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QEC ENERGY FRAMEWORK: THE COST OF GENERATING ELECTRICITY IN NUNAVUT

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 76,900 kW. The corporation also provides mechanical, electrical and line maintenance from three regional centres: Iqaluit, Rankin Inlet and Cambridge Bay.

Approximately 55 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 \$0.31/kWh. The differences in the variable rate between communities is shown in Appendix A.

For example, the residential cost of power in Arviat is approximately \$0.79/kWh. The fixed component is \$0.48/kWh and the variable component is approximately \$0.31/kWh.

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

In the example above, if QEC installed a renewable energy system in Arviat costing less than what it spends on fuel, the overall cost to generate electricity in the community would *decrease*.

Looking Forward

Net Metering

QEC's first major renewable energy initiative is 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.

Independent Power Producers

Independent Power Producers (IPPs) are legal entities, companies that own or operate facilities that generate electricity for the purpose of selling that electricity to a utility such as QEC. Currently, the *QEC Act* does not allow QEC to purchase power from Independent Power Producers. The corporation has commenced the process to amend the legislation and create the supporting policies and procedures to enable QEC to develop and implement an IPP program.

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 prove favourable. QEC may be limited by financial restrictions that will affect QEC's ability to secure the financing required to construct renewable energy projects.

IPP Procurement Process

- QEC will follow established procurement policies.
- Detailed contracts outlining technical and commercial conditions will be part of the process.

Cost-Benefit Analysis of QEC Ownership vs IPP 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.
- Any fuel savings realized from renewable energy is passed onto customers.

Disadvantages:

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

Independent Power Producers

Advantages:

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

Disadvantages:

- IPP will not have as much experience working in the remote communities of Nunavut.
- Electricity rate fixed, based on contract price for all customers i.e. the variable component supplied by the IPPs.
- Savings not passed onto customers.

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 entertain 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.
7. Appendix B presents data for the top 5 communities with the greatest wind potential (Arviat, Baker Lake, Iqaluit, Rankin Inlet and Sanikiluaq). This analysis uses data available from QEC's report *Potential for Wind Energy in Nunavut Communities* and actual kWh consumption for the 2015-2016 fiscal year. The report is available online at <http://www.gec.nu.ca/power-nunavut/renewable-energy/wind>.

Appendix A – Variable Component by Community

Based on April 1, 2014 rates

COMMUNITY	DOMESTIC NON-GOVERNMENT RATE	FIXED COMPONENT	VARIABLE COMPONENT
CAMBRIDGE BAY	\$0.76	\$0.46	\$0.30
GJOA HAVEN	\$0.89	\$0.59	\$0.31
TALOYOAK	\$0.98	\$0.63	\$0.36
KUGAARUK	\$1.14	\$0.79	\$0.35
KUGLUKTUK	\$0.93	\$0.63	\$0.31
RANKIN INLET	\$0.62	\$0.35	\$0.27
BAKER LAKE	\$0.70	\$0.40	\$0.30
ARVIAT	\$0.79	\$0.48	\$0.31
CORAL HARBOUR	\$0.95	\$0.60	\$0.35
CHESTERFIELD INLET	\$0.98	\$0.61	\$0.37
WHALE COVE	\$0.90	\$0.57	\$0.34
REPULSE BAY	\$0.85	\$0.55	\$0.30
IQALUIT	\$0.60	\$0.29	\$0.31
PANGNIRTUNG	\$0.66	\$0.38	\$0.27
CAPE DORSET	\$0.69	\$0.38	\$0.31
RESOLUTE BAY	\$1.01	\$0.70	\$0.32
POND INLET	\$0.90	\$0.63	\$0.27
IGLOOLIK	\$0.63	\$0.39	\$0.25
HALL BEACH	\$0.89	\$0.62	\$0.27
QIKITARJUAQ	\$0.78	\$0.50	\$0.28
KIMMIRUT	\$1.04	\$0.73	\$0.30
ARCTIC BAY	\$0.88	\$0.59	\$0.29
CLYDE RIVER	\$0.78	\$0.52	\$0.27
GRISE FIORD	\$0.92	\$0.59	\$0.33
SANIKILUAQ	\$0.82	\$0.52	\$0.31
AVERAGE	N/A	N/A	\$0.31

Appendix B - Project Scenarios

The following project scenarios are based on simple payback periods i.e. how much time it will take to pay for a renewable energy infrastructure based on the cost of diesel fuel saved. Factors such as annual maintenance costs and return on investment have not been incorporated into the analysis.

Community	Cost and Penetration	Fuel Consumption (L)	Total kWh sales	Penetration	Annual kWh supplied by wind	Annual Payback at \$0.31	Payback Period in years
Rankin	\$20M and 32%	4,827,400	16,932,600	32%	5,418,432	\$1,679,714	11.9
Rankin	\$28M and 49%	4,827,400	16,932,600	49%	8,296,974	\$2,572,062	10.9
Rankin	\$28M and 32%	4,827,400	16,932,600	32%	5,418,432	\$1,679,714	16.7
Baker Lake	\$19M and 47%	2,288,900	8,201,600	47%	3,854,752	\$1,194,973	15.9
Baker Lake	\$20M and 51%	2,288,900	8,201,600	51%	4,182,816	\$1,296,673	15.4
Baker Lake	\$20M and 47%	2,288,900	8,201,600	47%	3,854,752	\$1,194,973	16.7
Arviat	\$19M and 50%	2,298,600	8,188,600	50%	4,094,300	\$1,269,233	15.0
Arviat	\$21M and 56%	2,298,600	8,188,600	56%	4,585,616	\$1,421,541	14.8
Arviat	\$21M and 50%	2,298,600	8,188,600	50%	4,094,300	\$1,269,233	16.5
Iqaluit	\$35M and 24%	14,933,600	54,951,200	24%	13,188,288	\$4,088,369	8.6
Iqaluit	\$69M and 40%	14,933,600	54,951,200	40%	21,980,480	\$6,813,949	10.1
Iqaluit	\$69M and 24%	14,933,600	54,951,200	24%	13,188,288	\$4,088,369	16.9
Sanikiluaq	\$7M and 33%	985,400	3,464,000	33%	1,143,120	\$354,367	19.8
Sanikiluaq	\$11M and 52%	985,400	3,464,000	52%	1,801,280	\$558,397	19.7
Sanikiluaq	\$11M and 33%	985,400	3,464,000	33%	1,143,120	\$354,367	31.0

The cost and percentage of renewable energy penetration (or the percentage of diesel fuel you can replace with renewable energy in a given year) shown in Appendix B are extracted from QEC's report on "Potential for Wind Energy in Nunavut Communities". The kWh consumption figures are QEC actuals for 2015-2016 fiscal. The report is available online at <http://www.qec.nu.ca/power-nunavut/renewable-energy/wind>. A summary of the report's conclusion for the 5 communities with the highest wind potential is shown below.

COMMUNITY	COST ESTIMATE FOR WIND TURBINE INSTALLATIONS	DIESEL REDUCTION
Sanikiluaq	\$7 million to \$11 million	33% - 52%
Iqaluit	\$35 million to \$69 million	24% - 40%
Arviat	\$19 million to \$21 million	50% - 56%
Rankin Inlet	\$20 million to \$28 million	32% - 49%
Baker Lake	\$20 million to \$19 million	47% - 51%