Qulliq Energy Corporation



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Application for Major Project Permit

Iqaluit Generator Set G4 Replacement

February 2021



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Executive Summary

The Qulliq Energy Corporation (QEC) hereby applies to the Minister Responsible for Qulliq Energy Corporation pursuant to section 18.1 of the Qulliq Energy Corporation Act, R.S.N.W.T. 1988, c.N-2 for a project permit respecting the new Iqaluit Generator Set G4 (Genset G4) Replacement project (the "Project).

The project will have no impact on rates until the time of QEC's first General Rate Application (GRA) following the project in-service date, which is expected no earlier than the 4th Quarter of the 2023/24 fiscal year.

Iqaluit is a community with increasing demand for electricity, reflecting its growing population. The most recent expansion and upgrade of the Iqaluit power plant was completed in 2013. Presently, the power plant has an installed firm capacity (IFC) of 17,600 kW which is higher than the forecast 2023/24 RFC of 11,426 kW. The existing Genset G4 at the Iqaluit power plant, a 3,300 kW CAT D3612, has reached end of life and is not reliable due to frequent overhaul requirements in the past service years. Moreover, another genset (G2 Wartsila 12V32) with 4,300 kW capacity has also exceeded its operating life hours though currently deemed more stable than Genset G4 nevertheless making replacement of Genset G4 with a reliable generator set critical to secure load demand in Iqaluit.

The forecast Required Firm Capacity (RFC) for the 2029-30 fiscal year is 12,385 kW. To ensure the plant can continue to meet the RFC criteria, a new Genset with the same capacity (3,300 KW Continuous rating and max 1,200 RPM) is required. Qulliq Energy Corporation expects reductions in fuel consumption with the installation of the new genset.

Completion of this Project will enable QEC to continue to provide safe and reliable supply of energy to the community of Iqaluit for years to come and will be of benefit to the customers and QEC. The key benefits of installation of the new Genset Unit in Iqaluit include:

- Ensure sufficient installed capacity will meet QEC's required firm criterion.
- Resolving power reliability and stability concerns by replacement/upgrading of equipment and systems that are at the end of their useful service lives.

QEC's estimated cost to complete the project is \$8.415 million, which shall be split between two fiscal years: \$1.449 million in 2022/23 and \$6.965 million in 2023/24. If the Iqaluit Genset G4 Replacement is included in the Arctic Energy Fund (AEF) Program, the project will receive funding at a contribution of 75% of eligible cost, and QEC's customers will only be accountable for approximately 25% of the total project expenditures.



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1.0 Application

The Qulliq Energy Corporation hereby applies to the Minister Responsible for Qulliq Energy Corporation pursuant to Section 18.1 of the Qulliq Energy Corporation Act, R.S.N.W.T. 1988, cN-2 for a major project permit for the Iqaluit Genset G4 Replacement project. QEC is requesting permission to proceed with this project. Details in support of the requested project permit are set out below.

2.0 Background

QEC is committed to planning and developing cost effective and efficient ways to ensure energy supply remains safe, reliable and stable.

In 2013, QEC completed an expansion and upgrade of the Iqaluit Power Plant to accommodate current and future load growth. The plant expansion and upgrade did not include replacement of existing gensets as those were expected to be undertaken as required at a later date.

The Iqaluit Power Plant expansion and upgrade project added two gensets to the line-up which increased the plant installed capacity from 14,900 kW to 22,600 kW.

Although the plant's capacity is adequate to meet the community's future capacity requirements in accordance with the N-1 rule (i.e., total installed capacity less the highest generator capacity), there is significant risk to power reliability and stability as three of the gensets (G1, G2 and G4 with total capacity 10,600kW) in the generator lineup have exceeded expected lifecycle hours with Genset G4 being the less reliable warranting urgent replacement as it can no longer be overhauled and parts availability is becoming an issue.

At the time of the 2013 Plant expansion and upgrade project, QEC indicated Genset G4 would be due for replacement in 2016 based on forecast engine operating hours.

Power reliability and stability of the existing plant can be improved by installing a new Genset with same capacity (3,300 kW Continuous rating and max 1,200 RPM), with the additional benefit of expected reductions in fuel consumption.

3.0 Existing Facility

3.1 Introduction

Iqaluit is the capital city of the Canadian territory of Nunavut. It sits on vast Baffin Island in Frobisher Bay, located in the Qikiqtaaluk Region.



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Access to the community is limited to air and sea traffic travel only. The community fuel resupply is carried out annually in the summer/fall via fuel supply tanker. Some of the largest electricity loads in the community include the Government of Nunavut (GN) and Government of Canada Offices, Commercial customers including the Northern and Co-Op stores, Community Centers, schools, General Hospital and Clinics, and Recreational Centers including the Aquatic Centre and the Arctic Winter Games Arena.

QEC and its predecessors, the Northwest Territories Power Corporation (NTPC) and the Northern Canada Power Corporation (NCPC), have operated the diesel generating plant in Iqaluit since the plant was constructed in the early 60's. The plant was recently upgraded in 2013. Table 1 of Section 3.2 summarizes the current Genset line-up of the plant.

3.2 **Current condition**

The power plant present installed capacity (IC) is 22,600 kW and Installed Firm Capacity (IFC) is 17,600 kW which is higher than the projected required firm capacity (RFC) of 11,426 kW in 2023/24.

Genset G4 was installed in 1992 and has accumulated 141,806 total operating hours. This Genset is the first priority for replacement on this power plant as it has already exceeded its designed reliable operating lifecycle hours (120,000). It is noted that this unit was already due for replacement by 2016 based on engine life hours estimate. QEC Operations and Maintenance Department has already carried out the final major overhaul to keep this genset operational to ensure reliability and sustainable supply of electricity for the Igaluit community, and there is no more room for further overhauling to be carried out on this Generator.

With no more overhauling work planned on the current genset G4, this genset is at an increased risk of failure and maintaining it in the line-up puts the community at a higher risk of outages and failures, also resulting in higher maintenance costs.

QEC Operations has recommended replacing Genset G4 with a new generator set of similar capacity (3,300KW Continuous rating).



				Year	Engine Hours	Engine Lifecycle
Unit	Make	Model	kW Rating	Installed	(Jan 2021)	Hours
G3	Wartsila	12V200	2000	1996	87175	100000
G1	Wartsila	9R32	3000	1993	119593	120000
G4	Caterpillar	D3612	3300	1992	141806	120000
G2	Wartsila	12V32	4300	2000	150427	120000
G7	Wartsila 12V32		5000	2013	29933	120000
G8	G8 Wartsila 12V32		5000	2013	32590	120000
Tota	al Installed C	Capacity	22,600			
Inst	alled Firm C	apacity	17,600			

Table 1 - Iqaluit Power Plant Genset Line-up

Note: Installed Firm Capacity= Plant capacity with the largest unit out of service

4.0 Future Growth and Load Forecast

Table 2 summarizes the load forecast for Iqaluit. Installed Firm Capacity, which is the total installed capacity minus capacity of the biggest unit, is 17,600 kW. Although the IFC exceeds the RFC of this community beyond 2030 as per the load forecast projections, it is noted that three of the gensets (G1, G2 and G4 with total capacity 10,600kw) in the generator lineup have exceeded expected lifecycle hours. Loss of any two of these gensets is highly possible considering their accumulated utilization, which will create significant shortfall in the plant RFC.

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Inst. Capacity (kW)	22600	22600	22600	22600	22600	22600	22600	22600	22600	22600	22600
Largest Unit (kW)	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Inst. Firm Capacity (kW)	17600	17600	17600	17600	17600	17600	17600	17600	17600	17600	17600
Comm. Peak (kW)	10087	9960	10093	10230	10387	10572	10654	10807	10958	11107	11259
RFC (kW)	11096	10956	11103	11252	11426	11630	11719	11888	12054	12217	12385
Surplus (kW)	6504	6644	6497	6348	6174	5970	5881	5712	5546	5383	5215
Surplus (%)	59%	61%	59%	56%	54%	51%	50%	48%	46%	44%	42%
Generation (kWh)	59,031	60,347	61,128	61,772	62,714	63,527	64,349	65,235	66,100	66,984	67,889

Table 2 - Installed Capacity and RFC



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Assessment of Project Options 5.0

QEC recognizes the need for a long-term approach to prioritize and maximize the benefit of capital expenditures while providing safe and reliable electricity service.

The existing Genset G4 deficiencies, which increase the risk of genset failure and community outages, mean the "Do Nothing" option is not a viable option. The existing genset's life cannot be further extended through overhauls. Accordingly, QEC investigated the following options as potential solutions to address the genset end of life criticality at the Iqaluit plant.

Option 1 – Replace G4 with the same power capacity unit

This option includes replacement of genset G4 complete with the ancillary equipment, such as Radiator, Heat Exchanger and Silencer with a new 3,300 kW Generator (with continuous rating and max RPM 1,200). No critical upgrades of the genset foundation, support structures and fuel system are required.

Implementing this project will ensure safe and reliable power supply to the Igaluit community by ensuring a stable and available IFC.

Option 2 – Replace G4 with a different power capacity unit

QEC also considered options of replacing genset G4 with a different capacity than the existing genset (e.g., 2,000 kW or 4,000 kW) unit with respect of lowering capital costs or in the case of a higher capacity with respect to avoid future replacement of this genset in order to meet the community demand requirements.

This option is not recommended for the following reasons:

- There were minimal if any cost savings with installing a smaller capacity unit while the IFC would be reduced notably in the largest community in Nunavut increasing the possibility of load related capacity increase in the near term.
- Current Iqaluit Plant line-up already has bigger capacity gensets and the current IFC adequately meets longer term load projections for the community. This does not justify addition of a higher capacity unit to replace genset G4.

After examining the options, QEC considers the most cost effective option is to pursue Option 1, which QEC recommends for implementation.

The total preliminary cost estimate for Option 1 is \$8.415 million. This cost is a preliminary D-class estimate with accuracy of +/- 25%. The cost is subject to refinement during the project design.



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This project is currently being considered to receive funding from the Arctic Energy Fund (AEF) Program; if it is included in the AEF Program, it will receive government contribution of 75% of eligible expenses.

6.0 Impact of the Project on Ratepayers

QEC conducted an analysis of the impact of the Project on ratepayers in the community of Iqaluit. It should be noted the project will have no impact on rates until the time of QEC's General Rate Application following the project coming in-service, which is expected no earlier than the 2023/24 fiscal year.

QEC conducted the rate impact analysis based on the current system of community-based rates, as well as an alternative territorial rate design option. Under the current system, rate impacts to communities requiring new generator sets are high. These rate increases could be mitigated by rate options including moving to a territory-wide rate, or if community based rates were to continue, by not reflecting the full impact of the new capital addition in rates for the community (so that the revenue to cost coverage ratio for the community would be below unity and other communities would be required to have revenue to cost coverage ratios above unity).

The rate impact analysis is based on QEC's estimated net cost for this project of \$2.388 million, after the AEF contribution. While the Project is expected to improve fuel efficiency compared to the existing genset, QEC performed a conservative rate impact analysis which does not include expected fuel savings benefit of the Project.

Table 6 summarizes the estimated incremental revenue requirement increase due to the project of \$0.242 million. The estimated rate increase under the community-based rates is 0.41 cents/kWh, or 0.7% increase over the current domestic rate of 58.56 cents/kWh in Iqaluit. Under a territorial rate design scenario, the estimated average rate increase is 0.13 cents/kWh, or 0.2% over the current domestic rate of 58.56 cents/kWh.



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Project Characteristics	
Net Capital Cost (\$ 000)	2,388
Amortization Period (year)	27

Table 3 - Iqaluit Generator Set G4 Estimated Rate Impact

Net Capital Cost (\$ 000)	2,388
Amortization Period (year)	27
GRA Approved Return on Ratebase	6.45%
Revenue Requirement Impacts	
Amortization Expense (\$ 000)	88
Return on Ratebase (\$ 000)	154
sub-total: Revenue Requirement Increase	242
Total Revenue Requirement Impact (\$ 000)	242
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Iqaluit 2023/24 Forecast Sales (MWh)	58,598
Average Community-Based Rate Increase (c/kWh)	0.41
Territorial 2023/24 Forecast Sales	190,533
Average Territorial Rate Increase (c/kWh)	0.13

It is important to note this analysis has been provided for illustrative purposes only.

Actual rate impacts will depend on the overall revenue requirements and rate designs approved in subsequent General Rate Applications.

7.0 Grounds in Support of the Application

The implementation of the proposed Project is very important to QEC's customers and the public. The implementation of the project will address the following primary concerns:

• Power Reliability and Stability

Power is an essential service in the North and perhaps more so for big communities. Without reliable equipment, QEC's customers are at risk of system failure. A new fuel-efficient genset and plant automation will increase overall plant and power reliability in the Iqaluit.

• Safety Concerns

Replacement of this genset will allow QEC to address the existing deficiencies with the current Genset G4 related to reliability concerns.



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• Environmental Requirements

The existing Silencer is a regular Industrial Type and therefore it produces a lot of noise, which creates a lot of the noise pollution due to the power plant is located very close to residential areas of the community. The proposed Hospital Type Silencer will be able to reduce the noise, created by G4 unit, which will decrease total noise pollution by the power plant.

One of the most important Environmental factor of the diesel power plant is the greenhouse gas (GHG) emission. To reduce pollution of the exhaust gases we are planning to install an exhaust scrubber which will reduce CO₂ produced by the replaced genset.

8.0 Project Timeline

The project shall be performed in two fiscal years, 2022/23 and 2023/24 and approval of the capital budget for the project is expected for October 2021. The genset design will commence in the second quarter of 2022/23, with specifications and tenders to allow for ordering of materials and construction contracts beginning in the third quarter of 2022/23. Materials will be delivered during sealift 2023 and construction would begin immediately and be completed in December of 2023. Commissioning and project closeout will take place in the fourth quarter of 2023/24.

Table 4 illustrates the proposed project schedule for reference purposes.



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	TABLE 7 - PROPOSED IQALUIT GENSET G4 PROJECT SCHEDULE											
Task Table	2021 - 2022			2022 - 2023				2023 - 2024				
	1 ST QTR	2 ND QTR	3 RD QTR	4 [™] QTR	1 ST QTR	2 ND QTR	3 RD QTR	4 [™] QTR	1 ST QTR	2 ND QTR	3 RD QTR	4 [™] QTR
Budget approval												
RFP preparation												
Tendering Stage												
Project Design												
Procurement												
Construction												
Commissioning												
Project Close Out												

Table 4 - Proposed Iqaluit G4 Replacement Timeframe