Qulliq Energy Corporation

ᖃᓄᓕᒃᑯᓂᖅ ᐅᓚᒪᖅᑯᑎᓕᕆᔨᖏᑦᑐᑦ ᑎᒥᖅᑕᒃ
Qulliq Energy Corporation
Société d'énergie Qulliq
Qulliq Alruyaktuqtunik Ikumatjutiit

Application for Major Project Permit

CHESTERFIELD INLET NEW POWER PLANT

December 2021

Executive Summary

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 Chesterfield Inlet 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 2026/27 fiscal year.

The existing Chesterfield Inlet power plant is an aged plant which was constructed in 1975. 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.

Although it is the smallest community in the Kivalliq Region, Chesterfield Inlet is also considered the oldest permanent settlement in Nunavut. Building on this long history, future community growth and development is intended to encourage entrepreneurship and local business in areas such as tourism and other land-based economies. A new power plant will allow QEC to continue to provide the community with safe and reliable power that will not only accommodate future growth, but also provide opportunities for renewable energy production options at the lowest cost over the life of the facility. As well, QEC expects reductions in fuel consumption with the installation of the new gensets. The key benefits of constructing the new Power Plant in Chesterfield Inlet 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 $34.956 million. This project has been identified to receive funding from the Arctic Energy Fund (AEF) Program for a contribution of up to 75% of eligible expenses. The total funding available to QEC from the AEF Program is $175.0 million, of which $130.1 million has been committed to the capital projects already reviewed by the URRC and approved by the Minister Responsible for QEC. QEC intends to equally allocate the remaining AEF Program funding of $44.887 million between

Chesterfield Inlet and Kugaaruk new power plant capital projects. Accordingly, $22.444 million of the project cost will be funded by the AEF Program and as such QEC's customers would only have to pay for approximately $12.512 million of the total project cost.

Table of Contents

List of Tables

List of Figures

1.0 Application

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 Chesterfield Inlet 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 Chesterfield Inlet Power Plant was constructed in 1975. While the plant's installed capacity can adequately meet the community's current and projected capacity requirements over the next decade, the Chesterfield Inlet facility is now 46 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 four-engine power generation facility in Chesterfield Inlet, Nunavut. The power plant will be designed for a 40-year life and will incorporate new technology to improve reliability, efficiency, operation, and safety. The project will also include the installation of two 90,000-liter capacity horizontal fuel tanks, approximately 200-meters of underground fuel pipeline to connect to the Petroleum Products Division (PPD) Bulk Fuel Facility, approximately 1 km of distribution lines, appropriate fuel pumping facilities and an integral heated garage for Radial Boom Derrick (RBD) truck storage. The new plant will be fenced and have a secure service yard complete with two pole racks, one transformer storage platform, one cable reel storage platform, space for an emergency generator, a minimum of two storage sea cans, service transformers and feeder take off, contained storage for new and waste fuel and glycol, and space for a Transient Unit serviced from the power plant. The main power plant building will include an office, electrical control room, mechanical room, and garage/workshop, in addition to the power generation hall. The detailed design is anticipated to include the installation of industrial scrubbers and hospital grade silencers on the radiator and exhaust system to assist in the reduction of noise and exhaust emissions. The new plant will also be capable of integrating renewable energy sources. Upgrades to the existing distribution system will be required to connect to the new power plant.

QEC met with Chesterfield Inlet Hamlet Council on September 3, 2020, to present three proposed location options for the new power plant and outlined the pros and cons of each (Figure 1). As part of this discussion, it was identified that QECs preferred location, Option

2, located immediately to the east of the PPD Bulk Fuel Facility, was in conflict with a proposed archaeological reserve that would be included in the upcoming revision to the Community Plan. As such, this option was removed from consideration. The same day, Chesterfield Inlet Hamlet Council issued a motion (073/20) giving QEC authorization to proceed with site investigations at the two remaining locations; Option 1 and Option 3, located 70-75 metres northwest and north of the PPD Bulk Fuel Facility, respectively.

The geotechnical evaluation, and Phase I and Limited Phase II Environmental Site Assessment results were received by QEC in March 2021. The field component of the Archaeological Impact Assessment was completed for Option 1 and Option 3 in July 2021. Based on the results of the site investigations, QEC identified a preference for Option 3. No archaeological features or artifacts were observed in conflict with either the Option 1 or Option 3 sites. However, a potential pointer rock was noted 35 m away from Option 1 and a number of recent community and archaeological graves were observed within approximately 20 to 40 metres of the Option 3 boundary that will have to be taken into consideration in future project planning. A non-technical summary of the Archaeological Impact Assessment was submitted to the Government of Nunavut (GN) Department of Culture and Heritage on September 30, 2021. The results of the field assessment will be summarized in a final permit report that details the methods, project environment and recommendations. QEC anticipates the report to be available in December 2021. The report will be submitted to the Department of Culture and Heritage, and Inuit Heritage Trust.

QEC has been working internally to prepare a preliminary site layout for Option 3 to confirm all project components will fit within the approximately 6,000 square metre space available and that avoidance buffers can be maintained around the grave sites. Once the preliminary site plan is confirmed internally, QEC plans to discuss the proposed location with Chesterfield Inlet Hamlet Council and the GN Department of Culture and Heritage to request their feedback on the preferred location. If Chesterfield Inlet Hamlet Council and the GN Department of Culture and Heritage are supportive of the location, QEC will submit a formal land application. Once the location is confirmed, QEC will also proceed with submissions to the Nunavut Planning Commission and Nunavut Impact Review Board.

Figure 1 - Location of Proposed New Plant (Option 3)

3.0 Existing Facility

3.1 Introduction

Chesterfield Inlet is a hamlet located on the western shore of Hudson Bay in the Kitikmeot Region of Nunavut, Canada. Figure 2 provides a map indicating the location of Chesterfield Inlet.

Figure 2 - Chesterfield Inlet

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, the Victor Sammurtok School, 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 Chesterfield Inlet since the plant was constructed in 1975.

In 2019, to address projected load growth for the community, QEC installed a 500 kW emergency generation unit that was transferred from the old plant in Pangnirtung.

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

Table 1 - Chesterfield Inlet Power Plant Genset Line-up

Unit	Make	Model	kW Rating	Year Installed	Engine Hours (Oct 2021)	Engine Life Hours
G1	Detroit	Series 60	320	2010	57,571	72,000
G2	Detroit	Series 60	320	2013	38,921	100,000
G3	Volvo	TWD1643GE	400	2019	7,108	100,000
Total Installed Capacity			**1,040**			
Installed Firm Capacity			**640**			

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

3.2 Condition

The facility is 46 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 46 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 two single-wall fuel tanks that are not compliant with federal storage tank system regulations and codes of practice. The fuel tanks are located within a gravel berm that does not meet secondary containment requirements. Additionally, the facility lacks sufficient space for proper handling, storage and containment of industrial materials.

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

Chesterfield Inlet's population is estimated to reach 455 in 2021 according to the Nunavut Bureau of Statistics. Table 2 summarizes population projections for Chesterfield Inlet through 2036.

Table 2 - Chesterfield Inlet Population Projections

YEAR	PROJECTED POPULATION
2021	455
2026	490
2031	522
2036	568

Source: Nunavut Bureau of Statistics

4.2 Load Forecast

Table 3 summarizes the load forecast for Chesterfield Inlet. 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 - Chesterfield Inlet Actual Load and Load Forecast

	Fiscal Year	Generation MWh	Peak Load kW	Change %	RFC kW	Existing Plant IFC kW	RFC Surplus
Actual	2013	2,002	358		394	640	38%
	2014	2,110	410	15%	451	640	30%
	2015	2,077	389	-5%	428	640	33%
	2016	2,070	389	0%	428	640	33%
	2017	2,066	400	3%	440	640	31%
	2018	2,123	420	5%	462	640	28%
	2019	2,174	480	14%	528	640	18%
	2020	2,294	440	-8%	484	640	24%
Forecast	2021	2,262	447	2%	492	640	23%
	2022	2,319	463	4%	510	640	20%
	2023	2,393	481	4%	529	640	17%
	2024	2,427	490	2%	539	640	16%
	2025	2,485	493	1%	542	640	15%
	2026	2,543	508	3%	559	640	13%
	2027	2,596	520	2%	572	640	11%
	2028	2,655	532	2%	585	640	9%
	2029	2,714	543	2%	597	640	7%
	2030	2,774	554	2%	609	640	5%

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 - Chesterfield Inlet 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	2,002	358		394	640	38%
	2014	2,110	410	15%	451	640	30%
	2015	2,077	389	-5%	428	640	33%
	2016	2,070	389	0%	428	640	33%
	2017	2,066	400	3%	440	640	31%
	2018	2,123	420	5%	462	640	28%
	2019	2,174	480	14%	528	640	18%
	2020	2,294	440	-8%	484	640	24%
Forecast	2021	2,262	447	2%	492	640	23%
	2022	2,319	463	4%	510	640	20%
	2023	2,393	481	4%	529	640	17%
	2024	2,427	490	2%	539	640	16%
	2025	2,485	493	1%	542	640	15%
	2026	2,543	508	3%	559	640	13%
	2027	2,596	520	2%	572	640	11%
	2028	2,655	532	2%	585	1,270	54%
	2029	2,714	543	2%	597	1,270	53%
	2030	2,774	554	2%	609	1,270	52%

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 buildings no longer meet building codes;
- The footprint of the existing plant is too small to accommodate the required new gensets.

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 power 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, approximately 300-meters of underground fuel pipeline to connect to PPD Bulk Fuel Facility, appropriate fuel pumping facilities, and an integral heated garage for Radial Boom Derrick (RBD) truck storage. The new plant will be fenced and have a secure service yard complete with two pole racks, one transformer storage platform, one cable reel storage platform, space for an emergency generator, a minimum of two storage sea cans, service transformers and feeder take off, contained storage for new and waste fuel and glycol, space for a Transient Unit serviced from the power plant and approximately 1 km of distribution lines.

The plant would generate less noise and air pollution, due to installation of equipment such as industrial scrubbers and hospital grade silencers. Construction of a new power plant facility allows QEC to incorporate into site selection and engineering design geotechnical and environmental factors; such as depth to bedrock, permafrost, prevailing winds, snow accumulation, surface water drainage and surrounding land uses. The new plant would also be designed to be capable of integrating renewable energy sources.

The proposed generating capacity of the new plant is approximately 1,820 kW. A power plant of this capacity will meet Chesterfield Inlet'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	320	**G1**	550
G2	320	**G2**	550
G3	400	**G3**	360
		G4	360
Total Install	**1,040**		**1,820**
IFC	**640**	**IFC**	**1,270**

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 1,820 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 1,270 kW. At the target load of approximately 80% of the capacity to maximize the fuel efficiency, the adjusted installed firm capacity of the plant will be approximately 1,016 kW.

The RFC requirement for the community is projected at approximately 572 kW by 2026/27. Option 2 proposes a firm capacity taking into consideration the following:

1. Chesterfield Inlet 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 3 is $34.956 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 up to 75% of eligible expenses. The total funding available to QEC from the AEF Program is $175.0 million, of which $130.1 million has been committed

to the capital projects already reviewed by the URRC and approved by the Minister Responsible for QEC. QEC intends to equally allocate the remaining AEF Program funding of $44.887 million between Chesterfield Inlet and Kugaaruk new power plant capital projects. Accordingly, $22.444 million of the project cost will be funded by the AEF Program. As such, the net cost of the new plant for QEC's customers is estimated at $12.512 million as detailed in Table 6.

Table 6 - Project Contribution ($000)

Description	2023/24	2024/25	2025/26	2026/27	Total
Plant Replacement	**1,042**	**5,304**	**13,214**	**15,396**	**34,956**
AEF Ineligible Expenses[1]	292	366	324	572	1,554
AEF Contribution - 75%2	563	3,703	9,667	8,511	22,444
QEC Contribution - 25%	188	1,234	3,222	6,313	10,958
Total	**1,042**	**5,304**	**13,214**	**15,396**	**34,956**
Total QEC Contribution	**480**	**1,601**	**3,547**	**6,885**	**12,512**

Note:
1. Ineligible expenses includes land acquisition and in-house administration expenses.

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. The emergency generation unit installed in 2019 will be kept in Chesterfield Inlet as an emergency mobile unit.

QEC proposes to design the Chesterfield Inlet 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 Chesterfield Inlet. 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 2026/27 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 $12.512 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 $1.119 million. The estimated rate increase under the community-based rates is 47.19 cents/kWh, which is high at 48.0% increase over the current domestic rate of 98.31 cents/kWh in Chesterfield Inlet. However, under a territorial rate design scenario the estimated average rate increase is 0.57 cents/kWh, or 0.6% over the current domestic rate of 98.31 cents/kWh.

Table 7 - Chesterfield Inlet New Power Plant Estimated Rate Impact

Project Characteristics	
Net Capital Cost ($ 000)	12,512
Amortization Period (year)	40
GRA Approved Return on Ratebase	6.45%
Revenue Requirement Impacts	
Amortization Expense ($ 000)	313
Return on Ratebase ($ 000)	806
sub-total: Revenue Requirement Increase ($ 000)	**1,119**
Total Revenue Requirement Impact ($ 000)	**1,119**
Chesterfield Inlet 2026/27 Forecast Sales (MWh)	*2,372*
Average Community-Based Rate Increase (c/kWh)	47.19
Territorial 2026/27 Forecast Sales (MWh)	*198,032*
Average Territorial Rate Increase (c/kWh)	0.57

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 plant has two single-wall fuel tanks that are not compliant with federal storage tank system regulations and codes of practice. The fuel tanks are located within a gravel berm that does not meet secondary containment requirements. Additionally, the facility lacks sufficient space for proper handling, storage and containment of industrial materials. 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 Chesterfield Inlet 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 evaluation, and Phase I and Limited Phase II environmental site assessment for the project were completed in 2020. The field component of the archeological impact assessment was completed in July 2021. A non-technical summary of the Archaeological Impact Assessment was submitted to the Government of Nunavut (GN) Department of Culture and Heritage on September 30, 2021. The results of the field assessment will be summarized in a final permit report that details the methods, project environment and recommendations. QEC anticipates the report to be available in

December 2021. The report will be submitted to the Department of Culture and Heritage, and Inuit Heritage Trust.

Once the preliminary site plan is confirmed internally, QEC plans to discuss the proposed location with Chesterfield Inlet Hamlet Council and the GN Department of Culture and Heritage to request their feedback on the preferred location. If Chesterfield Inlet Hamlet Council and the GN Department of Culture and Heritage are supportive of the location, QEC will submit a formal land application. Once the location is confirmed, QEC will also proceed with submissions to the Nunavut Planning Commission and Nunavut Impact Review Board. It is anticipated that this process may take four to six months.

The new power plant design will commence in the second quarter of 2023/24, with specifications and tenders to allow for ordering of materials and construction contracts beginning in the second quarter of 2024/25. Site grading works will begin during July - September of 2025 and materials will be delivered during sealift 2025. Construction would begin in the second quarter of 2025/26 and be completed in 2026/27. Table 8 illustrates the proposed project schedule for reference purposes.

Table 8 - Proposed Chesterfield Inlet Power Plant Project Schedule

Task Table	2021-2022				2022-2023				2023 - 2024				2024 - 2025				2025 - 2026				2026 - 2027			
	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																								