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Re: *Reliability and Resource Adequacy Study Review* – Combustion Turbine Feasibility Study

At the technical conference on the *Reliability and Resource Adequacy Study Review* proceeding ("*RRA Study Review*") on May 1 and 2, 2023, Newfoundland and Labrador Hydro ("Hydro") provided an overview of all of the reports, studies, and analyses underway or planned for fulsome consideration of the next supply resource for the province. Following the technical conference, in correspondence dated May 5, 2023, the Board of Commissioners of Public Utilities ("Board") directed Hydro to file a number of updates regarding the studies and analyses ongoing within the *RRA Study Review*. In particular:

1) Hydro shall file by May 19, 2023 a comprehensive list of all reports, studies and analyses it has currently underway or planned with respect to the reliability of the LIL, potential alternative generation resources, the load forecast, and any other issues raised in the 2022 RRAS Update and the May 1-2, 2023 technical conference. This list shall include a description of the scope of each study, report and analysis, the consultant or group undertaking the work and the schedule for completion.

2) Hydro shall file with the Board a copy of each report, study or analysis listed in response to number 1 above as it is completed.[1]

On May 25, 2023, Hydro provided the Board with a list of all reports, studies, and analyses currently underway or planned to support future filings in relation to the *RRA Study Review*.[2] Enclosed with this letter is an overview of the Combustion Turbine Study. The overview references an attachment which is the study ("Concept Design Study") performed by Hatch Ltd. The Concept Design Report contains

[1] "Newfoundland and Labrador Hydro - Reliability and Resource Adequacy Study Review - To Parties - Further Process," Board of Commissioners of Public Utilities, May 5, 2023, p. 2.
[2] "*Reliability and Resource Adequacy Study Review* – Listing of Planned Reports, Studies, and Analyses," Newfoundland and Labrador Hydro, May 25, 2023, Table 1 and att. 1.

substantial third-party commercially sensitive information; Hatch Ltd. is completing the redaction of this information and the parties will be provided the redacted version in the coming days.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

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Combustion Turbine Feasibility Study

Overview

September 29, 2023

A report to the Board of Commissioners of Public Utilities

newfoundland labrador hydro

Preamble

The Combustion Turbine Feasibility Study is one of many studies currently underway as part of the ongoing resource planning process within the *Reliability and Resource Adequacy Study Review* proceeding ("*RRA Study Review*").

The *RRA Study Review* has been appropriately evolving since the "Reliability and Resource Adequacy Study" was filed in 2018 ("2018 Filing"),[1] which addressed Newfoundland and Labrador Hydro's ("Hydro") long-term approach to providing continued reliable service for customers. Ongoing resource planning processes provide an in-depth analysis of system requirements over the next ten years. They consider which assets should be maintained and if new assets are required to ensure Hydro has the right energy mix to reliably meet these demands today and into the future.

Net-zero goals and the resulting decarbonization of our province and economy have resulted in a higher load forecast than was initially contemplated in 2018 when the primary consideration was new asset integration; as such, there are now two significant issues facing Hydro:

1) New asset integration and reliability impacts; and

2) Load growth requirements associated with decarbonization.

As all utilities do, Hydro examines many factors to determine possible outcomes and associated generation needs required for a series of load forecasting scenarios. In the "Reliability and Resource Adequacy Study - 2022 Update," ("2022 Update")[2] Hydro determined that, in line with good utility practice, there is a need for reliable backup generation to address the uncertainty of the Labrador-Island Link ("LIL") reliability. Hydro is in the process of developing an expansion plan that considers many different generation options, including combustion turbines, hydroelectric generation, and other potential resource options. As a result, Hydro engaged an external consultant to study the feasibility of installing a combustion turbine as a source of fuel-fired backup generation on the Avalon Peninsula. In filing this study, and additional studies as committed,[3] Hydro is working to ensure appropriate scrutiny of its recommendations and decisions, while striving to honour the lessons from the past and make

[1] "Reliability and Resource Adequacy Study," Newfoundland and Labrador Hydro, rev. September 9, 2019 (originally filed November 16, 2018).
[2] "Reliability and Resource Adequacy Study – 2022 Update," Newfoundland and Labrador Hydro, October 3, 2022.
[3] "Reliability and Resource Adequacy Study Review – Listing of Planned Reports, Studies, and Analyses," Newfoundland and Labrador Hydro, May 25, 2023.

recommendations that are in the long-term best interest of all electricity customers in Newfoundland and Labrador.

As the *RRA Study Review* has evolved since 2018, so too has the industry and environment in which utilities operate. The dramatic societal shift towards cleaner, sustainable energy sources is having major impacts on electricity grids and utility planning for the future. Across the country, utilities have to balance unprecedented growth at unprecedented speed as a result of decarbonization and electrification of the grid.

In August 2023, the federal government released the draft Clean Electricity Regulations ("Draft Regulations") outlining how utilities across the country should prepare for a decarbonized electricity grid by 2035. Hydro is partaking in the consultation period to ensure that all recommended future resource options are within the bounds of the Draft Regulations. As noted by Electricity Canada upon release of the Draft Regulations:

> *Canada's electricity providers want this as well. Now that the draft Clean Electricity Regulations (CERs) have finally been released, electricity providers and government can continue the conversation about how we can build the electricity grid to meet the needs of Canadians in 2035 and beyond.*[4]

Hydro has been communicating and working with its stakeholders on the need to address the uncertainty of LIL reliability and the associated impact on overall system reliability, as well as the need to respond to the evolving electricity system needs arising from electrification. These dramatic shifts mean there is an urgency to build new supply arising from a rapidly changing load forecast, which is built on rapidly changing public policy. Hydro understands the risk and the urgency; however, Hydro strongly contends that the appropriate work must be done to gather all evidence necessary to make well-informed and prudent decisions that benefit all electricity customers of this province.

The Combustion Turbine Feasibility Study is one of many studies Hydro is undertaking to ensure it has the critical data and analyses required to make well-informed, prudent decisions. Hydro and its stakeholders must examine and thoroughly consider all viable options to address these needs. Hydro

[4] "Statement by Electricity Canada on the draft Clean Electricity Regulations," Electricity Canada, August 10, 2023. <https://www.electricity.ca/news/statement-by-electricity-canada-on-the-draft-clean-electricity-regulations/>.

reiterates that the feasibility analysis to arrive at the first specific potential solution in a series of solutions is not yet done. Many solutions will be required over the coming decade—and longer. As previously communicated, Hydro is confident the required analysis and associated reporting on all options to the Board of Commissioners of Public Utilities ("Board") and parties will be such that, a recommendation for the first solution may be made in 2024. Hydro has been and will continue to work as expeditiously and prudently as possible utilizing all internal and external resources available, at the pace that engineering analysis requires, ensuring that any application for new generation is the correct one that can be justified after a review of all viable alternatives.

Contents

List of Attachments

1.0 Context within the RRA Study Review

Since the 2018 Filing, Hydro has filed regular updates to the Reliability and Resource Adequacy Study, as well as numerous technical notes, additional studies, and third-party reports. The *RRA Study Review* has included five rounds of requests for information and four technical conferences, providing for substantial discourse and exchange of information between Hydro, the Board, and the parties. Further, there are additional studies and reporting underway and upcoming throughout the next year.

The regulatory record for this proceeding is robust, with good reason. The provincial electrical grid is in the midst of unprecedented change—it is evolving from an isolated to an interconnected system, some of the assets the province has historically relied on most are aging and nearing retirement, there are significant new assets integrated into the electrical system and being proven reliable, and the province is facing a material increase in load driven by global transitions from fossil fuels to renewable energy sources.

In the coming years and decades, Hydro will have to make significant investments to continue to meet its legislative obligation of safely and reliably providing electrical service in an environmentally responsible manner to Newfoundlanders and Labradorians.[5] As such, through the *RRA Study Review*, Hydro is modelling its system expansion in consideration of various forecast scenarios and within the context of continuously evolving energy policy. The numerous studies that Hydro has completed and planned are all necessary to validate the information that Hydro feeds into its models that produce critical information on which timely, prudent decisions can be made.

While the enclosed report provides valuable, necessary information, it cannot and should not be considered independently of the rest of the studies and analyses ongoing through the *RRA Study Review*. Rather, it is an input that must be considered along with other studies completed and ongoing, to inform Hydro's broader system resource planning process now and into the future.

2.0 Background

In its May 25, 2023 correspondence to the Board, Hydro advised that it had engaged Hatch Ltd. ("Hatch") to complete a feasibility study to examine the feasibility of installing a combustion turbine as a

[5] *Electrical Power Control Act*, *1994*, SNL 1994, c E-5.1, s 3(b)(iii).

source of fuel-fired backup generation on the Avalon Peninsula.[6] The review considered the use of a combustion turbine in the instance where it might be required to provide backup generation for six consecutive weeks, supporting reliable delivery of electricity, primarily during peak hours. As part of the 2022 Update, this situation was modelled as a worst-case scenario based on a catastrophic level failure of the LIL. The entirety of Hatch's final report is provided as Attachment 1 and is referenced herein as the "Concept Design Report."

The information contained within the Concept Design Report provides Hydro with the necessary information to

- Assess the viability of combustion turbine options;
- Inform any decision to proceed to further engineering of potential solutions; and
- Provide updated costs for system expansion modelling purposes.

The scope for the Concept Design Report required Hatch to contemplate new combustion turbine(s) that would be installed for **emergency backup generation** and **load peaking** as required. Hydro required the combustion turbine to include synchronous condensing capability, the capability of fast start (generation up to rated load within ten minutes), and Best Available Control Technology ("BACT") for emission control. As Hydro remains committed to supporting the growth of renewable energy supply, the review also included the criteria that any technology considered must have fuel flexibility that would allow Hydro to maintain compliance with Canada's Clean Electricity Regulations. Hatch reviewed three size scenarios (150 MW, 300 MW, and 450 MW) and only the options that were capable of burning diesel, natural gas, biofuel, and hydrogen blends were considered.

In its assessment, Hatch was required to consider plant size, possible site locations in the Northeast Avalon area, land purchase requirements, fuel supply, water supply, engine selection, electrical interconnection, and environmental impact. All of this information is necessary to determine the parameters of a technically viable combustion turbine option and ensure the quality of inputs into the resource planning model.

[6] "*Reliability and Resource Adequacy Study Review* – Listing of Planned Reports, Studies, and Analyses," Newfoundland and Labrador Hydro, May 25, 2023.

It is important to note that the Concept Design Report does not, and was not intended to, make recommendations as to whether a combustion turbine is an appropriate solution to meet the needs of the electrical system. This determination will be made upon consideration of all matters being contemplated within the *RRA Study Review*. Rather, the Concept Design Report provides valuable information that will serve as input and improve the quality of Hydro's resource planning model. It is a prudent, necessary step in the evaluation of combustion turbines.

The purpose of this overview is to provide a high-level summary of Hatch's findings and recommendations as well as Hydro's assessment of those findings and planned next steps.

3.0 Summary of Hatch's Findings and Recommendations

3.1 Site Location

The Concept Design Report examines three plant sizes—150 MW, 300 MW, and 450 MW. These sizes were selected to examine a broad range of combustion turbine supply options. The 150 MW plant size allowed for a near-direct comparison of another resource option—Unit 8 at the Bay d'Espoir Hydroelectric Generating Facility, with a 154 MW capacity. The 450 MW plant size was selected to reflect an approximate comparison of the planning reserve margin requirement of 480 MW by 2032, as reported in the 2022 Update, and the 300 MW plant size was chosen as a middle-ground option between the other plant sizes. For each size, Hatch investigated six potential sites located on the Northeast Avalon: Holyrood, Paddy's Pond, Sugarloaf Pond, Soldiers Pond, Bremigens Pond, and Petty Harbour Long Pond. The location on the Northeast Avalon is preferred due to the appreciable transmission constraints that limit power flow to the Avalon Peninsula. The requirement for future transmission reinforcements would be reduced if generation supply, or a combustion turbine, were to be located closer to the Northeast Avalon as the main load center. Each of the six potential sites was examined for the following criteria:

- Technical and operational, including land suitability and space, switchyard requirements, transmission constraint considerations, proximity to nearest transmission station, fuel type, fuel storage, fuel supply and delivery, and technical availability of water.
- Environmental and social, including protected areas, rare flora and fauna, flood zone watershed, wetlands potentially affected, quality of life (such as noise and aesthetics), recreational conflicts, and archaeological potential.

- Regulatory and legal considerations, including water use and water rights, land zoning and jurisdiction, as well as permitting, delays, and other obstacles.

A site characterization and weighting workshop was held between Hatch and Hydro where each criterion was examined and a weighting was assigned to each item. **After performing a site assessment, Hatch determined Holyrood to be the top site, based on the previously noted technical criteria.**

3.2 Combustion Turbine Technology Review and Selection

As a baseline, Hydro required Hatch to consider a simple-cycle, liquid-fueled, aero-derivative combustion turbine package. Although overall plant capacities of 150 MW, 300 MW, and 450 MW were considered, Hydro specified a minimum engine capacity of approximately 50 MW (rating). Hydro also required the plant to include synchronous condensing capability, the capability of fast start (generation up to rated load within ten minutes), enclosure in a winterized building, and for the plant to be designed for BACT for emission control. Additionally, Hatch was also expected to explore other combustion turbine manufacturer options and ratings to determine the best economical value, procurement lead times, and the ability to operate or be converted to operate on biofuel and/or gas (e.g., natural gas, hydrogen) in the future.

For its study, Hatch contacted major original equipment manufacturers ("OEM") or specific combustion turbine technologies that met the project requirements. The OEMs were asked to provide cost estimates, equipment general arrangement drawings, performance data on natural gas and diesel, biofuel and hydrogen fuel capability and experience, and estimated delivery timeline.

3.3 Fuel Considerations

As a combustion turbine would have to be fueled by No. 2 diesel fuel until an alternate fuel source proved viable, specifically regarding availability and reliability, the evaluation of No. 2 diesel fuel supply and logistics was required as part of Hatch's scope. Fuel requirements were predicted to range from three barges every ten days for a 150 MW facility to six barges every ten days for a 450 MW facility.

Hatch determined that No. 2 diesel fuel delivery for the 150 MW scenario is achievable, based on current market conditions and in consideration of the existing Holyrood Combustion Turbine. It would be challenging by truck; however, delivery by barge would be possible for a site that is close to a shoreline.

Fuel storage is required to accommodate the variable fuel consumption of the emergency plant. Maintaining sufficient fuel for ten days of operation with additional daily fuel deliveries is recommended to supply the Island's needs during a potential six-week shortfall situation on the Island,[7] as is setting up contracts with multiple fuel suppliers to ensure demand can be met. Due to its existing dock and road access, the logistics around securing and storing fuel contribute to Holyrood being the preferred site. Hatch did not evaluate or include costs for any wharf/jetty upgrades necessary to accept diesel fuel delivery at Holyrood.

Hatch was also asked to discuss the feasibility of fuel sources aside from No. 2 diesel fuel, estimated costs, and infrastructure requirements. **Hatch considered natural gas, liquid hydrogen, hydrogen, biofuel, and ethanol. At present, there is no existing supply chain and/or infrastructure for any of these fuel alternatives within Newfoundland and Labrador that would meet Hydro's needs.** However, as the world transitions away from fossil-fueled sources of power, transportation options for alternate fuel sources as well as the potential for local production may make supply more economically and logistically feasible in the future. **Hydro is conducting a fuel market study[8] that will take a broader and longer-term look at the availability of fuels, both the risk of decreasing availability of No 2 diesel fuel and the potentially increasing availability of renewable fuels as a source of supply.**

3.4 Plant Size

Hatch recommended that capacity be limited to 150 MW, due to the ability of the plant to source the required fuel. Supplying diesel to operate a combustion turbine of more than 150 MW would provide significant challenges to sourcing and maintaining deliveries. Hatch does not recommend the construction of a 300 MW or 450 MW plant at this time given the limited sources of fuel and the requirement for a large on-site fuel storage that may or may not be used in the future.[9]

Hatch's position is that it is a better alternative to build a 150 MW emergency backup plant for the initial phase and consider other options for subsequent phases.

[7] Based on available information regarding supplier notice periods, Hydro is conducting a fuel market study, the outcome of which may enable Hydro to further discern its fuel storage requirements. The next Resource Adequacy Plan will also include an update and recommendations for the LIL six-week shortfall analysis, which will help refine fuel storage requirements.
[8] As per the "Reliability and Resource Adequacy Study Review – Listing of Planned Reports, Studies, and Analyses," Newfoundland and Labrador Hydro, May 25, 2023, it is estimated that the Fuel Market Study will be filed in the first quarter of 2024.
[9] Currently, diesel is the main option available in Newfoundland and Labrador. Depending on the growth in the private sector, hydrogen and biofuels may become more locally available in the future.

Hatch recommended ten days of fuel storage for operation at full load with additional daily deliveries of fuel. A total volume of five million litres would be required for this amount of operation, consistent with storage requirements for the existing Holyrood combustion turbine. Fuel storage life is expected to be approximately 12 months with regular monitoring and treatment. If the fuel is not needed for emergency use in the event of a system contingency, or if it is not needed for system peaking, this amount of fuel would be considered "stale" and would require disposal and replacement.

3.5 Project Duration

Project schedules were completed for the 150 MW options as well as others, with the quickest delivery time at 18 months.[10] Time to project completion ranged from five to six years for the 150 MW option.[11] This schedule starts at the time of filing a build application with the Board and includes one year for regulatory review and approval. Any deviations from that timeline would impact the schedule accordingly. Further, these timelines reflect OEM delivery times as currently quoted. As jurisdictions electrify their systems, supply chain constraints could impact delivery times.

Hydro notes that the schedule to install the last combustion turbine in the 2014–2015 period was a unique circumstance. Current lead times from vendors have increased from historical experience, where previously there was an ability to expedite the procurement of a solution. Further, the solution in 2014–2015 was also chosen for expediency but was not necessarily the most appropriate long-term solution for the Island Interconnected System in consideration of operational requirements including fast-start and synchronous condenser capability.

3.6 Estimated Project Cost

Hydro has developed an AACE[12] Class 5 cost estimate based on vendor pricing collected by Hatch as well as material project costs such as taxes, financing, permit applications and environmental approvals, escalation, project development, legal costs, internal engineering costs, project management, and interest during construction.

[10] Based on vendor feedback to Hatch.
[11] In comparison, project schedules ranged from six to nine years for the 450 MW option.
[12] Association for the Advancement of Cost Engineering ("AACE").

Hydro estimates that the total cost for a 150 MW combustion turbine is approximately $516 million, as shown in Table 1. During the FEED[13] phase, an AACE Class 3 cost estimate will be developed.

Table 1: AACE Class 5 Cost Estimate ($000)

Project Cost	2024	2025	Beyond	Total
Material Supply	0.0	0.0	13,089.0	**13,089.0**
Labour	2,013.4	2,013.4	21,287.2	**25,314.0**
Consultant	654.9	782.3	2,335.3	**3,772.5**
Contract Work	0.0	0.0	306,206.0	**306,206.0**
Other Direct Costs	60.0	60.0	1,603.8	**1,723.8**
Interest and Escalation	217.4	494.8	77,640.5	**78,352.7**
Contingency	682.1	713.9	86,130.3	**87,526.3**
Total	**3,627.8**	**4064.4**	**508,292.1**	**515,984.3**

4.0 Hydro's Assessment of Hatch's Findings

Hydro accepts Hatch's recommendations related to the site location (Holyrood) and approximate plant size (150 MW). Hydro also accepts Hatch's estimated project schedule timeframe of approximately six years. Regarding the specific engine type, Hatch recommended an aero-derivative combustion turbine due to its fuel efficiency and fuel flexibility.[14]

5.0 Draft Clean Electricity Regulations

In August 2023, the Government of Canada released its Draft Regulations.[15] Although they are not yet finalized and therefore remain subject to change, the Draft Regulations are a key consideration in Hydro's evaluation of potential new sources of generation.

The Draft Regulations recognize that certain jurisdictions may be required to maintain fossil-fuel-utilizing facilities as part of their fleet for various reasons. In addition to including exemptions for isolated systems, the Draft Regulations include exceptions that may apply to Hydro's needs, and in particular to the 30 t/GWh[16] hour annual average performance standard. A unit (other than one combusting coal),

[13] Front-end engineering design ("FEED").
[14] Hydro will complete FEED activities to confirm whether an aero-derivative or industrial-type engine is best suited for Hydro's operating requirements
[15] "Draft Clean Energy Electricity Regulations," Environment and Climate Change Canada, August 10, 2023. <https://www.canada.ca/en/environment-climate-change/news/2023/08/draft-clean-electricity-regulations.html>.
[16] Tonnes per gigawatt hour ("t/GWh").

that operates up to 450 hours per year may emit no more than 150 kt[17] of CO_2 per year. Additionally, the Draft Regulations allow any unit to operate during emergency circumstances[18] without being required to meet the performance standard during that period if the unit has been provided an exemption to do so by the Minister of Environment.

Hydro aims to align itself with Environment and Climate Change Canada, the Clean Energy Regulations and the goal for a net zero electricity sector by 2035. Where possible, Hydro intends to minimize its environmental footprint by using less fossil fuel generation to meet demand. Based on the exemptions above, **Hydro believes that if a new 150 MW combustion turbine were to be selected as an alternative to meet the needs of the electrical system, it could be operated in a manner that is compliant with the current Draft Regulations and aligns with Hydro's mandate of providing reliable electricity in an environmentally responsible manner**.

Hydro continues to provide feedback to the federal government on its jurisdictional requirements and is monitoring the progress of these Draft Regulations, as well as all other provincial and federal energy policy developments. Hydro will seek confirmation of assumptions and interpretation of the Draft Regulations with Environment and Climate Change Canada.

6.0 Conclusion and Next Steps

Should Hydro's planning process identify a need for a combustion source of electricity supply, Hatch recommended a 150 MW combustion turbine to be located at the Holyrood site. Such a project is currently estimated at a preliminary cost of approximately $516 million and will take an estimated six years to complete. This information will serve as input as Hydro continues to advance analysis in support of its spring 2024 Resource Adequacy Plan. This plan will define the capacity requirements to reliably meet customer load and include a recommendation for new supply in the form of an expansion plan.

The recommendations of the spring 2024 Resource Adequacy Plan will be the basis for the development of capital budget applications for the construction of new sources of supply. Given the magnitude of expenditure for potential solutions, advanced engineering information and cost estimates for all

[17] Kilotonnes ("kt").
[18] The Draft Regulations characterize an emergency circumstance as one that arises due to an extraordinary, unforeseen, and irresistible event.

prominent alternatives will be required for ultimate project approval decisions. Recognizing the urgency for a regulatory application, Hydro will begin the additional engineering analysis required in parallel with the Resource Adequacy Plan work to meet the timelines for a build application. To this end, Hydro is currently advancing FEED work for an eighth generating unit at the Bay d'Espoir Hydroelectric Generation Facility, which will include additional planning, engineering and design work, and refinement of its cost estimate from an AACE Class 5 cost estimate to an AACE Class 3 cost estimate. **Similarly, Hydro is progressing FEED work for the 150 MW combustion turbine alternative. Hydro anticipates that this work will be completed in late 2024.**[19]

Hydro wishes to reiterate that this is not a recommendation to build a combustion turbine. As stated herein, major supply decisions are predicated on thorough consideration of all supply alternatives. **The decision to progress engineering and planning for a combustion turbine and an eighth generating unit at the Bay d'Espoir Hydroelectric Generating Facility will ensure Hydro has all the necessary information for the first required solution to file a build application.** Hydro is completing this work with urgency, utilizing internal and external expertise at the pace that engineering analysis requires.

[19] "Reliability and Resource Adequacy Study Review – Listing of Planned Reports, Studies, and Analyses," Newfoundland and Labrador Hydro, May 25, 2023.