

Qulliq Energy Corporation



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Qulliq Energy Corporation
Société d'énergie Qulliq
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Application for Major Project Permit

GJOA HAVEN 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 Gjoa Haven 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.

Gjoa Haven is a community with increasing demand for electricity, reflecting its growing population. The existing Gjoa Haven power plant is an aged plant which was constructed in 1977. Although the existing power plant has 1,600 kW installed firm capacity (IFC) which exceeds the community's 2019-20 required firm capacity of 1,177 kW and the 2029-30 forecast of 1,319 kW, the existing power plant has exceeded its design life. As the plant continues to age it will become more difficult to maintain the facility and its reliability will become an issue. Moreover, generator set G1 has significantly exceeded its engine life hours and needs to be replaced to maintain reliability in 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. In addition, 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 Gjoa Haven 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.
- Addressing environmental requirements of fuel storage system according to applicable codes and standards.
- The new plant will be capable of integration with renewable energy sources.

QEC's estimated cost to complete the project is \$36.274 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 Gjoa Haven 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 Gjoa Haven Power Plant was constructed in 1977. Although the plant's capacity can adequately meet the community's current and projected capacity requirements over the next decade, the Gjoa Haven facility is now 44 years old and is due for replacement for multiple reasons, including the need to replace aging equipment and compliance with current safety and environmental regulations.

QEC intends to engage in a multiyear project to build a new power plant in Gjoa Haven, 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. A 200-meter fuel pipeline (partially underground) will be constructed to connect to the Petroleum Products Division's (PPD) system. 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 service life cycle of 40 years, and will be capable of integrating renewable energy sources.

QEC met with the Gjoa Haven Hamlet Council on July 30, 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, the Hamlet requested that QEC complete preliminary site investigations on two locations, one identified by QEC ("Option 1") and one identified by the Hamlet ("Option 5"). Following the site investigations and subsequent discussions with Hamlet Council regarding the results, the Hamlet issued a resolution (dated January 12, 2021) approving QEC to proceed with construction of the new power plant as the proposed "Option 1" location. This location is 200 meters west of the PPD Tank Farm and is situated along an existing road (Nuvu Road).



Figure 1 - Location of Proposed New Plant: Option One



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

Gjoa Haven is the only settlement on King William Island, located in the Kitikmeot Region north of the Arctic Circle. Figure 2 provides a map indicating the location of Gjoa Haven.

Figure 2 - Gjoa Haven





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 schools, 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 Gjoa Haven since the plant was constructed in 1977. Table 1 summarizes the current Genset line-up of the plant.

Table 1 - Gjoa Haven Power Plant Genset Line-up

Unit	Make	Model	kW Rating	Year Installed	Engine Hours (Jan 2021)	Engine Life Hours
G1	Caterpillar	D 3512	720	1995	130870	100000
G2	MTU	8V/4000M63	500	2018	15990	100000
G3	Gua	SF360TA	550	2009	42866	100000
G4	Caterpillar	3508B	550	2018	272	100000
Total Installed Capacity			2,320			
Installed Firm Capacity			1,600			

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

3.2 Condition

The facility is 44 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 44 years old. The building and ancillary equipment are old and have begun to deteriorate.
- 2) **Genset Replacement**: G1 is approaching has exceeded its retirement usage limit and needs to be replaced.
- 3) **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.
- 4) **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.



- 5) **Capacity:** The existing plant meets QEC’s required firm capacity (RFC) criterion. The Gjoa Haven existing plant’s previous years load and load forecast is provided in Table 3. However, RFC is at risk for the community since G1 has exceeded its retirement usage limit and needs to be replaced so RFC is guaranteed.

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

Gjoa Haven’s population is estimated to reach 1,217 as of 2021 by Nunavut Bureau of Statistics. Table 2 summarizes population projections for Gjoa Haven through 2036.

Table 2 - Gjoa Haven Population Projections

YEAR	PROJECTED POPULATION
2021	1217
2026	1259
2031	1285
2036	1302

Source: Nunavut Bureau of Statistics

4.2 Load Forecast

Table 3 summarizes the load forecast for Gjoa Haven. 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 - Gjoa Haven Actual Load and Load Forecast

	Fiscal Year	Generation MWh	Peak Load kW	Change %	RFC kW	Existing Plant IFC kW	RFC Surplus
Actual	2013	5,009	1004		1104	1600	31%
	2014	5,250	960	-4%	1056	1600	34%
	2015	5,424	940	-2%	1034	1600	35%
	2016	5,619	960	2%	1056	1600	34%
	2017	5,851	1100	15%	1210	1600	24%
	2018	5,841	1040	-5%	1144	1600	29%
	2019	6,167	1080	4%	1188	1600	26%
	2020	6,234	1070	-1%	1177	1600	26%
Forecast	2021	6,219	1098	3%	1208	1600	25%
	2022	6,220	1105	1%	1216	1600	24%
	2023	6,285	1105	0%	1215	1600	24%
	2024	6,383	1119	1%	1231	1600	23%
	2025	6,440	1129	1%	1242	1600	22%
	2026	6,515	1147	2%	1262	1600	21%
	2027	6,593	1161	1%	1277	1600	20%
	2028	6,665	1171	1%	1288	1600	19%
	2029	6,742	1185	1%	1303	1600	19%
	2030	6,819	1199	1%	1319	1600	18%

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 – Gjoa Haven RFC Surplus Projection with Project

	Fiscal Year	Generation MWh	Peak Load kW	Change %	RFC kW	Existing/ New Plant IFC kW	RFC Surplus
Actual	2013	5,009	1,004		1104	1600	31%
	2014	5,250	960	-4%	1056	1600	34%
	2015	5,424	940	-2%	1034	1600	35%
	2016	5,619	960	2%	1056	1600	34%
	2017	5,851	1,100	15%	1210	1600	24%
	2018	5,841	1,040	-5%	1144	1600	29%
	2019	6,167	1,080	4%	1188	1600	26%
	2020	6,234	1,070	-1%	1177	1600	26%
Forecast	2021	6,219	1,098	3%	1208	1600	25%
	2022	6,220	1,105	1%	1216	1600	24%
	2023	6,285	1,105	0%	1215	1600	24%
	2024	6,383	1,119	1%	1231	1600	23%
	2025	6,440	1,129	1%	1242	1600	22%
	2026	6,515	1,147	2%	1262	2000	37%
	2027	6,593	1,161	1%	1277	2000	36%
	2028	6,665	1,171	1%	1288	2000	36%
	2029	6,742	1,185	1%	1303	2000	35%
	2030	6,819	1,199	1%	1319	2000	34%

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;
- 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; 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 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, required upgrade of existing distribution system to connect to the new facility, space for Transient Unit, and a Quonset Garage. The new plant will also have space for two Sea Cans for storage, a waste disposal area, and a fence.

The plant would generate less noise and air pollution, due to installation of new 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 3,100 kW. A power plant of this capacity will meet Gjoa Haven'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	720	G1	1100
G2	500	G2	900
G3	550	G3	550
G4	550	G4	550
Total Installed Capacity	2320		3100
IFC	1600	IFC	2000

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 3,100 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 2,000 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 1,600 kW.

The RFC requirement for the community is projected at approximately 1,262 kW by 2025/26. Option 2 proposes a firm capacity taking into consideration the following:

1. Gjoa Haven 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 \$36.274 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 \$1.363 million (including land acquisition and in-house administration costs). As such, the net cost of the new plant for QEC's customers is estimated at \$10.091 million as detailed in Table 6.

Table 6 - Project Contribution (\$000)

Description	2022/23	2023/24	2024/25	2025/26	Total
Plant Replacement	1,010	5,005	14,299	15,960	36,274
AEF Ineligible Expenses	259	170	330	604	1,363
AEF Contribution - 75%	563	3,627	10,477	11,517	26,183
QEC Contribution - 25%	188	1,209	3,492	3,839	8,728
Total	1,010	5,005	14,299	15,960	36,274
Total QEC Contribution	447	1,379	3,822	4,443	10,091

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 G4 will be kept in Gjoa Haven as an emergency mobile unit.

QEC proposes to design the Gjoa Haven 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 Gjoa Haven. 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

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**

Although the current plant meets QEC's required firm capacity criterion, genset G1 has exceeded its expected lifecycle hours and is not reliable to continue to support the community's RFC. As the Gjoa Haven 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&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 Gjoa Haven Power Plant Project Schedule

Task Table	2020-2021				2021-2022				2022-2023				2023 - 2024				2024 - 2025				2025 - 2026			
	1 ST QT	2 ND QT	3 RD QT	4 TH QT	1 ST QT	2 ND QT	3 RD QT	4 TH QT	1 ST QT	2 ND QT	3 RD QT	4 TH QT	1 ST QT	2 ND QT	3 RD QT	4 TH QT	1 ST QT	2 ND QT	3 RD QT	4 TH QT	1 ST QT	2 ND QT	3 RD QT	4 TH QT
Finalize List of Proposed Sites	Yellow																							
Geo-Tech Study and Recommendations		Yellow	Yellow	Yellow																				
Site Selection Approval			Yellow	Yellow																				
Develop Business Case and Cost Estimate (Class 'D')			Yellow	Yellow																				
Final P Regulatory Process and Approval				Yellow	Yellow	Yellow	Yellow																	
FMB Approval						Yellow	Yellow																	
Tendering Stage							Yellow	Yellow	Yellow	Yellow	Yellow													
Project Detail Design									Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow								
Construction contract Tender and Award													Yellow	Yellow	Yellow	Yellow	Yellow	Yellow						
Construction																	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Substantial Completion																								Yellow
Project Handover																								Yellow
Project Close Out																								Yellow