic Centre in 2018. In spring 2020, QEC and the City of Iqaluit signed a new DHS agreement for the City's Aquatic Centre, Water Treatment Plant, Water Booster Station and Water Reheat Station for a 20-year term.

New DHS infrastructure is being built in Sanikiluaq and Taloyoak with expected completion dates in 2022 and 2023, respectively.

Given that DHS delivers benefits to QEC, customers and the environment, the Corporation will attempt to maximize the number of customers served by DHS.

Challenges: The effort to expand DHS is contingent on funds becoming available to grow the system. Expanding DHS is a capital-intensive process that has occurred only with the support of federal funding; QEC will attempt to secure additional federal support as a means of expanding DHS.

WIND & SOLAR

Current Status: Wind and solar power are technologies that can be successfully deployed in arctic conditions. While it is important to select the right equipment, particularly for wind projects, the major barrier to deploying wind or solar projects is financial, not technological.

In Nunavut, supplying electricity through wind and solar projects is being pursued with the stipulation that there cannot be a resulting increase in customers' electricity rates. The business case for wind and solar relies on subsidies from the federal government or extremely long payback periods.

Because wind and solar technologies are intermittent in nature, they must be backed-up by maintaining full diesel capacity, meaning, QEC must continue to maintain and rebuild diesel power plants even if wind or solar systems are installed. This adds strain to the business case associated with wind and solar, and, potentially, upward pressure on electricity rates.

In 2016, QEC commissioned the "Potential for Wind Energy in Nunavut Communities" report to determine the viability of wind resource in the territory. This desk stop study identified Sanikiluaq, Iqaluit, Arviat, Rankin Inlet and Baker Lake with the highest potential for wind resources. The report can be accessed at https://www.qec.nu.ca/power-nunavut/renewable-energy/wind

QEC completed a Solar PV (Photovoltaic) panel demonstration project at the Iqaluit power plant in 2016 with promising results. QEC will be installing a 500 KW solar panel with storage capacity as part of the new Kugluktuk power plant construction project and the Corporation will continue to pursue funding from federal programs to further invest in wind and solar technology.

Ongoing technological improvements will continue to increase this technology's viability, reliability, and affordability.

Battery Storage: To compensate for their intermittent nature, and allow safe connection to QEC's grid, large wind and solar installations will require battery storage. Battery storage allows for the smooth transition from renewables powering the grid to diesel power when the wind stops or it's cloudy. This ensures a stable supply of power to QEC's customers. These storage units are currently expensive, increasing the costs for renewable installations.

Challenges: Obtaining the funding to deploy wind and solar projects, short duration battery storage and high cost of battery technology

Development Potential: Short-term. QEC launched a Net Metering program in April 2018 and anticipating to launch a Commercial and Institutional Power Producers program in 2020-2021. An Independent Power Producers program, to enable large scale alternative energy generation by third parties, is currently under development.

HYDRO

Current Status: On hold due to the significant capital requirements. Hydro electrical power generation is a proven, on demand power generation source. The reliability of hydro generation is dependent on the water reservoir, water source and plant design. QEC has been exploring the potential use of hydroelectric power since 2005. Exploration studies covering 14 potential locations within Nunavut hydro generation have been completed at a cost of $10M. Out of the 14 sites, a feasibility study identified two sites for consideration: Jaynes Inlet (power generation capacity between 12-15MW) and Armshow South (power generation capacity at 7.3MW). Although additional work will be required to confirm the feasibility study, these projects, if proven, could supply Iqaluit's electricity needs for the medium to long term. The hydro generation would displace approximately 30% of QEC's diesel fuel needs, but would not result in lower electricity rates in the short term. Iqaluit is preferred for this option as communities with small customer base and electricity demand will not be able to support this capital intensive option.

The latest updated cost estimates obtained by the consultants Knight Piesold in December 2017 are $232M for Jaynes Inlet and $175M for Armshow South.

Proposed Manitoba-Kivalliq Hydro Project: The proposed project by the Kivalliq Inuit Assocation (KivIA) is to build a 1,200 kilometre hydroelectric transmission line linking Manitoba to the communities of Arviat, Baker Lake, Chesterfield Inlet, Rankin Inlet, Whale Cove, and two operating mines in the region. The project seeks to provide the five communities and two mines with an alternative electricity supply from diesel power generation. KivIA's latest cost projection for the Kivalliq Hydro-Fibre Link is $1.6B. The federal government supplied $1.6 million for the project's technical and feasibility study while the Canada Infrastructure Bank signed a memorandum of understanding to advise KivIA and its partners on this proposed project. QEC issued a letter of support for the study and is engaged with KivIA on any new developments on this initiative.

Other hydro options and initiatives will be considered on a case-by-case basis, using customer cost impact as one of the primary evaluation criteria.

Challenges: Large capital investment required.

Development Potential: Medium-term (10-20 years).

TIDAL

Current Status: There is worldwide interest in tidal energy. Tidal power can be more efficient, predictable and persistent than wind or solar photovoltaic (PV). Minas Passage, Bay of Fundy (Nova Scotia) has the highest average tides in the world. In Nunavut, the potential for tidal energy

in Frobisher Bay, where tides are among the highest in Canada, is high. Presently, the leading technologies to convert tidal energy into electrical energy are tidal barrages and in-stream turbines. Neither technology has reached the stage of commercial deployment.

Challenges: Unknown reliability at a commercial deployment level.

Development Potential: Medium to long-term; QEC will further observe the potential for tidal power as it develops commercial viability.

GEOTHERMAL

Current Status: With geothermal technology, this renewable, on-demand energy can be harnessed to efficiently heat and cool buildings of all types. Studies presented by the Waterloo Institute for Sustainable Energy show that Western Canada has excellent potential for power generation and much of Canada has potential for shallow to intermediate grade depth geothermal energy. Assessment and modelling has not been done in the Canadian arctic, but there is potential for deep hard rock geothermal systems that could provide reliable energy.

QEC commissioned the "Nunavut Geothermal Feasibility Study" report in 2018 to assess geothermal potential in Nunavut. The report can be accessed at https://www.cangea.ca/nunavutgeothermal.html The initial study suggests Resolute Bay, Cambridge Bay and Baker Lake as having the best potential for geothermal energy. In 2019-2020, QEC received funding from Canadian Northern Economic Development and Polar Knowledge Canada to pursue the second phase of the study. The next step includes comprehensive data collection and analysis for the above communities, as well as temperature gradient well drilling in Baker Lake which is expected to commence in summer 2021. Based on the outcome of the second phase, QEC will select one of the three communities for further exploration, pending community acceptance.

Challenges: Lack of existing data for northern geothermal potential; financial constraints.

Development Potential: Long-term.

BIOMASS/WASTE

Current Status: Waste produced in Nunavut communities consists of municipal solid waste, biomass, materials such as paper, cardboard, food waste, combustible materials such as plastics and synthetics made from petroleum, and noncombustible materials such as glass and metals. All of these become part of the landfill, which has environmental impacts. Using developing technology, these methods aim to compress and dispose waste while attempting energy generation from them.

The City of Iqaluit has started to explore waste management options for Iqaluit and the feasibility to generate energy from landfill waste. QEC will be available to engage with the City to explore this option and provide support, as required.

Challenges: Small quantities of waste available in most communities limit potential power generation, costs to import materials to use for biofuel, costs to transition to large-scale combined heat and power plants that combust biomass. Iqaluit may have the potential to use the waste for

energy generation as the largest community; however, the quantity/quality of waste material available in Iqaluit has not been determined to date.

Development Potential: Long-term.

NUCLEAR

Current Status: Nuclear power generation in Canada was established in the 1950s. A low-carbon emitting form of energy generation, nuclear power generates 15% of Canada's electricity, including 60% in Ontario and 33% in New Brunswick.

In 2018, the Government of Canada launched the Canadian Small Modular Reactors (SMRs) Roadmap as one of the actions under the Pan-Canadian Framework on Clean Growth and Climate Change. QEC joined interested provinces, territories, industries and utilities to develop a roadmap for SMRs that included an engagement session hosted by Natural Resources Canada (NRCan) in Iqaluit in May 2018. Due to the limited information available on the challenges SMRs face while operating in the Arctic, QEC is only in the research stage, acquiring information on the technical viability and financial considerations of SMRs. A summary of the Roadmap project and final report can be accessed at https://smrroadmap.ca

SMRs are nuclear fission reactors that are being designed to be small in both power output and physical size, portable and scalable, and able to be integrated with renewable energy systems.

In Canada, SMRs have three potential applications:

- On-grid power generation to replace coal plants.
- On- and off-grid combined heat and power for heavy industry such as oil sands producers and remote mines.
- Off-grid power, district heating, and desalination for remote communities.

There are no current plans or projects underway for an SMR to be built or tested in Nunavut, however the third application is a potential option for Nunavut with district heating and desalination features being particularly applicable.

Based on the Roadmap report recommendations to various stakeholders, the Government of Canada plans to launch Canada's SMR Action Plan in late 2020. This Plan will outline the progress and ongoing efforts across Canada on SMRs. QEC is supporting NRCan's objective to continue the dialogue with communities in Nunavut, provide an update on the SMR technology, and learn more about the stance of communities on nuclear energy. A virtual engagement with Nunavut stakeholders is planned to begin in fall 2020 and continue into 2021.

Challenges: Financial cost, regulatory issues, nuclear waste management and public perception of the safety of nuclear power.

Development Potential: Long-term.

ENERGY SOURCES: PRESENT STATUS AND FUTURE VIABILITY IN NUNAVUT

TECHNOLOGY	CURRENT STATUS	DEVELOPMENT POTENTIAL	QEC NEXT STEP
Diesel	• Sole energy source for electricity in Nunavut	• Improved reliability • Improved efficiency	• Power plant and generator set replacements under the Arctic Energy Fund to be completed between 2018-2027
District Heating Systems (DHS)	• DHS is presently connected to 24 buildings in five communities • Recent expansion of the Iqaluit DHS to the city's Aquatic Centre	• Short-medium term potential to increase residual heat projects	• New DHS infrastructure projects in Sanikiluaq and Taloyoak to be completed between 2019-2023
Solar	• Pilot project of solar panels on Iqaluit power plant completed • New Kugluktuk power plant will have a 500kW solar panel installed	• Short-medium term potential to supplement diesel generation	• Pursue funding proposals • Commercial and Institutional Power Producers and Independent Power Producers opportunities
Wind	• Resource assessment completed for all communities • Data collected for Iqaluit & Sanikiluaq for potential wind turbine project	• Short-medium term potential to supplement diesel generation	• Pursue funding proposals • Commercial and Institutional Power Producers and Independent Power Producers (IPP) opportunities

TECHNOLOGY	CURRENT STATUS	DEVELOPMENT POTENTIAL	QEC NEXT STEP
Hydro Electric	• On Hold • Kivalliq Inuit Association study ofproposed Manitoba Kivalliq Hydro-fibre project	• Medium to long-term potential to replace diesel generation in Iqaluit and the Kivalliq region.	• Awaiting further information from Kivalliq Inuit Association on proposed Manitoba Kivalliq Hydro-fibre project
Nuclear	• Exploratory	• Long-term potential to replace or supplement diesel generation	• Continue to monitor technology development
Bio Energy (waste)	• Exploratory	• Medium-term potential (in Iqaluit) to supplement diesel generation	• Continue to monitor technology development in Nunavut
Tidal	• Exploratory	• Long-term potential to supplement diesel generation	• Continue to monitor technology development
Geothermal	• Initial assessment completed for geothermal potential produced the "Nunavut Geothermal Feasibility Study" • Continues to be exploratory	• Long-term potential to supplement diesel generation	• Conduct comprehensive data collection and analysis in Cambridge Bay, Resolute Bay and Baker Lake. Perform temperature gradient well drilling in Baker Lake.

Looking Forward

FEDERAL GOVERNMENT FUNDING

QEC has been and will continue submitting proposals to acquire funding for alternative energy projects from the Government of Canada; these programs and applications will change on an ongoing basis.

NET METERING

QEC launched its Net Metering Program in 2018. Net Metering allows residential customers and one municipal account per community to generate their own electricity supply using renewable generation systems, and send surplus electricity they produce to the electrical grid in exchange for an energy credit. This credit will reset to zero on April 1st of every year, which is the start of each new fiscal year. The maximum amount of energy a net metering customer may put back into a QEC power grid is 10 kilowatts per hour.

COMMERCIAL AND INSTITUTIONAL POWER PRODUCERS

QEC is developing a Commercial and Institutional Power Producers (CIPP) program for existing commercial and institutional customers interested in generating renewable energy on their premises. All energy generated must be sold to QEC and bought back based on the applicable community rate. Similar to the proposed IPP program, QEC will pay customers the avoided cost of diesel (the price QEC pays for diesel per kilowatt hour) to ensure the CIPP program will not result in an increase to the cost of electricity for any QEC customers. This program is anticipated to launch at the end of 2020-2021.

INDEPENDENT POWER PRODUCERS

An Independent Power Producer (IPP) is an entity that owns and operate renewable energy facilities to generate electricity for sale to QEC. QEC is proposing to pay the avoided cost of diesel for any energy produced by an IPP. This will make the IPP Program revenue neutral, meaning it will not increase the cost of electricity to any QEC customers. QEC is in the process of developing the technical and policy requirements for the program, with an anticipated launch in 2021.

ARCTIC ENERGY FUND

The Arctic Energy Fund (AEF) is a federal funding program aimed at enhancing energy efficiency and reliability in the north, offered through Infrastructure Canada's Investing in Canada Infrastructure program. This fund will provide QEC up to $175M under a 75/25 percent cost shared arrangement, of which QEC's contribution would be a maximum of $58M.

Under this major construction initiative, QEC has identified complete power plant rebuilds and generator set replacements across the territory in communities which need it most. These upgrades are required to replace aging infrastructure and to ensure QEC is able to meet the

energy needs of Nunavut's communities. QEC will communicate more details as projects receive funding.

Conclusion

Alternative energy sources exhibit the potential to supplement current diesel energy generation and reduce the territory's reliance on fossil fuel imports. Due to the unique situation in Nunavut of 25 independent power plants not linked by a grid, reliability is a key factor in determining the feasibility of implementing alternative energy systems.

In the short-term, solar and wind power along with the expansion of district heating offer the potential to supplement diesel generation and reduce diesel consumption.

In the medium-term, there is potential for hydroelectric power generation and waste (or biomass) systems for Iqaluit.

There is long-term potential for other emerging technologies such as geothermal and tidal systems, though these technologies have not been fully developed or shown to be commercially viable.

At this time, QEC is only acquiring information on the technical viability and financial considerations of nuclear technology in the form of SMRs.

QEC will not be able to incorporate alternative energy sources into its generation supply mix unless significant funding becomes available. Support is required from the federal and territorial governments – it cannot be done with existing capital resources. The Corporation's existing resources and focus must remain on delivering a reliable supply of energy to our customers at affordable electricity rates. Moreover, consultation with key stakeholders will remain a critical component before QEC pursues alternative energy projects.

Appendix A

QEC ENERGY FRAMEWORK: THE COST OF GENERATING ELECTRICITY IN NUNAVUT

QEC ENERGY FRAMEWORK

Executive Summary

QEC Energy Framework: The Cost of Generating Electricity in Nunavut examines the current cost of generating electricity within Nunavut, including the cost of buying diesel fuel to generate electricity and the financial considerations when evaluating renewable energy alternatives. It considers the potential impact of renewable energy on customer rates and QEC's financial viability to participate in alternative technology use. The variable cost of diesel fuel and its impact on the cost of electricity is used as a basis to evaluate the cost of incorporating renewable energy into Nunavut's electrical supply mix.

In addition to providing an outline of how the cost of electricity is determined, the goal of this framework is to provide a foundation for additional dialogue with communities, organizations and other stakeholders on energy in Nunavut. This framework is not intended to be a detailed analysis of electrical generation.

Introduction

Qulliq Energy Corporation (QEC) is the sole provider of electrical power in Nunavut. Currently, all of QEC's electrical needs are met by imported diesel fuel. To responsibly incorporate renewable energy sources into the supply mix, QEC must consider the financial implications of investing in renewable energy. In an effort to facilitate an understanding of the renewable energy business case and enable further discussion, the corporation is sharing the financial framework associated with generating electricity.

QEC's mandate is to provide safe and reliable electricity in an affordable fashion. *QEC's Energy Framework* is a high-level document that reviews the general cost structure associated with generating electricity in Nunavut and the impact it has on customers' electricity rates. The framework is also intended to support future policy and project specific discussions.

Power in Nunavut

QEC delivers electricity to approximately 15,000 electrical customers across Nunavut. Power is generated and distributed to Nunavummiut through the operation of 25 standalone diesel power plants in 25 communities, with an installed capacity of approximately 76,00 kW. The corporation also provides mechanical, electrical and line maintenance from three regional centres: Iqaluit, Rankin Inlet and Cambridge Bay.

Approximately 50 million litres of diesel is consumed annually to generate electricity for the territory. Electricity costs vary across Nunavut and are known to be the highest rates in Canada. Diesel generation will continue to be the central means of generating electricity in a practical and reliable basis throughout Nunavut for the immediate future; however, QEC would like to incorporate renewable energy where possible in an economically sustainable manner.

Electricity Rate Structure

Rates

Nunavut's electricity rates are comprised of fixed and variable components. **The fixed component (of the electricity rate) is comprised of the cost of infrastructure, investments and ongoing operations across the territory.**

The variable component (of the electricity rate) is dependent on the amount QEC pays for diesel fuel. This variable component of purchasing diesel fuel impacts what QEC charges its customers for power.

Over the last four years, the variable component for the territory has averaged approximately $0.26/kWh. The differences in the variable rate between communities are shown in Appendix A.

Total electricity rate = Fixed Component + Variable Component

where

Variable Component = QEC Diesel Cost

and

Fixed Component = Infrastructure, Investment and Operations Costs

This means that the variable component is the maximum rate that the corporation can afford to pay for renewable energy without raising the electricity rate. If QEC purchased or installed renewable energy generation costing more than QEC's diesel cost, the overall cost to generate electricity could *increase*. If QEC purchased or installed renewable energy costing less than QEC's diesel cost, the overall cost to generate electricity could *decrease*.

Total electricity rate = Fixed Component + QEC Diesel Cost

or

Total electricity rate = Fixed Component + Cost to Purchase Renewable Energy

Looking Forward

Net Metering

QEC's first major renewable energy initiative was the Net Metering Program. Net metering allows customers to generate their own electricity using renewable energy generation systems and send surplus power back to QEC's grids for an energy credit to offset their electrical bills. QEC's Net Metering Program is limited to residential customers and one municipal government account per community

As with other jurisdictions, credits are only useable within the same fiscal year. Unused credits are set to zero at the end of March of every year. Customers may install a maximum of 10kW of generating capacity per location.

Commercial and Institutional Power Producers

QEC is currently developing a Commercial and Institutional Power Producers (CIPP) program. The CIPP program will allow existing commercial and institutional customers to generate electricity on their premises using renewable energy systems. Under this program, all power generated by the customer must be sold to QEC. Load displacement or behind the meter installation is not permitted since this would raise other customers' electricity rates. The corporation anticipates launching the CIPP program in the 2020-2021 fiscal year.

Independent Power Producers

Independent Power Producers (IPPs) are entities that own and operate renewable energy facilities to generate electricity for sale to QEC. The corporation is in the process of developing an IPP program which is expected to be launched in 2021. This program will allow independent producers to develop standalone generation facilities and to sell all power generated to QEC. As part of QEC's proposal, Inuit organizations and municipalities will be given the first opportunity to own and operate community scale installations in their respective regions.

Where appropriate, QEC will install, own and operate renewable energy facilities; however, this is not the only possible model for acquiring renewable power generation in Nunavut. IPPs may play a role in constructing future renewable energy facilities. Factors impacting IPPs or QEC ownership decisions may include financial resources (i.e. the ability to make the initial capital investment), community impact, regulations, and policy or strategic objectives.

Initial project construction funding requirements may preclude QEC from constructing renewable energy generation facilities, even when the longer-term business case proves favorable. QEC may be limited by financial restrictions that will affect its ability to secure the financing required to construct renewable energy projects.

Cost-Benefit Analysis of QEC Ownership vs IPP/CIPP Ownership

QEC Ownership

Advantages:

- QEC has experience in generating and operating in communities; it has the ability to respond to a variety of issues, including power quality issues, equipment failures, etc.

Disadvantages:

- Significant financial investment required, which may or may not be possible with current financial limitations.
- Require fundraising/government injection (federal/territorial).

IPP/CIPP Ownership

Advantages:

- QEC acquires additional generation capacity without an upfront capital investment.
- Proponents assumes all risks and operational and maintenance work associated with the project.

Disadvantages:

- Proponents may have limited experience working with power generation in the remote communities of Nunavut.
- Electricity rate fixed, based on contract price for all customers i.e. the variable component supplied by the IPP/CIPP.

About the QEC Energy Framework

Notes to complement the preceding discussion:

1. This framework is not intended to be a comprehensive review. It is a high-level overview intended to be introductory in nature and purpose.
2. *QEC Energy Framework* is not a policy. It presents the financial structure associated with electrical generation, the variable cost of power and potential impact on customers.
3. Nothing within this document should be interpreted as a formal offer to customers or renewable energy generators.
4. This framework has purposely not included any content on the impact of diesel or renewable energy on the environment or health.
5. QEC will pursue and consider additional discussion and feedback regarding the framework.
6. *QEC Energy Framework* discusses procuring or building renewable energy capacity, however, QEC will consider other procurement arrangements that satisfy the financial objectives suggested herein.

Appendix A – Electricity Rates by Community

Based on April 1, 2019 Domestic/Residential Rates

	DOMESTIC NON-GOVERNMENT RATE	FIXED COMPONENT	VARIABLE COMPONENT
CAMBRIDGE BAY	$0.75	$0.53	$0.23
GJOA HAVEN	$0.90	$0.63	$0.27
TALOYOAK	$0.99	$0.73	$0.26
KUGAARUK	$1.16	$0.90	$0.26
KUGLUKTUK	$0.94	$0.71	$0.23
RANKIN INLET	$0.61	$0.36	$0.24
BAKER LAKE	$0.69	$0.44	$0.25
ARVIAT	$0.79	$0.56	$0.23
CORAL HARBOUR	$0.95	$0.69	$0.26
CHESTERFIELD INLET	$0.98	$0.72	$0.26
WHALE COVE	$0.91	$0.64	$0.27
NAUJAAT	$0.85	$0.60	$0.25
IQALUIT	$0.59	$0.34	$0.24
PANGNIRTUNG	$0.64	$0.35	$0.29
KINNGAIT	$0.67	$0.41	$0.26
RESOLUTE BAY	$1.02	$0.77	$0.26
POND INLET	$0.90	$0.64	$0.26
IGLOOLIK	$0.62	$0.37	$0.25
SANIRAJAK	$0.89	$0.65	$0.24
QIKIQTARJUAQ	$0.77	$0.51	$0.26
KIMMIRUT	$1.05	$0.75	$0.29
ARCTIC BAY	$0.88	$0.60	$0.28
CLYDE RIVER	$0.78	$0.54	$0.24
GRISE FIORD	$0.92	$0.65	$0.28
SANIKILUAQ	$0.82	$0.57	$0.25
AVERAGE	N/A	N/A	$0.26