Qulliq Energy Corporation

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Qulliq Energy Corporation
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Application for Major Project Permit

CAMBRIDGE BAY NEW POWER PLANT

February 2021

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 Cambridge 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 2025/26 fiscal year.

Cambridge Bay is a community with increasing demand for electricity, reflecting its growing population and increasing government and commercial enterprise. The existing Cambridge Bay power plant is an aged plant which was constructed in 1958. It suffers from several deficiencies, including unreliable superstructure, and aging systems and equipment.

In particular, the existing switchgear is aged and obsolete and requires replacement to maintain reliability in the future. The building structure itself is also in poor condition and with no room for expansion. This situation requires a solution to ensure QEC can continue providing safe, reliable power to the community.

Proceeding with the proposed Project will maintain safe and reliable electricity supply in the community at the lowest cost over the life of the facility. As well, Qulliq Energy Corporation expects reductions in fuel consumption with the installation of the new gensets. The key benefits of constructing the new Power Plant in Cambridge Bay include:

- 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.
- Addressing environmental requirements of fuel storage system according to applicable codes and standards.
- Integration capability with renewable energy resources.

QEC's estimated cost to complete the project is $50.237 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 Cambridge 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 Cambridge Bay Power Plant was constructed in 1958. Although the plant's installed capacity can adequately meet the community's current and projected capacity requirements over the next decade, the Cambridge Bay facility is now 63 years old and 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 a new power plant in Cambridge Bay, Nunavut. The project will include the installation of a 90,000-liter capacity horizontal fuel tank and two 2 million-liter capacity vertical 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 substantially reduce sound and air pollution. The new plant will have a life cycle of over 40 years and will be capable of integrating renewable energy sources.

QEC met with the Cambridge Bay Hamlet Council on July 20, 2020. At this time, QEC presented four proposed location options for the new power plant and outlined the pros and cons of each location. Following these discussions, on August 24, 2020 the Hamlet carried a motion to approve in principle the location approximately 400 meters north of the PPD tank farm, in the area of the new industrial lands on the east side of the road (identified as "Option 2"). This location is approximately 2 kilometers outside the community core.

Figure 1 - Location of Proposed New Plant (Option 2)

QEC has already performed Geotechnical and Environmental studies and survey of the lot, and completed archeological research. QEC anticipates receiving Nunavut Impact Review Board (NIRB) approval by June 2021. Land approval for the proposed site has also been obtained from the Hamlet.

3.0 Existing Facility

3.1 Introduction

Cambridge Bay is a hamlet located on Victoria Island in the Kitikmeot Region of Nunavut, Canada. Figure 2 provides a map indicating the location of Cambridge Bay.

Figure 2 - Cambridge 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, three school including the Nunavut Arctic College, 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 Cambridge Bay since the plant was constructed in 1958.

In 2016/17 in order to address the load required for the new Canadian High Arctic Research Station (CHARS) campus and the associated projected load growth for the community, QEC installed a modular unit of 1100 kW (G5) outside of the existing power plant. That modular unit can be used as a standby plant. Furthermore, QEC replaced genset G3 and upgraded it from 720 kW to 1,100 kW in 2017/18.

Table 1 summarizes the current Genset line-up of the plant.

Table 1 - Cambridge Bay Power Plant Genset Line-up

Unit	Make	Model	kW Rating	Year Installed	Engine Hours (Jan 2021)	Engine Life Hours
G1	MTU	16V4000	1100	2010	43908	100000
G2	Caterpillar	D3508B	550	2007	38063	100000
G3	Caterpillar	D3516B	1100	2017	13643	100000
G4	MTU	16V4000	1100	2010	44937	100000
G5	MTU	16V4000	1100	2016	6248	100000
Total Installed Capacity			**4,950**			
Installed Firm Capacity			**3,850**			

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

3.2 Condition

The facility is 63 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) **Aging Infrastructure:** The facility is 63 years old. The building and ancillary equipment are old and have begun to deteriorate.
2) **Safety Issues:** 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.
3) **Environmental Requirements:** The existing plant has a tank that is single-walled, 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.

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

Cambridge Bay's population is estimated to reach 1,756 in 2021 according to the Nunavut Bureau of Statistics. Table 2 summarizes population projections for Cambridge Bay through 2036.

Table 2 - Cambridge Bay Population Projections

YEAR	PROJECTED POPULATION
2021	1756
2026	1803
2031	1829
2036	1845

Source: Nunavut Bureau of Statistics

4.2 Load Forecast

Table 3 summarizes the load forecast for Cambridge Bay. With the proposed plant capacity QEC will be able to meet community's power demand and provide reliable and safe electricity in the community for the foreseeable future.

Table 3 - Cambridge Bay Actual Load and Load Forecast

	Fiscal Year	Generation MWh	Peak Load kW	Change %	RFC kW	Existing Plant IFC kW	RFC Surplus
Actual	2013	9,414	1702		1872	2370	21%
	2014	9,953	1679	-1%	1847	2370	22%
	2015	11,095	2091	25%	2300	2370	3%
	2016	12,359	2178	4%	2396	2370	-1%
	2017	12,902	2265	4%	2492	3470	28%
	2018	12,130	2200	-3%	2420	3850	37%
	2019	12,109	2040	-7%	2244	3850	42%
	2020	12,138	2231	9%	2454	3850	36%
Forecast	2021	12,753	2256	1%	2482	3850	36%
	2022	12,806	2267	0%	2494	3850	35%
	2023	12,974	2301	1%	2531	3850	34%
	2024	13,265	2342	2%	2577	3850	33%
	2025	13,441	2397	2%	2636	3850	32%
	2026	13,661	2421	1%	2664	3850	31%
	2027	13,898	2464	2%	2711	3850	30%
	2028	14,117	2504	2%	2754	3850	28%
	2029	14,351	2545	2%	2800	3850	27%
	2030	14,590	2590	2%	2849	3850	26%

RFC=Required Firm Capacity = 110% of Peak Load
IFC=Installed Firm Capacity= Capacity with the largest unit out of service

Table 4 illustrates plant capacity and RFC requirements with the proposed Project.

Table 4 - Cambridge Bay RFC Surplus Projection with New Power Plant Project

	Fiscal Year	Generation MWh	Peak Load kW	Change %	RFC kW	Existing/ New Plant IFC kW	RFC Surplus
Actual	2013	9,414	1,702		1872	2370	21%
	2014	9,953	1,679	-1%	1847	2370	22%
	2015	11,095	2,091	25%	2300	2370	3%
	2016	12,359	2,178	4%	2396	2370	-1%
	2017	12,902	2,265	4%	2492	3470	28%
	2018	12,130	2,200	-3%	2420	3850	37%
	2019	12,109	2,040	-7%	2244	3850	42%
	2020	12,138	2,231	9%	2454	3850	36%
Forecast	2021	12,753	2,256	1%	2482	3850	36%
	2022	12,806	2,267	0%	2494	3850	35%
	2023	12,974	2,301	1%	2531	3850	34%
	2024	13,265	2,342	2%	2577	3850	33%
	2025	13,441	2,397	2%	2636	3850	32%
	2026	13,661	2,421	1%	2664	3850	31%
	2027	13,898	2,464	2%	2711	4150	35%
	2028	14,117	2,504	2%	2754	4150	34%
	2029	14,351	2,545	2%	2800	4150	33%
	2030	14,590	2,590	2%	2849	4150	31%

RFC=Required Firm Capacity = 110% of Peak Load
IFC=Installed Firm Capacity= Capacity with the largest unit out of service

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;
- Upgrading the existing plant requires the installation of temporary generation equipment on the same site, which is not feasible; and
- 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 five-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 a 90,000-liter double wall horizontal fuel tank, two 2 million-liter capacity vertical fuel tanks, approximately 400-meter fuel pipeline to connect to PPD facility, appropriate pumping facilities, Quonset garage, concrete pad for transformers, storage for two sea cans, pole racks, waste disposal area and approximately 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 5,500 kW. A power plant of this capacity will meet Cambridge Bay's peak load projections for 40 years. Table 5 indicates the genset ratings of the existing plant and proposed new plant.

Table 5 - Existing and Proposed Genset Line-up

Existing Units	Existing Rating (KW)	Proposed Units	Proposed Rating (KW)
G1	1100	**G1**	1350
G2	550	**G2**	1100
G3	1100	**G3**	1100
G4	1100	**G4**	1100
G5	1100	**G5**	850
Total Install	**4950**		**5500**
IFC	**3850**	**IFC**	**4,150**

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 5,500 kW. QEC dispatch programming is set at 80% of capacity of engines online to ensure reliability and good fuel economy.

The installed firm capacity (IFC) of the plant will be 4,150 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 3,320 kW.

The RFC requirement for the community is projected at approximately 2,664 kW by 2025/26. Option 2 proposes a firm capacity taking into consideration the following:

1. Cambridge 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 $50.237 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 $1.7 million (for land acquisition and in-house administration costs). As such, the net cost of the new plant for QEC's customers is estimated at $13.818 million as detailed in Table 6.

Table 6 - Project Contribution ($000)

Description	2022/23	2023/24	2024/25	2025/26	Total
Plant Replacement	**1,173**	**7,092**	**19,185**	**22,787**	**50,237**
AEF Ineligible Expenses	422	207	378	672	1,679
AEF Contribution - 75%	563	5,164	14,105	16,586	36,419
QEC Contribution - 25%	188	1,721	4,702	5,529	12,140
Total	**1,173**	**7,092**	**19,185**	**22,787**	**50,237**
Total QEC Contribution	**610**	**1,928**	**5,080**	**6,201**	**13,818**

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.

Prior to demolition of the old power plant all major components will be reviewed during asset disposal process to evaluate age, reliability and feasibility to re-purpose any or all of these major components. Genset G5 will be kept in Cambridge Bay as an emergency mobile unit.

QEC proposes to design the Cambridge 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 Cambridge 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 2025/26 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 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 $13.818 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 7 summarizes the estimated incremental revenue requirement increase due to the project of $1.236 million. The estimated rate increase under the community-based rates is 9.14 cents/kWh, which is high at 12.1% increase over the current domestic rate of 75.39 cents/kWh in Cambridge Bay. However, under a territorial rate design scenario the estimated average rate increase is 0.62 cents/kWh, or 0.8% over the current domestic rate of 75.39 cents/kWh.

Table 7 - Cambridge Bay New Power Plant Estimated Rate Impact

Project Characteristics	
Net Capital Cost ($ 000)	13,818
Amortization Period (year)	40
GRA Approved Return on Ratebase	6.45%
Revenue Requirement Impacts	
Amortization Expense ($ 000)	345
Return on Ratebase ($ 000)	891
sub-total: Revenue Requirement Increase ($ 000)	**1,236**
Total Revenue Requirement Impact ($ 000)	**1,236**
Cambridge Bay 2027/28 Forecast Sales (MWh)	*13,527*
Average Community-Based Rate Increase (c/kWh)	9.14
Territorial 2027/28 Forecast Sales (MWh)	*200,607*
Average Territorial Rate Increase (c/kWh)	0.62

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:

- **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 aged and obsolete and not Arc resistant and cannot be modified, which increases fire risk of the facility impacting the risk of future reliability or employee safety.

- **Environmental Requirements**

The existing fuel storage system is aged with some of the storage tanks leaking and single walled and not in compliance with the current codes and regulations of Environment Canada. The proposed project will address these environmental requirements.

- **Power Reliability and Stability**

Although IFC at the current plant meets QEC's RFC criterion, as the Cambridge 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 is expected to increase fuel efficiency and overall plant reliability.

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&II environmental assessments were performed in January 2021. The archeological assessment is anticipated for completion by June 2021.

The new power plant 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 second quarter of 2023/24. Site grading works will begin during July - September of 2024 and materials will be delivered during sealift 2024. Construction would begin second quarter of 2024/25 and be completed in 2025/26. Table 8 illustrates the proposed project schedule for reference purposes.

Table 8 - Proposed Cambridge Bay Power Plant Project Schedule

Task Table	2020-2021				2021-2022				2022-2023				2023 - 2024				2024 - 2025				2025 - 2026			
	1ST QT	2ND QT	3RD QT	4TH QT	1ST QT	2ND QT	3RD QT	4TH QT	1ST QT	2ND QT	3RD QT	4TH QT	1ST QT	2ND QT	3RD QT	4TH QT	1ST QT	2ND QT	3RD QT	4TH QT	1ST QT	2ND QT	3RD QT	4TH QT
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																								
FMB Approval																								
Tendering Stage																								
ProjectDetail Design																								
Construction contract Tender and Award																								
Construction																								
Substantial Completion																								
Project Handover																								
Project Close Out																								