Qulliq Energy Corporation

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Société d'énergie Qulliq
Qulliq Alruyaktuqtunik Ikumatjutiit

Application for Major Project Permit

NEW KUGLUKTUK POWER PLANT

August 9, 2017

Executive Summary

The Qulliq Energy Corporation (QEC) hereby applies to the Minister Responsible for Qulliq Energy Corporation pursuant to section 18.1 of the QEC Act, R.S.N.W.T. 1988,c.N-2 for a project permit respecting the new Kugluktuk Power Plant Project.

The project will have no impact on rates until the time of QEC's first General Rate Application following the project coming in-service, which is expected no earlier than the 2020/21 fiscal year.

Kugluktuk is a community with growing demand for electricity, reflecting its growing population and tourism industry. The existing Kugluktuk power plant is an aged plant, which was constructed in 1968. It suffers from several deficiencies, including unreliable superstructure, and aging systems and equipment.

Proceeding with the proposed Project will provide the lowest overall cost over the life of the facility. As well, with the installation of the new engines, which have improved fuel efficiency, the Corporation expects reductions in fuel costs.

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

- 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; and
- Addressing environmental requirements associated with the existing single walled fuel supply line.

In addition, the new plant will be capable of integration with renewable energy sources, such as wind turbines or solar panels in the future.

QEC is requesting approval of a $31.4 million capital project permit to complete the construction of a new diesel power plant in Kugluktuk. It is noted that the forecast budget is based on preliminary estimates (D-class estimate with accuracy of +/- 25%), as the Corporation has not started the actual project work. As such, the forecast budget is subject to refinement during the project design.

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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 QEC Act, R.S.N.W.T. 1988, cN-2 for a major project permit respecting the Kugluktuk Power Plant Project. QEC is requesting approval for $31.4 million in capital cost to complete this project. Details in support of the requested project permit are set out below.

2.0 Background

2.1 Preamble

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

The Kugluktuk Power Plant was constructed in 1968. The plant consists of the powerhouse, a garage used for line trucks and line material storage, and a garage which is used as a warehouse.

Now approaching 50 years since its original construction, the Kugluktuk facility is due for replacement for multiple reasons, including the need to replace aging equipment; safety concerns; and compliance with current regulations.

QEC intends to engage in a multiyear project to replace the Kugluktuk power plant. The new power plant will use more efficient engines with much less fuel consumption by incorporating current technologies. The plant will also generate much less sound and air pollution due to the availability of equipment like industrial scrubbers and hospital grade silencers. The new plant will have a life cycle of 40 plus years, and be capable of integration with renewable energy sources such as wind turbines or solar panels in the future.

QEC discussed the project with Hamlet officials during a site visit in November 2016. Following these discussions the Hamlet approved a resolution to allow QEC to build a new power plant on lots 461 & 462 near the Petroleum Product Division’s tank farm.

3.0 Current Kugluktuk Power Generation System

3.1 Introduction

Kugluktuk is the westernmost community in Nunavut located north of the Arctic Circle on the Canadian mainland at the mouth of the Coppermine River where it feeds into Coronation Gulf.

The current estimated population of Kugluktuk is 1,638.[1] Table 1 summarizes population projections for Kugluktuk[2] through 2036.

Table 1 – Kugluktuk Population Projections

Year	Projected population
2021	1,723
2026	1,863
2031	2,007
2036	2,154

Source: Nunavut Bureau of Statistics

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. Municipal services such as domestic water and sewage are conducted locally using designated trucks. Some of the largest electricity loads in the community are demanded by the Hamlet Office and Community Centre, two schools, and the Northern 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 Kugluktuk since the plant was constructed in 1968.

Table 2 summarizes the current genset line-up of the plant.

Table 2 – Kugluktuk Genset Line-up

Unit	Make	Model	kW Rating	Year Installed	Engine Hours (May 2017)
G1	Detroit	DD4000	875	2007	74,392
G2	Detroit	Series 60	300	2002	38,171
G3	Detroit	Series 60	300	2005	32,151
G4	Caterpillar	D 3512	720	1993	80,623
Total Installed Capacity			**2,195 kW**		

[1] Nunavut Bureau of Statistics. (2014). *Nunavut Population Estimates by Region and Community, 2014 to 2035, as of December 17,2014.* http://stats.gov.nu.ca/en/Population%20projections.aspx

[2] Nunavut Bureau of Statistics. (2014). *Nunavut Population Estimates by Region and Community, 2014 to 2035, as of December 17,2014.* http://stats.gov.nu.ca/en/Population%20projections.aspx

3.2 Current Facility Condition

The facility is nearly 50 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 nearly 50 years old. The building and ancillary equipment are old and have begun to deteriorate.

2) Genset Replacement: G1 and G4 are approaching their retirement usage limit and soon will be due for replacement.

3) Safety Issues: The facility is a very old plant and is at a higher risk of equipment failure. Existing switch gear is not Arc resistant nor can it be modified due to age which increases fire/safety risk of the facility.

4) Environmental Requirements: The existing plant has a fuel supply line that is approximately 1.5 km long. This line is single walled and does not comply with the present codes and regulations. Upgrade costs of this underground pipeline to comply with the regulations can be in excess of $3-5 million. These added costs can be avoided if a new plant can be constructed near the PPD tank farm so that this piping upgrade is no longer necessary.

Table 3 – Kugluktuk Load Forecast

	Fiscal Year	Generation MWh	Peak Load kW	Change %	RFC kW	IFC kW
Actual	05/06	4,925	947		1042	
	06/07	5,032	973	3%	1070	
	07/08	5,353	1,027	6%	1130	1320
	08/09	5,495	1,020	-1%	1122	1320
	09/10	5,481	1,046	3%	1151	1320
	10/11	5,462	1,028	-2%	1131	1320
	11/12	5,658	1,057	3%	1163	1320
	12/13	5,577	1,080	2%	1188	1320
	13/14	5,665	1,052	-3%	1157	1320
	14/15	5,906	1,067	1%	1174	1320
	15/16	5,839	1,037	-3%	1141	1320
Forecast	16/17	5,767	1,065	3%	1172	1320
	17/18	5,804	1,070	0%	1177	1320
	18/19	5,866	1,071	0%	1178	1320
	19/20	5,910	1,075	0%	1183	1320
	20/21	5,896	1,074	0%	1182	1320
	21/22	5,907	1,082	1%	1190	1320

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

4.0 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 uphold 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 due to the following factors:

- 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 temporary generation equipment installation on the same site, which is not feasible;
- The community is against the continued operation of the plant at the current location and it desires to develop a new subdivision at the current plant site;
- Rehabilitating the existing plant would require upgrading the fuel supply line to meet environmental regulations, which is estimated to cost in excess of $3-5 million.

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

Option 2 – Construct a New Plant at a New Location

Option 2 involves the construction of a new power plant at a suitable location that will minimize interference with the community's development.

The plant would be a four-engine generation facility designed for a 40 year life and would incorporate new technology to improve efficiency, operation, and safety. The plant would meet all requirements including fuel storage and pumping facilities, Quonset huts, storage racks and berms and fencing.

The plant would also generate much less sound and air pollution, due to the availability of equipment like industrial scrubbers and hospital grade silencers. The new plant would be capable of integrating renewable energy sources, such as wind turbines or solar panels in the future.

The proposed generating capacity of the new plant is approximately 2.6 MW. A power plant of this capacity will meet Kugluktuk's peak load projections for 40 years following the project's completion. Table 4 indicates the rating of the proposed new and existing power plant.

Table 4 – Existing and Proposed Genset Line-up

Proposed Units	Proposed Nominal Rating (KW)	Existing Units	Existing Rating (KW)
G1	550	**G1**	875
G2	550	**G2**	300
G3	750	**G3**	300
G4	750	**G4**	720
IFC	**1850**	**IFC**	**1,320**
Total	**2600**		**2195**

Based on the manufacturing of the engines the expected installed capacity of the new plant is 2,600 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 1,850 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 1,480 kW.

The RFC requirement for the community is projected at approximately 1,190 kW by 2021/22. Option 2 proposes a firm capacity taking into consideration the following:

1. Kugluktuk is a growing community in Nunavut. Some of the planned developments include a new health and care centre and a new jail.

2. The plant is being built for long-term and having a reasonable RFC surplus can avoid extra costs related to capacity increase in the future.

The average fuel efficiency of the existing plant is approximately 3.6 kWh/L. Plants with new generation technologies can have efficiencies above 4 kWh/L. With an estimate of 4 kWh/L, or almost 10 % improvement in efficiency, and annual generation of 5.9 GWh, the expected fuel savings from the new plant will be 164,000 liters per year as shown in Table 5.

Table 5 – Fuel Consumption Savings Estimate

L1	Forecast generation (MWh)	5,907
L2	Current fuel efficiency (kWh/l)	3.6
L3=L1/L2	Current consumption (L000)	1,641
L4	Fuel efficiency improvement	10%
L5=L3xL4	Fuel savings (L000)	164

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 budget for Option 2 is $31.4 million. Details on project costs under this option are provided in Table 6.

Table 6 – Proposed Project Budget

Kugluktuk Project Cost Breakdown					
Accountability	**Description**	**2018/19**	**2019/20**	**2020/21**	**Totals**
	Project Preparation	37,000	-	-	37,000
	Land Acquisition	130,000	-	-	130,000
	Geotechnical & Environmental study	75,000	-	-	75,000
	Contract Labour - Conceptual Design	240,000	-	-	240,000
Project Scoping / Planning - Total		**482,000**	**-**	**-**	**482,000**
	Project Management	-	68,500	68,500	137,000
	Site Monitoring	-	40,000	85,000	125,000
	Quality Assurance (QA)	-	32,000	113,500	145,500
Project Monitoring/Quality Assurance - Total		**-**	**140,500**	**267,000**	**407,500**
	EPCM Services	-	1,370,000	950,000	2,320,000
	Operations & Maintenance Costs	-	972,500	1,595,000	2,567,500
	Facilities and Utilities	-	54,500	99,500	154,000
	Transportation	-	380,000	430,000	810,000
	Civil Works	-	800,000	-	800,000
	Foundation	-	1,150,000	-	1,150,000
	Structural Works	-	650,000	-	650,000
	Architectural Works	-	685,000	-	685,000
	Mechanical and Piping Works	-	-	7,576,000	7,576,000
	Fuel Systems and Storage	-	-	2,385,000	2,385,000
	Electrical Works	-	-	4,466,000	4,466,000
Project Design/Construction Cost -Total		**-**	**6,062,000**	**17,501,500**	**23,563,500**
	Distribution System	2,500	129,500	656,500	788,500
Distribution System Cost -Total		**2,500**	**129,500**	**656,500**	**788,500**
	Telecommunication Setup	-	-	75,000	75,000
Telecommunication Setup Cost -Total		**-**	**-**	**75,000**	**75,000**
	Commissioning Activities	-	-	330,000	330,000
	Documentation	-	-	100,000	100,000
Commissioning Cost -Total		**-**	**-**	**430,000**	**430,000**
	Subtotal	**$ 484,500**	**$ 6,332,000**	**$ 18,930,000**	**$ 25,746,500**
	Contingency (10%)	$ 48,450	$ 633,200	$ 1,893,000	2,574,650
	Subtotal	**$ 532,950**	**$ 6,965,200**	**$ 20,823,000**	**$ 28,321,150**
	Overhead & AFUDC (11%)	$ 58,625	$ 766,172	$ 2,290,530	3,115,327
	Total (rounded to nearest 1000)	**$ 592,000**	**$ 7,731,000**	**$ 23,114,000**	**$ 31,436,000**

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 such time as the new plant is operational.

The adaptation of the Kugluktuk Plant to accommodate a potential renewable energy sources is in keeping with the Government of Nunavut's Energy Strategy, Ikummatiit. The strategic objectives that are important to this project include:

- Improve the security of the energy system by reducing reliance on imported fossil fuels, and diversifying energy supply to include clean alternative and domestic energy sources.

- Manage the cost of energy-based services such as transportation, heating, hot water, lighting, and cooking, by reducing the cost of providing energy and improving efficiency of its use.

- Reduce the impact on the environment by reducing energy-related emissions which contribute to pollution and climate change.

- Provide business and employment opportunities as the Territory increases energy efficiency and uses renewable and domestic energy sources.

5.0 Impact of the Project on Ratepayers

QEC conducted an analysis of the impact of the Project on ratepayers in the community of Kugluktuk. 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 2020/21 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 for communities needing new power plants would be high. However, 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).

As discussed in Section 4.0, the implementation of the Project is expected to improve the efficiency of the new facility. In order to reflect this, the rate impact analysis incorporates estimated fuel cost savings based on a 10% reduction in fuel consumption.

Table 7 summarizes the calculation of the estimated incremental revenue requirement increase due to the project of $2.626 million and average rate increase. The estimated rate increase under community based rates is 48.01 cents/kWh, which is very high. However, under a territorial rate design scenario the estimated average rate increase is 1.42 cents/kWh.

Table 7 – Kugluktuk New Power Plant Estimated Rate Impact

Project Characteristics	
Capital Cost ($ 000)	31,436
Amortization Period (year)	40
GRA Approved Return on Ratebase	6.45%
Revenue Requirement Impacts	
Amortization Expense ($ 000)	786
Return on Ratebase ($ 000)	2,026
sub-total: Revenue Requirement Increase	**2,812**
less: Operational Savings	
Estimated Annual Fuel Savings (litres)	164
GRA Approved Fuel Price ($/L)	1.1328
Estimated Savings ($ 000)	**186**
Total Revenue Requirement Impact ($ 000)	**2,626**
Kugluktuk 2021/22 Forecast Sales (MWh)	*5,470*
Average Community-Based Rate Increase (c/kWh)	48.01
Territorial 2021/22 Forecast Sales	*185,421*
Average Territorial Rate Increase (c/kWh)	1.42

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.

6.0 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**

  As the Kugluktuk 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 switch gear is not Arc resistant and cannot be modified, which increases fire risk of the facility. Further, the water treatment plant adjacent to the powerhouse adds to the powerhouse snow loads. It is not known if the powerhouse was designed for the additional snow drift load.

- **Environmental Requirements**

  The existing fuel supply line 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.

- **Hamlet Council Concerns**

  QEC held discussions with the Hamlet regarding the replacement of the plant and a suitable location for the new facility. The Hamlet expressed its support for the new plant at a new location. In supporting a new location for the plant, the Hamlet outlined the following rationale:
  - Firstly and foremost, the safety and well-being of the community. With the existing power plant site, the fuel line from the fuel tanks to power plant runs beneath a significant portion of the community. Concerns have been raised that any possible break in the fuel line may be detrimental to the health and safety of the community and its residents.
  - Secondly, the Hamlet is in process of developing a commercial enterprise area/zone and if the new power plant was to be located to this area, this would add value to this endeavor.

- Thirdly, the Hamlet is developing a new subdivision near the current site of the power plant. Building the new plant at a new location allows the Hamlet to be better prepared to serve the needs of the growing community in the foreseeable future.

In addition, 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 long run.

7.0 Project Timeline

QEC anticipates construction of the project to commence in the second quarter of 2018/19. Initial efforts will focus on geotechnical and Phase I environmental assessments.

The new power plant design will be completed in the third quarter of 2018/19, with specifications and tenders allowed for ordering of materials and construction contracts. Site works will begin during the summer of 2019 and materials to be delivered during sealift 2019. Construction would begin during the summer of 2019 and be completed in the third quarter of 2020/21.

The Gantt Chart below illustrates the proposed project schedule for reference purposes.

	Proposed Kugluktuk Project Schedule											
	2018/19				2019/20				2020/21			
	1st QTR	2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR	3rd QTR	4th QTR
Geothech and Envir Assessments												
Power Plant Design												
Specify Major Equipment/Tendering												
Procurement/Shipping												
Construction												
Testing/Commissioning												

8.0 Conclusions and Recommendations

QEC recommends the development and construction of a new plant at a new location. The current plant has numerous issues including the age of the existing facility, safety concerns, and environmental requirements. QEC is recommending that a new power plant be constructed using the solutions proposed in Option 2. The existing plant will remain in operation while the new facility is constructed and then be decommissioned.

Other options examined by QEC are not technically feasible.

In summary, Option 2, the development and construction of a new plant is the preferred option to address the deficiencies of the current plant and maintain safe, reliable electricity service to the community.