# **Qulliq Energy Corporation**



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# **Application for Major Project Permit**

# **ARCTIC BAY NEW POWER PLANT**

October, 2019



### **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 Arctic Bay Power Plant Project.

The project will have no impact on rates until the time of QEC's first General Rate Application following the project in-service date, which is expected no earlier than the 2022/23 fiscal year.

Arctic Bay is a community with increasing demand for electricity, reflecting its growing population. The existing Arctic Bay power plant is an aged plant which was constructed in 1974. Presently, the power plant has 620 kW installed firm capacity (IFC) which is less than the 2017-18 678 kW peak demand of the community. It is not technically feasible to expand capacity of the existing power plant due to lack of space and poor building infrastructure condition. This situation places the community at great risk of QEC not being able to supply safe, reliable power to the community.

Proceeding with the proposed Project will provide safe and reliable electricity supply in the community at the lowest cost over the life of the facility. As well the Corporation expects reductions in fuel costs per kilowatt with the installation of the new engines.

Completion of this Project will provide a safe and reliable supply of energy to the community of Arctic Bay for years to come, to the benefit of customers and QEC. The key benefits of constructing the new Power Plant in Arctic Bay include:

- Ensuring sufficient installed capacity to meet QEC's required firm capacity criterion.
- Resolving power reliability and stability concerns by replacement/upgrading of equipment and systems at the end of their useful service life;
- Resolving safety and operation concerns by addressing the current structural issues; and
- Addressing environmental requirements associated with the existing single walled fuel storage system.
- The new plant will be capable of integration with renewable energy sources.

QEC's estimated cost to complete the project is \$32.357 million. This project has been identified to receive funding from the Arctic Energy Fund (AEF) Program for a contribution of 75% of eligible expenses, and as such QEC's customers would only have to pay for approximately 25% of the total project cost.



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# **1.0** Application

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, cN-2 for a major project permit for the Arctic Bay Power Plant 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 that energy supply remains safe, reliable and stable.

The Arctic Bay Power Plant was constructed in 1974. The plant's capacity is inadequate to meet the community's current capacity requirements. The capacity of the existing plant cannot be increased due to the lack of space and condition of the facility.

Now 45 years since its original construction, the Arctic Bay facility is due for replacement for multiple reasons, including the need to replace aging equipment; safety concerns; and compliance with current safety and environmental regulations.

QEC intends to engage in a multiyear project to build the new power plant in Arctic Bay, Nunavut. The project will include the installation of two 90,000 liter double wall horizontal fuel tanks and the new power plant will use more fuel-efficient engines. The plant will generate much less noise and exhaust gases, due to the availability of equipment like industrial scrubbers and hospital grade silencers which will reduce sound and air pollution significantly. The new plant will have a life cycle of over 40 years, and will be capable of integrating renewable energy sources.

QEC discussed the project with Hamlet officials during a site visit on May 25<sup>th</sup>, 2017. Following these discussions, the Hamlet approved a resolution to allow QEC to build the new power plant on the Proposed Lot A. The proposed lot is located approximately 1.2 kilometers outside of the community, next to the PPD Tank Farm on the northern side of the Nanisivik Highway. Figure 1 provides a picture of the location of the proposed new plant.



### Figure 1 – Location of Proposed New Plant



QEC has already performed Geotechnical and Environmental studies, archeological research, obtained Nunavut Impact Review Board (NIRB) approval, performed survey of the lot. The lease agreement for 50 years has been signed and QEC is in the process of obtaining the Land Title.

# **3.0 Existing Facility**

### 3.1 Introduction

Arctic Bay is the north-westernmost community of the Borden Peninsula on Baffin Island, located in the Qikiqtaaluk Region north of the Arctic Circle. Figure 2 provides a map indicating the location of Arctic Bay.



#### Figure 2 – Arctic Bay



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 Hamlet Office & Community Centre, one school, Health Centre, Northern Store and Co-Op stores.

QEC and its predecessors, the Northwest Territories Power Corporation (NTPC) and the Northern Canada Power Corporation (NCPC), have operated the diesel generating plant in Arctic Bay since the plant was constructed in 1974. Table 1 summarizes the current Genset line-up of the plant.

Unit	Make	kWYearMakeModelRatingInstalled				
G1	Caterpillar	D 3508	480	1995	94,021	
G2	Caterpillar	D 3406	290	1995	6,606	
G3	Detroit	Series 60	330	2018	2,843	
Total	Installed C	apacity	1,100			
Insta	alled Firm C	apacity	620			

### Table 1 – Arctic Bay Genset Line-up

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

### 3.2 Condition

The facility is 45 years old and has exceeded its 40-year design life. The overall condition of the facility is poor. The current plant has a number of technical and engineering deficiencies, including:

- 1) <u>Aging Infrastructure</u>: The facility is 45 years old. The building and ancillary equipment are old and have begun to deteriorate.
- 2) **Genset Replacement:** G1 is approaching its retirement usage limit and soon will be due for replacement.
- 3) <u>Safety Issues:</u> The facility is a very old plant and is at a higher risk of equipment failure. The existing switchgear is not Arc Flash resistant nor can it be modified due to age. This increases the fire and safety risk of the facility.
- 4) <u>Environmental Requirements</u>: The existing plant has a tank that is singlewalled, which is not code compliant as per present codes. In addition, the tank is housed in a berm, which requires decanting each year. The melt water that accumulates in the steel berm gradually erodes and degrades the berm floor.



5) <u>Capacity</u>: The existing plant does not meet QEC's required firm capacity (RFC) criterion. The Arctic Bay existing plant's previous years load and load forecast is provided in Table 3. Based on the load the community is experiencing a significant RFC deficit (reaching a range of 20% in the last three years and forecast to grow to a 40% range by 2027).

## 4.0 Future Growth

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.

### 4.1 **Population Forecast**

The current estimated population of Arctic Bay<sup>1</sup> is 904. Table 2 summarizes population projections for Arctic Bay through 2036.

YEAR	PROJECTED POPULATION
2021	938
2026	989
2031	1055
2036	1138

#### Table – 2. Arctic Bay Population Projections

<sup>1</sup>Source: Nunavut Bureau of Statistics



# 4.2 Load Forecast

Table 3 provides the summary of Arctic Bay existing plant's previous years load and load forecast.

	Fiscal	Generatio	Peak Load	Change	RFC	Existing Plant IFC	RFC
	2011	2.025	<b>KVV</b>	70	KVV 770	KVV (20)	
	2011	2,925	/00		770	620	24%
	2012	3,071	650	-7%	715	620	15%
	2013	3,009	590	-9%	649	620	5%
ual	2014	3,128	630	7%	693	620	12%
Act	2015	3,116	648	3%	713	620	15%
·	2016	3,194	688	6%	757	620	22%
	2017	3,361	690	0%	759	620	22%
	2018	3,393	678	-2%	746	620	20%
	2019	3,414	703	4%	773	620	25%
	2020	3,500	724	3%	796	620	28%
	2021	3,537	730	1%	803	620	30%
ast	2022	3,587	735	6%	757	620	22%
rec	2023	3,647	747	2%	822	620	33%
Fo	2024	3,697	761	2%	837	620	35%
	2025	3,752	772	1%	849	620	37%
	2026	3,809	783	1%	861	620	39%
	2027	3,865	793	1%	872	620	41%

Table 3 – Arctic Bay Actual Load and Load Forecast

# 5.0 Assessment of Project Options

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 plant deficiencies mean the "Do Nothing" option is not a viable option. Operating assets beyond their service life also places a larger burden on QEC's maintenance and operations personnel by trying to maintain and operate assets that should be replaced.

QEC investigated the following options as potential solutions to address the deficiencies at the existing plant.



# Option 1 – Major Plant Upgrade

This option includes upgrading and replacement of major components and systems within the existing facility, including the gensets.

However, this option is not technically feasible for the following reasons:

- The plant has deteriorated due to age and is beyond upgrading;
- The footprint of the existing plant is too small to accommodate the required new gensets;
- Upgrading the existing plant requires the installation of temporary generation equipment on the same site, which is not feasible;
- The existing plant site does not have sufficient land space to accommodate a plant expansion.

Based on these considerations, Option 1 is not a viable option.

### **Option 2 – Construct a New Plant at a New Location**

This option involves the construction of a new power plant at a suitable location in the community.

The plant would be a four-engine generation facility designed for a 40-year life and would incorporate new technology to improve reliability, efficiency, operation, and safety. The plant would meet current operational, safety and environmental regulations. The new construction will include fuel storage consisting of two 90,000 liter double wall horizontal fuel tanks and appropriate pumping facilities, concrete pad for transformers storage, pole racks, berms for used oil and approximately 1.2 km of distribution lines.

The plant would generate less noise and air pollution, due to the remote location and installation of equipment, including industrial scrubbers and hospital grade silencers. The new plant would be capable of integrating renewable energy sources.

The proposed generating capacity of the new plant is approximately 1680 kW. A power plant of this capacity will meet Arctic Bay's peak load projections for 40 years. Table 4 indicates the genset ratings of the existing plant and proposed new plant.



Existing Units	Existing Rating (KW)	Proposed Units	Proposed Rating (KW)			
G1	480	G1	360			
G2	290	G2	480			
G3	330	G3	360			
		<b>G4</b>	480			
Total Installed Capacity	1100		1680			
IFC	620	IFC	1,200			

## Table 4 – Existing and Proposed Genset Line-up

IFC=Installed Firm Capacity= Capacity with the largest unit out of service

Based on the manufacturing of the engines the expected installed capacity of the new plant is 1680 kW. This is a nominal capacity, and normally engines work at 80-90 % of capacity to get the highest fuel consumption efficiency and life cycle.

The installed firm capacity (IFC) of the plant will be 1200 kW. At the target load of approximately 80% of the capacity to maximize the fuel efficiency, the adjusted firm capacity of the plant will be approximately 960 kW.

The RFC requirement for the community is projected at approximately 809 kW by 2021/22. Option 2 proposes a firm capacity taking into consideration the following:

- 1. Arctic Bay is a growing community in Nunavut.
- 2. The plant is being built for long-term use.

Anticipated benefits from the new plant include the following:

- Resolving power reliability and stability concerns by replacement/upgrading of equipment and systems at the end of their useful service life; and
- Resolving safety and operation concerns by addressing the current structural issues.



The total preliminary cost estimate for Option 2 is \$32.357 million. This cost is a preliminary D-class estimate with accuracy of +/- 25%. The cost is subject to refinement during the project design.

This project has been identified to receive funding from the Arctic Energy Fund (AEF) Program for a contribution of 75% of eligible expenses. Ineligible AEF expenses are estimated to be approximately \$1 million (\$0.7 million for land acquisition and \$0.3 million for administration cost). As such, the net cost of the new plant for QEC's customers is estimated at \$8.839 million as detailed in Table 5.

Description	2020/21	2021/22	Total		
Plant Replacement	9,906	22,451	32,357		
AEF Ineligible Expenses	700	300	1,000		
AEF Contribution - 75%	6,905	16,613	23,518		
QEC Contribution - 25%	2,302	5,538	7,839		
Total	9,906	22,451	32,357		
<b>Total QEC Contribution</b>	3,002	5,838	8,839		

Table 5 – Project Contribution (\$000)

After examining the options, QEC considers the most feasible and cost effective option is to pursue the construction of a new plant. QEC will maintain and operate the existing facility until the new plant is operational.

QEC proposes to design the Arctic Bay Plant with the ability to integrate potential renewable energy sources in the future.

# **6.0** Impact of the Project on Ratepayers

QEC conducted an analysis of the impact of the Project on ratepayers in the community of Arctic Bay. It should be noted that 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 2022/23 fiscal year.

QEC conducted the rate impact analysis based on the current system of communitybased rates, as well as an alternative territorial rate design option. Under the current system, rate impacts to communities needing new power plants 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 cost for this project of \$8.839 million, after the AEF contribution. The Project is expected to improve fuel efficiency compared to the existing plant. The rate impact analysis assumes a 10% reduction in fuel consumption.

Table 6 summarizes the estimated incremental revenue requirement increase due to the project of \$0.708 million. The estimated rate increase under the community-based rates is 24.68 cents/kWh, which is very high at 28% increase over the current domestic rate of 87.99 cents/kWh in Arctic Bay. However, under a territorial rate design scenario the estimated average rate increase is 0.38 cents/kWh, or 0.4% over the current domestic rate of 87.99 cents/kWh.

Project Characteristics	
Net Capital Cost (\$ 000)	8,839
Amortization Period (year)	40
GRA Approved Return on Ratebase	6.45%
Revenue Requirement Impacts	
Amortization Expense (\$ 000)	221
Return on Ratebase (\$ 000)	570
sub-total: Revenue Requirement Increase	791
less: Operational Savings	
Estimated Annual Fuel Savings (litres)	88
GRA Approved Fuel Price (\$/L)	0.9336
Estimated Savings (\$ 000)	82
Total Revenue Requirement Impact (\$ 000)	708
Arctic Bay 2021/22 Forecast Sales (MWh)	2,870
Average Community-Based Rate Increase (c/kWh)	24 68
	200
Territorial 2021/22 Forecast Sales	185,421
Average Territorial Rate Increase (c/kWh)	0.38

### Table 6 – Arctic Bay New Power Plant Estimated Rate Impact

It is important to note that 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

The current plant does not meet QEC's required firm capacity criterion. As the Arctic Bay power plant continues to age and systems become more outdated, it will become more difficult to maintain the facility and plant reliability will become an issue. Power is an essential service in the North and perhaps more so for remote communities. Without reliable equipment, QEC's customers are at risk of system failure. A new power plant equipped with new fuel-efficient gensets and plant automation will increase fuel efficiency and overall plant reliability.

#### Safety Concerns

Construction of a new power plant will allow QEC to address the existing deficiencies with the current power plant related to the safety concerns. In particular, the existing switchgear is not Arc resistant and cannot be modified, which increases fire risk of the facility.

#### • Environmental Requirements

The existing fuel storage system is single walled and therefore does not comply with the current codes and regulations of Environment Canada. The proposed project will address these environmental requirements.

The new plant will be capable of integrating renewable energy sources, such as wind turbines or solar panels should the opportunities arise in the future. This will help reduce greenhouse gas emissions to the atmosphere and reduce the cost of energy in the end.

### **8.0 Project Timeline**

The geotechnical and Phase I environmental assessments were performed in October 2018. The archeological assessment and land survey were performed in August 2019.

The new power plant design will commence in the third quarter of 2019/20, with specifications and tenders to allow for ordering of materials and construction contracts beginning in the fourth quarter of 2019/20. Site grading works will begin during July - September of 2020 and materials will be delivered during sealift 2020. Construction would begin during 2020 and be completed in 2021/22. The Gantt Chart below illustrates the proposed project schedule for reference purposes.



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	TABLE 7 - PROPOSED ARCTIC BAY PROJECT SCHEDULE															
Task Table	2018 - 2019			2019 - 2020			2020 - 2021				2021 - 2022					
	1 <sup>s⊤</sup> QTR	2 <sup>ND</sup> QTR	3 <sup>RD</sup> QTR	4 <sup>™</sup> QTR	1 <sup>s⊤</sup> QTR	2 <sup>ND</sup> QTR	3 <sup>RD</sup> QTR	4 <sup>TH</sup> QTR	1 <sup>s⊤</sup> QTR	2 <sup>ND</sup> QTR	3 <sup>RD</sup> QTR	4 <sup>™</sup> QTR	1 <sup>s⊤</sup> QTR	2 <sup>ND</sup> QTR	3 <sup>RD</sup> QTR	4 <sup>™</sup> QTR
Finalize List of Proposed Sites																
Geo-Tech Study and Recommendations																
Site Selection Approval																
Develop Business Case and Cost Estimate (Class 'D')																
MPP Regulatory Process and Approval																
Tendering Stage																
Project Design																
Construction																
Substantial Completion																
Project Handover																
Proiect Close Out																