

**Newfoundland and Labrador Hydro
Request for Network Services, and
Bi-directional Firm and Non-Firm Point-to-
Point Transmission Services**

SIS T 001B

Maritime Link Plus Soldiers Pond Synchronous Condensers

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Executive Summary

The addition of the Lower Churchill Project, including the 735/315 kV station at Churchill Falls, 315 kV transmission lines between Churchill Falls and Muskrat Falls (combined referred to as the Labrador Transmission Assets – LTA), the Muskrat Falls Generating Station and the Labrador – Island HVdc Link (LIL) will expand the transmission system within the Province of Newfoundland and Labrador, connecting the Labrador Interconnected Transmission System and the Island Interconnected Transmission System. Further, the addition of the Maritime Link will provide the first electrical connection between the Island of Newfoundland and Nova Scotia.

In a letter dated December 7, 2012, Newfoundland and Labrador Hydro (Hydro) made a request for Network Services, Bi-direction Firm Point-to-Point Transmission Services and Bi-directional Non-Firm Point-to-Point Transmission Services using the expanded Provincial Interconnected System. The request includes:

- Hydro's requests for network service over its existing transmission facilities, LTA and LIL to meet its native load requirements;
- Hydro request for bi-direction firm and non-firm point-to-point transmission service as follows:
 - Up to 900 MW of deliveries via LTA between Churchill Falls and Muskrat Falls generating facilities, in either direction, pursuant to the Water Management Agreement imposed by PUB Order No. P.U. 8 (2010) dated March 9, 2010;
 - Imports from external control areas into the Province. Two separate point-to-point transmission reservations are required;
 - Up to 900 MW import at the Labrador control area boundary
 - Up to 500 MW import at the Newfoundland control area boundary
 - Export of up to 500 MW from generation resources in the Province, including Muskrat Falls, through the Newfoundland and Labrador Transmission System to the interconnection with the Maritime Link (ML); and
 - Export of up to 900 MW from generating resources within the Province, including Muskrat Falls, through the Newfoundland and Labrador Transmission System to the control area boundary in Labrador.
- Timing of the service is to coincide with the commercial operation of LTA, Muskrat Falls Generating Station, LIL and/or Maritime Link as appropriate; and
- Duration of the service is to be no less than 50 years.

A System Impact Study (SIS) was required to determine the quantities of firm and non-firm transmission service available on each requested interface.

The Lower Churchill Project (LCP) has advised that the interconnection of the Labrador and Island Interconnected Systems will take a phased approach.

For the purposes of the system impact study the phased approach is divided into four sequential steps as follows:

- A. Maritime Link only in service
- B. Maritime Link and Soldiers Pond Synchronous Condensers in service
- C. Maritime Link, Soldiers Pond Synchronous Condensers and Labrador-Island HVdc Link in service
- D. Maritime Link, Soldiers Pond Synchronous Condensers, Labrador-Island HVdc Link and Muskrat Falls Generation in service

This SIS report covers the impacts of the addition of the Maritime Link and Soldiers Pond Synchronous Condensers on the Island Interconnected System and the resultant import/export capabilities available at the Bottom Brook interface. Additional SIS reports will be prepared for each sequential step.

This report is supported by technical analysis completed by TransGrid Solutions Inc. (TGS) on behalf of, and in cooperation with, the Transmission Planning Department of the NLSO. The TGS analysis is documented in the report “Operational Studies: Maritime Link & Soldiers Pond Synchronous Condensers” dated November 10, 2017.

Given the Transmission Services requests are for combined firm point-to-point services up to the 900 MW and 500 MW limits, the SIS does not determine required system additions for firm service up to the requested capacities. Rather, the SIS determines the magnitude of firm and non-firm services up to the requested capacities given the transmission system configuration at the time of the start of both Network and Transmission Services requests.

This SIS does not determine the requirements of new generation added to the system to provide additional capacity where capacity deficiencies are found when assessing the Hydro export request.

This SIS does not contemplate the system additions to either the Hydro-Québec TransÉnergie (HQT) system to receive or deliver up to 900 MW at the Labrador control area boundary, or the Nova Scotia Power Inc. (NSPI) system to receive or deliver up to 500 MW at the Newfoundland control area boundary. Hydro will be required to make the necessary transmission service requests and commercial arrangements with the respective transmission providers outside of the NLSO control area.

A series of 13 base cases were developed to assess the import and export capacity at the Bottom Brook interface with the Maritime Link. Both steady state and stability analyses were used to assess critical contingencies on the Island Interconnected System. Island Interconnected System load, on Island generation dispatch and Maritime Link imports and exports were adjusted to ensure the NLSO steady state and dynamic performance criteria were met. The analyses have resulted in the import and export limits discussed below. The most severe contingency for Island Interconnected System performance was found to be the sudden loss of the maritime Link bipole.

The import limits in the Maritime Link and Soldiers Pond Synchronous Condenser stage is very dependent upon generation dispatch and system load.

From the perspective of the transmission service request for firm and non-firm import service at Bottom Brook, the SIS results indicate that a firm import of 108 MW is available at Bottom Brook in the Maritime Link and Soldiers Pond Synchronous Condensers stage of the project implementation. The 108 MW firm import limit is based upon the Island Interconnected System ability to accept 108 MW of import capacity independent of system load and generation dispatch. An additional 242 MW of non-firm import is available at Bottom Brook depending upon the Island Interconnected System load. Given the variability in system load and generation dispatch the NLSO will have to post the capacity of available non-firm import on a seasonal basis.

The export limit in the Maritime Link and Soldiers Pond Synchronous Condenser stage is a function of not only the Island load but also the generation dispatch and particularly, the number of Holyrood thermal units that are on line.

From the perspective of the transmission service request for firm and non-firm export service at Bottom Brook, the SIS results indicate that a firm export of 55 MW is available at Bottom Brook in the Maritime Link Only and Soldiers Pond Synchronous Condenser stage of the project implementation. The 55 MW firm import limit is based upon the Island Interconnected System ability to deliver 55 MW of export capacity independent of system load and generation dispatch. An additional 80 MW of non-firm export is available at Bottom Brook depending upon the Island Interconnected System load and status of generation at Holyrood. Given the variability in system load and generation dispatch the NLSO will have to post the capacity of available non-firm export on a seasonal basis.

Finally application of a frequency controller on the Maritime Link was found to have benefit to the Island Interconnected System by reducing the amount of under frequency load shedding that is experienced for loss of generation on the Island system. Setting the frequency controller with an adequate dead band and setting its bandwidth limits improves Island frequency performance for loss of generation on the Island and permits the Island to support loss of generation in Nova Scotia using Island spinning reserve without adversely impacting the Island performance. With two Soldiers Pond synchronous condensers in service under frequency load shedding on the Island can be avoided for loss of on Island generation if 90 MW of capacity is available from Nova Scotia. In addition, with two Soldiers Pond synchronous condensers in service, the Island can provide 70 MW of support to Nova Scotia via the Maritime Link to assist in system response to generation loss in Nova Scotia without causing under frequency load shedding on the Island. The application of a frequency controller does not impact the firm and non-firm import and export limits on the Maritime Link at this stage of project implementation.