Attachment 21

Bay d'Espoir Hydro Generating Unit 8 Summary Report – November 2022

Newfoundland and Labrador Hydro

Bay d'Espoir Hydro Generating Unit 8
Summary Report

newfoundland labrador hydro

Executive Summary

The study includes the consideration of the development of a 154 MW unit (Unit 8) located in Powerhouse 2 next to existing Unit 7 at a total capital cost of $522.0 million (approximately $3.4 million per megawatt).

The principal parameters for this development are as follows:

- Time to project in-service 70 months
- Installed Capacity 154 MW
- Number of Units 1
- Estimated Unit Efficiency 98%

The rock excavation for the second unit and downstream portion of the draft tube was constructed in 1977 when Powerhouse 1 was commissioned. As this project would share the existing annual water supply from the existing watershed, there is no direct increased energy production associated with this project.

The Bay d'Espoir Unit 8 would interconnect to the Island transmission system via construction of a 1.9 kilometre, 230 kV line from the Unit 8 step-up transformer to Terminal Station No. 2 ("TS2").

Operations and Maintenance ("O&M") is estimated to have costs of 1% to 2% of direct project costs per year.

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1.0 Project Description

Bay d'Espoir Unit 8 is a proposed 154 MW unit located in Powerhouse 2 next to the existing Unit 7. The rock excavation for the second unit and downstream portion of the draft tube was constructed in 1977 when Powerhouse 1 was commissioned.

The Bay d'Espoir facility is comprised of a reservoir including dams and a spillway; two adjacent powerhouses with an average gross head of 179 metres and a total installed capacity of 600 MW; and a tailrace channel rejoining the Bay d'Espoir facility. The addition of Unit 8 would be comprised of the following key components:

- An enlarged headrace channel, including a bifurcation excavated in the rock, supplying both the existing entrance channel to Unit 7 intake and the new entrance channel to Unit 8 intake;
- A new water intake similar to the existing intakes;
- A new buried steel penstock connecting the new intake to the new generating unit;
- A new generating unit; and
- An additional service bay as part of Powerhouse 2 next to existing Unit 7.

The electricity would be produced by the use of a Francis-type turbine, with a rated output of 154 MW.

To complete the interconnection with the existing system, Bay d'Espoir Unit 8 would interconnect to the system via the construction of a 1.9 kilometre, 230 kV line from the Unit 8 step-up transformer to TS2.

2.0 Generation Characteristics

The principal parameters for this development are as follows:

- Installed Capacity 154 MW at generator terminals
- Rated Flow 102 m^3/s
- Gross Head Design 179.75 m
- Net Design Head 173.5 m
- Rotating Speed near 225 rpm
- Estimated Generator Efficiency 98%

3.0 Transmission Requirements

Bay d'Espoir Unit 8 would interconnect to the system via construction of a 1.9 kilometre, 230 kV line from the Unit 8 step-up transformer to TS2. The line route would be parallel to the existing line between Unit 7 and TS2 with five transmission line crossings and one river crossing.

4.0 Environmental Considerations

Hydroelectric developments of this nature will be subject to the provincial *Environmental Protection Act*, and the Environmental Assessment Regulations. The overall timeline for the regulatory approval process could be impacted should an environmental preview report or an environmental impact statement be required. The project could also be subject to the federal Environmental Assessment Process. The federal government, in accordance with the *Canadian Environmental Assessment Act,* usually reviews undertakings that are subject to the provincial Environmental Assessment Process. Where possible the provincial and federal Environmental Assessment Process are harmonized in an effective and timely manner.

The most substantial environmental impact is anticipated to be during the construction phase of the project. However, as the expanded hydropower facility will be integrated to the existing facilities operation with limited changes to the actual operations, less environmental impacts are expected compared to a new hydropower facility.

Similar to the hydroelectric component, transmission line construction would also be subject to environmental assessment. While detailed design has yet to be completed, there are no immediate concerns with respect to the proposed line routing. It is believed that any environmental issues would be typical of any transmission line construction project and could be easily mitigated.

During construction, the control of sedimentation from excavation activities warrants special attention. Controls such as silt fences, rip rap, turbidity curtains, properly constructed settlement basins, containment of runoff from spoil areas and the relocation of fish during dewatering will need to be implemented. The handling and storage of fuels and other hazardous materials in an environmentally safe manner is also included in the cost.

One of the possible outcomes of the regulatory approval process will be the requirement to develop a detailed Environmental Protection Plan for the project. An Environmental Protection Plan generally outlines the owner's policy with respect to environmental protection, the owner's responsibility, the contractor's responsibility, compliance monitoring requirements, effects monitoring requirements, and contractor/sub-contractor education, etc.

5.0 Cost

5.1 Methodology

The cost estimate for the construction of Bay d'Espoir Unit 8 is an AACE[1] Class 3 estimate, completed by SNC Lavalin in 2017, escalated to 2022 costs. Typical accuracy ranges for the AACE Class 3 estimates are -10% to -20% on the low side and +10% to +30% on the high side. These accuracy ranges depend on the technological complexity of the project and level of engineering achieved.

All sales taxes have been excluded from the estimate as they are refundable.

5.2 O&M Costs

Annual O&M costs for hydroelectric generation plants are typically classified as fixed or variable. Fixed O&M costs relate to those costs incurred during the upkeep and maintenance of the various assets. They typically do not vary significantly with generation and include items such as staffing, plant related general and administrative expenses, and maintenance of structures and grounds.

[1] American Association of Cost Engineering ("AACE").

Variable O&M expenses are production-related costs which vary with the amount of electricity generation. These costs include maintenance of mechanical components such as turbine bearings and runners.

Rule of thumb estimates for the anticipated annual maintenance costs were completed. These estimates were derived from parameters, established through a third party consultant's review of their database for similar works. The parameters utilized for fixed and variable maintenance estimates are as follows:

- Variable O&M: $5.70 per MWh
- Fixed O&M: 1% to 2% of direct project cost per year

It is expected that there is no material incremental variable O&M cost associated with Unit 8 as the variable cost for the Bay d'Espoir facility is not expected to increase as a result of an additional unit. As mentioned previously, there is no direct increased energy production associated with this project.

6.0 Schedule

The construction methodology for this project is typical for heavy civil construction projects, involving various types of earthworks, concrete structures, etc. The schedule assumes an overall project duration of 70 months, with construction lasting 54 months. Estimated project duration has increased since 2017 for several reasons:

i. Increased time to prepare the project for approval including updating class 3 estimates for cost and schedule once field work is completed;

ii. Extended time frame to procure long lead time items (i.e., on the critical path is the time to acquire the generator); and

iii. Longer management contingency of six months.

A summary of the schedule is as follows:

6.1 Year One

- Cost and Schedule upgade;
- Environmental and Regulatory approval process initiated; and
- Complete additional field testing.

6.2 Year Two

- Completion of environmental and regulatory approvals;
- Engineering detailed design; and
- Prepare tender documents and award contracts.

6.3 Year Three

- Continued engineering/procurement of major equipment;
- Upgrade access road to Unit 7;
- Excavate laydown areas;
- Construction of camp facilities;
- Installation of site services infrastructure;
- Start powerhouse concreting;
- Start penstock construction;
- Approach channel excavation;
- Powerhouse mechanical and electrical;
- Tailrace excavation; and
- Construct the switchyard.

6.4 Year Four

- Completion of powerhouse mechanical and electrical;
- Construct the intake;
- Complete construction of powerhouse;
- Start powerhouse mechanical and electrical;
- Trashracks assembly and installation; and
- Rock plug excavation.

6.5 Year Five

- Complete powerhouse mechanical and electrical;
- Start turbine installation; and
- Construct the transmission line.

6.6 Year Six

- Install the turbine;
- Final testing and commissioning; and
- Complete site rehabilitation works.

The following works/activities are considered to be on the critical path of the project:

- Water to Wire ("W2W") Equipment Packages are long-lead items and larger size turbine generator unit design, manufacturing, and installation timeline will likely form the critical path;
- Post-pandemic global supply chain challenges;
- Labour shortages which will be aggravated by a renewal energy project boom; and
- Environmental and regulatory approvals.

7.0 Feasibility

Based on the preliminary information there are no anticipated restrictions which would prevent the development of the project. Minimal impact to the existing system is anticipated during construction and any identified environmental concerns can be addressed through the implementation of mitigation measures. However, as construction will be occurring on a brownfield site, no additional environmental issues are expected.

Additionally, Powerhouse 2 was commissioned in 1977 (Phase 3) and the addition of a future unit was considered during construction. As such, rock excavation for the second unit was completed, and the downstream portion of the draft tube, complete with the draft tube gates guides were constructed to minimize interfering with the operation of the existing Unit 7 during the addition of Unit 8.