ᓄᓇᕗᒻᒥ ᐆᒻᒪᖅᑯᑏᑦ ᐊᑭᖏᓐᓂᒃ ᕿᒥᖅᑯᔩᑦ ᑲᑎᒪᔨᖏᑦ
UTILITY RATES REVIEW COUNCIL OF NUNAVUT
IGLUIN AULATJUTITIGUN AKITUTILAANGINNUT KATIMAYIIT NUNAVUNMI
CONSEIL D'EXAMEN DES TAUX DES ENTREPRISES DE SERVICES DU NUNAVUT

November 30, 2017

Hon. Jeannie Ehaloak
Minister Responsible for
the Qulliq Energy Corporation
Legislative Assembly of Nunavut
P. O. Box 2410
Iqaluit, NU X0A 0H0

Dear Minister Ehaloak,

RE: The Major Project Permit Application Respecting the Kugluktuk Plant Replacement, Report 2017-04.

By letter dated July 13, 2017, the Qulliq Energy Corp (QEC) applied to the responsible Minister for approval of a major capital project permit for a new power plant in the community of Kugluktuk. By letter dated the same day, the responsible Minister requested advice from the Utility Rates Review Council of Nunavut with respect to QEC's Application.

In response to the Application and the Minister's request, please find attached the Utility Rates Review Council's Major Project Permit Application respecting Kugluktuk Plant Replacement Report 2017-04.

Yours truly,

Anthony Rose
Chair
Utility Rates Review Council of Nunavut

CC: Cc: Premier Paul Quassa, Minister responsible for URRC
Kathy Okpik, Deputy Minister EIA
Bruno Pereira, President Qulliq Energy Corporation
Laurie-Anne White, Executive Director URRC

P.O. Box 1000, Stn 200, Iqaluit, NU, X0A 0H0
Tel: 867-975-6054 URRC@gov.nu.ca

Report to the Responsible Minister for the Qulliq Energy Corporation On:

The Major Capital Project Permit Application Respecting Construction of a New Power Plant in Kugluktuk

Report 2017-04

November 29, 2017

THE UTILITY RATES REVIEW COUNCIL

MEMBERS

Anthony Rose	Chair
Graham Lock	Vice Chair
Jimmy Akavak	Member
Robbin Sinclaire	Member
Nadia Ciccone	Member

SUPPORT

Laurie-Anne White	Executive Director
Raj Retnanandan	Consultant

LIST OF ABBREVIATIONS

AMI	Automated Metering Infrastructure
EV	Electric Vehicles
GRA	General Rate Application
IC	Installed Capacity
IFC	Installed Firm Capacity
MW	Megawatts
NDV	Net Demand Variability
PSA	Public Sector Accounting
QEC	Qulliq Energy Corporation
RFC	Required Firm Capacity
URRC	Utilities Rates Review Council

TABLE OF CONTENTS

Contents

1.0 BACKGROUND

1. Qulliq Energy Corporation (QEC), as a designated utility, is required pursuant to Section 18.1 of the Qulliq Energy Corporation Act (QEC Act), to seek approval from the responsible Minister prior to undertaking a major capital project. In this regard, Section 18.1 of the QEC Act provides as follows:

> Definition
> (1) In this section, "major capital project" means a capital project that has a total cost that exceeds $5,000,000.
>
> Major capital project
> (2) The Corporation shall not undertake, nor permit any of its subsidiaries to undertake, a major capital project unless it applies in advance to the Minister for an order giving permission for the project.
>
> Minister may seek advice
> (3) Before responding to an application for permission made under subsection (2), the Minister may seek the advice of the Utility Rates Review Council established under the *Utility Rates Review Council Act*.
>
> Corporation to provide information
> (4) The Corporation shall provide the Minister and the Utility Rates Review Council with any information necessary for the Minister to decide whether permission should be granted.
>
> What Minister may do
> (5) The Minister may
> (a) grant permission for undertaking the major capital project, with or without conditions; or
> (b) refuse permission.
>
> Order
> (6) Permission granted by the Minister under paragraph (5)(a) shall be in the form of an order.

2. Section 7e) of the URRC Act states, among others, the purposes of the Review Council are to advise the Minister responsible for the Qulliq Energy Corporation concerning applications for permission for major capital projects under section 18.1 of the *Qulliq Energy Corporation Act*.

3. On July 13, 2017, QEC applied to the responsible Minister for approval of a major capital project permit for a new power plant in the community of Kugluktuk. On the same date, the responsible Minister requested advice from the URRC with respect to QEC's Application. The URRC consideration of the matter is set out in this Report.

2.0 PARTICULARS OF THE APPLICATION

4. QEC proposes the construction of a new power plant in the community of Kugluktuk to replace the existing plant, at an estimated cost of $31.4 million. 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. QEC currently serves about 600 customers (residential, commercial and street lighting) and the number of customers is projected to increase to about 720 by 2031/32. The average rate of growth in load is projected at about 1% per year.

5. QEC indicates the age of the existing plant is approaching 50 years and has exceeded its design life of 40 years. QEC states, the current plant has a number of technical and engineering deficiencies, including:

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

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

    c. 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.

    d. 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.

6. QEC states, 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.

7. QEC presented the URRC with two project options, for purposes of the project permit application.

8. Option 1 – Major Plant Upgrade

This option includes upgrading and replacement of major components and systems within the existing facility, including the gensets. QEC states this option is not 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 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 the above considerations, QEC concluded Option 1 is not a viable option.

9. Option 2 – Construct a New Plant at a New Location

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

QEC states 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.

10. QEC states, 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 in the future.

11. QEC states, the proposed generating capacity of the new plant is approximately 2.6 MW and a power plant of this capacity will meet Kugluktuk's peak load projections for 40 years following the project's completion.

3.0 PROCESS

3.1 MAJOR OR MINOR APPLICATION

12. Under the URRC Act, it is directed that at the sole discretion of the URRC, the URRC shall determine whether an Application is either Minor or Major for purposes of determining the time required for processing of the Application; a minor Application provides for a time limit of 90 days for the URRC to report to the responsible Minister while a major application provides a time limit of 150 days. In view of the significant level of investment proposed in the project permit application, and considering the need for at least two rounds of information requests and responses, the URRC determined to treat the subject Application as major Application.

3.2 PUBLIC CONSULTATION PROCESS

13. The URRC caused notice of the Application to be published in newspapers having general circulation in Nunavut for the month of August 2017. The Mayor of Kugluktuk was notified of the Application by letter dated August 29, 2017.

14. The URRC also provided an opportunity for the public to make written comments respecting the major capital project permit application by the deadline of October 18, 2017. No written submissions or comments were received from the public or any other party with respect to the Application by that date.

15. QEC responded to two rounds of information requests from the URRC on September 5, 2017 and October 6, 2017.

4.0 EXAMINATION OF THE APPLICATION

4.1 NEED FOR THE PROJECT

16. The URRC notes the existing plant at Kugluktuk needs replacement due to aging equipment, safety concerns and the need to comply with environmental standards. The URRC also notes QEC's view that use of the existing site for construction of the new power plant may not be technically or economically feasible for the following reasons:

- Rehabilitation of a fifty year old asset will involve more complications, will cost far more than a new plant and will result in far less than the 40 to 50 years reliable life expected of a new structure.
- A rehabilitation study scope definition/tendering /study completion /interpretation and execution will involve much more time than a rebuild at a new location. Also, potential saving of $3 to $5 million can be at risk if the new Kugluktuk Plant is not built in a reasonable time to allow decommissioning of the existing 1.5 km single walled fuel supply line.
- Due to lack of space, the existing plant site cannot accommodate essential features, e.g. there is no room for arc-resistant switchgear, it cannot accommodate fire suppression system, and it cannot accommodate footprints of higher rated diesel gensets
- A large-scale rehabilitation of a working power plant would require substantial back up power costs during construction that could have safety and reliability implications for the community and operating personnel. [URRC QEC 5d) i)]

17. In view of the foregoing the URRC is satisfied that replacement of the old plant with a new plant at the existing site would not be technically and economically feasible. Accordingly, the URRC is prepared to recommend approval of a project permit for construction of a new plant at a new site in Kugluktuk.

18. Notwithstanding the above, the URRC is concerned that alternatives to the recommended Option 2 project concept, have not been examined or evaluated sufficiently by QEC from the point of view of meeting QEC's strategic objectives for the project to achieve the lowest possible lifetime costs. Given that the intended plant replacement would serve the community for over 40 years, the URRC considers that alternatives to the proposed project concept should be examined with strategic objectives in mind including minimization of lifetime costs.

4.2 ALTERNATIVE PROJECT DESIGN CONCEPTS

19. QEC states the strategic objectives that are important to this project include the following:
    - 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 Nunavut increases energy efficiency and uses renewable and domestic energy sources.

20. With respect to the above objectives, QEC states renewable generation components with electricity storage can be added to the proposed diesel plant in the future; further, intermittent renewable energy sources installed in the future will not affect the proposed diesel plant rating and consequently the investment required to address the current deficiencies of the diesel generation station in the community.

21. QEC indicates that it operates in the most challenging utility environment in North America; QEC's plants must provide firm, reliable capacity under the most adverse winter weather conditions observed on the continent. QEC states it has no hydro-electricity and no transmission or distribution interconnections between communities; winter storm conditions often make communities inaccessible, even by aircraft, which means the potential impact of a winter electricity generation failure on community reliability and safety is extremely high. QEC states it is not aware of any other utility operating in similarly isolated, non-interconnected settings that relies on intermittent renewable resources to satisfy their firm capacity planning requirements.

22. While acknowledging and recognizing the unique conditions that would have been considered in establishing the required firm capacity requirements for diesel generation in the Nunavut communities, the URRC is not convinced that intermittent renewable energy sources which might be installed in the future will not affect the proposed diesel plant rating and consequently the investment required to address the current deficiencies of the diesel generation station in the community.

23. The URRC is concerned that the proposed approach to planning the addition of diesel capacity in Kugluktuk, without regard to the changing planning environment and technology that is becoming available for renewable supply and storage, may not result in appropriate sizing of diesel units designed to serve customers over the next 40 years, nor, would it enable the cost effective integration of renewable sources and storage over time; this, in turn, could result in higher lifetime costs of the project.

24. The URRC expects that system planning of the community grid would need to change with increasing levels of Net Demand Variability[1](NDV) and possible load reductions due to addition of intermittent renewable sources of supply and distributed generation under the net metering program (on a limited scale now with potential for expansion);

[1] Defined as the demand, net of supply from variable (or intermittent) resources.

the system may also, in due course, be required to accommodate charging stations for Electric Vehicles (EV) which could require two-way flows of electricity for battery charging as well as serve as distributed storage resources; the availability of diverse types of utility scale storage technologies could potentially provide both reliability and ancillary services such as load balancing.

25. While the rate at which the above changes may unfold is uncertain at this time, the direction of change is more certain. This means, greater share of renewable supply, increasing NDV, increasing share of EVs in the transportation sector, use of distributed and centralized storage and other smart grid integrative technologies for system optimization including smart inverters and Automated Metering Infrastructure (AMI); this also means greater planning uncertainty and the requirement to adopt modeling techniques to predict and manage a changing system to achieve efficient outcomes.

26. In addition to the effective integration of renewables discussed above, the URRC is also not persuaded that the Option 2 Installed Capacity (IC) has been optimized under the existing planning criteria. In this regard, the following table sets out the IC, the Installed Firm Capacity (IFC) and the Required Firm Capacity (RFC) proposed for Option 2:

	Required Firm Capacity and Surplus-New Plant (Option 2)		
		2021/22	2031/32
		kW	kW
1	G1	550	550
2	G2	550	550
3	G3	750	750
4	G4	750	750
5	Installed Capacity [sum L1 to L4]	2600	2600
6	Installed Firm Capacity[L5-L4 (largest Unit)]	1850	1850
7	Peak Load Table 3 of App; Table, URRC QEC2f)]	1082	1249
8	Required Firm Capacity (RFC) [L7*1.1]	1190	1374
9	Surplus Capacity	660	476
10	Percent Surplus	55%	35%

27. The above table suggests the percent of surplus capacity in relation to required firm capacity would continue to be about 35% by year 2031/32. QEC stated the proposed 2600 MW installed capacity is required because:

> Normally engines operate at 80-90 % to get the highest fuel consumption efficiency and life cycle. In the event the largest unit is out of service or maintenance or another reason, any two of the other engines (550kW + 750kW) can support the community load at the peak time. This range will allow more engine builders (with different frame size with comparable rating) to participate in the bidding process. [URRC QEC 2h)]

28. QEC states it is prudent engineering judgement to consider additional factors including the following in sizing the generating units:
    - Availability of generating units of different sizes in the marketplace;
    - Sizes and compatibility with other generation units in the Corporation's fleet to standardize maintenance; and
    - Operational considerations including sizing of units so that they can be operated at optimum efficiency as often as possible.

29. QEC indicates, the range of generator sizing is intended to allow broader competition among bidders (with different frame sizes and rating of gensets). The selection of the winning bid may result in different installed firm capacity but will still be sufficient to satisfy the Corporation's RFC. [URRC QEC 5c)]

30. While there may be some merit in QEC's reasons as noted above for proposing an IFC materially higher than the RFC, the URRC considers that these reasons would likely have existed when the RFC criteria were established, and the RFC would have been set at a level so as to reasonably balance reliability versus cost while allowing for growth.

31. The URRC considers the sizing of units performing different roles such as base load, peaking, spinning reserves etc. need to be optimized under a forward looking planning environment that contemplates cost effective integration of renewables and storage. The URRC has not seen any evidence from QEC that the configuration of units was appropriately calibrated to minimize overall costs of the plant including capital and operating costs.

32. With regard to the projected costs under the proposed Option 2, the URRC notes from URRC QEC 3b and c), that the cost data for the Kugluktuk plant (estimated to cost $31.4 million for a combined capacity of 2600 MW) was based on the actual bid for a comparable diesel plant at Cape Dorset. URRC QEC 6, Table 1 indicates the current estimated cost for the Cape Dorset plant to be $28.9 million.

33. The URRC notes that in URRC Report 2011-03 the Council recommended approval of a major project permit for construction of a power plant at Cape Dorset at a cost of $12.6 million with a combined capacity of 2800 kW. The URRC notes the cost increase from the project permit approval for the Cape Dorset plant to the corresponding actual bid cost, which, in turn, is reflected in the projected cost structure of the Kugluktuk plant, is very significant. The URRC has not seen any evidence that would support the significant increase in cost structure for new power plants as discussed above.

34. On the issue of costs, the URRC notes QEC has not taken into consideration any funding from the Federal Government under the Canada Arctic Energy Fund ($175 million) that may be available to offset the cost of replacing older plants and for integration of renewable sources of supply.

35. In view of all of the above, the URRC recommends, QEC be required to carry out a prefeasibility assessment by an independent consulting firm, of one or more alternative design options for the replacement of the plant in Kugluktuk that would enable effective

integration of renewable supply while ensuring reliability at the lowest lifetime cost of supply. The study must include consideration of the following, among others:

- Strategies for optimizing supply costs in Kugluktuk while reducing dependence on fossil fuel generation and taking into consideration a changing environment with increasing share of renewable intermittent supply, increasing NDV, increasing share of EVs in the transportation sector, use of distributed and centralized storage and other smart grid integrative technologies for system optimization including smart inverters and AMI;
- Optimum configuration and sizing of the diesel units for reliability and cost considering the overall nature and diversity of system components as well as the duties performed by the diesel units;
- Approaches to optimizing construction costs in order to minimize overall costs and maximize economic efficiency while recognizing the local conditions for engagement and mobilization of contractors;
- Assess the amount of funding if any that may be available from the Canada Arctic Energy Fund to offset the Kugluktuk plant replacement costs.

5.0 URRC RECOMMENDATION

36. Having considered the foregoing matters, the URRC recommends as follows:

- That the major capital project permit approval for construction of the new power plant in Kugluktuk be granted, with the condition that QEC complete the additional due diligence steps as set out in paragraph 35 prior to commencement of construction and if a change in project concept and scope is considered appropriate, to present the proposed concept and costs to the URRC for information through the responsible Minister
- That the prudence of the actual cost of construction of the project be examined at the time the project is proposed to be included in rate base.

37. Nothing in this Report shall prejudice the URRC in its consideration of any other matters respecting QEC.

ON BEHALF OF THE

UTILITY RATES REVIEW COUNCIL OF NUNAVUT

DATED: November 29, 2017

Anthony Rose

Chair