NLSO Standard

Annual Planning Assessment

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newfoundland labrador hydro
a nalcor energy company

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1 Purpose

The purpose of this document is to present the NLSO Transmission Planning Requirements for its annual planning assessment. Criteria applied in the annual planning assessment are covered under a separate document “NLSO Transmission Planning Criteria”.

2 Introduction

A key function of the NLSO Transmission Planning Department is to ensure the development of a safe, reliable and economical transmission system for the benefit of users within the Province of Newfoundland and Labrador in a coordinated manner.

The transmission planning process requires the use of computer software to perform power system studies in order to demonstrate that the power system meets planning criteria for the present and future states of the system. An annual assessment of the transmission system is utilized to determine the timing of system additions/modifications to ensure long term safe, reliable and economical operation.

This NLSO Standard Annual Planning Assessment sets out the specific requirements, including reporting, for an annual transmission planning assessment of the Newfoundland and Labrador Interconnected System rated 46 kV and above.

3 Definitions

Consequential Load Loss: All Load that is no longer served by the Transmission system as a result of Transmission Facilities being removed from service by a Protection System operation designed to isolate the fault. (As per NER Glossary of Terms)

Extra High Voltage (EHV) Transmission: Transmission system with a nominal operating voltage greater than 300 kV.

High Voltage (HV) Transmission: Transmission system with a nominal operating voltage up to 300 kV.

Load: An end-use device or customer that receives power from the electric system. (As per NERC Glossary of Terms)

Long-Term Transmission Planning Horizon: Transmission planning period that covers years six through ten or beyond when required to accommodate any known longer lead time projects that may take longer than ten years to complete. (As per NERC Glossary of Terms)

Near-Term Transmission Planning Horizon: The transmission planning period that covers Year One through five. (As per NERC Glossary of Terms)

Newfoundland and Labrador Interconnected System: The interconnected transmission systems in both Newfoundland and Labrador with a rated voltage of 46 kV and above including the Labrador – Island HVdc Link. This term is interchangeable with the term Provincial Interconnected System.

Newfoundland and Labrador System Operator (NLSO): Newfoundland and Labrador Hydro operating in its role as the system operator. This is synonymous with the role of Hydro's Energy Control Centre (ECC) and corresponding support staff.

NL: Newfoundland and Labrador.

NL Subtransmission System: Those transmission facilities located in **NL**, operating at a voltage level above 66 kV but below 230 kV. This is a term used in commercial agreements.

NL Transmission District: The **NL Transmission District** is comprised of the Labrador – Island HVdc Link and the bulk 230 kV AC portion of the Island Interconnected System, including all equipment and radial lines rated at 230 kV and above used to connect the bulk system to NL generating plants or to equipment rated at lower voltage levels to supply NL Native Load. The NL Transmission District also

includes all reactive devices whether static or synchronous, including associated dedicated transformers connected directly to the 230 kV or higher voltage equipment. It does not include generator step-up transformers or transformers stepping down to voltages below 230 kV. This is a term used in commercial agreements for determination of losses.

NL Transmission System: The transmission facilities located in **NL**, primarily operating at a voltage level of 230 kV or higher, including, without limitation, the Labrador-Island Link, the Labrador Transmission Assets and Island Interconnected System but excluding the high voltage direct current portion of the Maritime Link transmission line owned by NSP Maritime Line Incorporated. This is a term used in commercial agreements.

Non-Consequential Load Loss: Non-Interruptible Load loss that does not include: (1) Consequential Load Loss, (2) the response of voltage sensitive Load, or (3) Load that is disconnected from the System by end-user equipment. (As per NERC Glossary of Terms)

NPCC: The Northeast Power Coordinating Council Inc. A not-for-profit corporation in the state of New York responsible for promoting and enhancing the reliability of the international, interconnected bulk power system in Northeastern North America.

Planning Authority: The responsible entity that coordinates and integrates transmission Facilities and service plans, resource plans, and Protection Systems. (As per NERC Glossary of Terms) For the Newfoundland and Labrador Interconnected System this is the NLSO Transmission Planning Department.

Planning Coordinator: See Planning Authority (As per NERC Glossary of Terms)

Transmission Planner: The entity that develops a long-term (generally one year and beyond) plan for the reliability (adequacy) of the interconnected bulk electric transmission systems within its portion of the Planning Authority area. (As per NERC Glossary of Terms). For the Newfoundland and Labrador Interconnected System this is the NLSO Transmission Planning Department.

4 GENERAL REQUIREMENTS

This section provides the general requirements for the NLSO Annual Planning Assessment.

4.1 Requirements for System Models

The Transmission Planning Department shall maintain system models in the current version of PSS®E used by NPCC[1] for performing studies necessary to complete the Planning Assessments of the Newfoundland and Labrador Interconnected System. The system models shall include:

- Existing Facilities
- Known outage(s) of generation or Transmission Facility(ies) with a duration of at least six months. New planned Facilities and changes to existing Facilities. The new planned facilities will include those facilities in the transmission service request queue
- Real and reactive load forecasts
- Known commitments for Firm Transmission Service and Interchange
- Resources (supply or demand side) required for load. Demand side may be included in the load forecast.

The system models shall include, as a minimum, peak and light load base cases for each of years 1 and 5 to cover the near-term planning horizon and peak and light load base cases for year 10 of the load forecast to cover the long-term planning horizon. Additional intermediate load base cases and additional years may be developed at the discretion of the Transmission Planner.

The base case system models will simulate the system in its normal system condition for the projected load condition. This will form the pre-contingency condition.

[1] The NLSO Transmission Planning models in PSS®E use the same version as NPCC to ensure efficient data exchange with neighbouring entities.

4.2 Requirements for Annual Planning Assessments

The Transmission Planning Department shall prepare an annual Planning Assessment of the Newfoundland and Labrador Interconnected System. The Assessment shall use current or qualifying past studies, document assumptions, and document results of the steady state, short circuit and stability analyses.

The Near Term Planning Horizon portion of the steady state analysis shall be assessed annually and supported by annual current or qualified past studies. Qualifying studies must include the following conditions:

- System peak load for either Year One or Year Two plus Year Five
- System light load for either Year One or Year Two plus Year Five
- Single contingency events in addition to any known long term outages

For each of the studies, sensitivity case(s) may be utilized to demonstrate the impact of changes to the basic assumptions used in the model, as required. To accomplish this, the sensitivity analysis in the Planning Assessment may vary one or more of the following conditions by a sufficient amount to stress the System within a range of credible conditions that demonstrate a measurable change in System response:

- Real and reactive forecasted Load.
- Expected transfers.
- Expected in service dates of new or modified Transmission Facilities.
- Reactive resource capability.
- Generation additions, retirements, or other dispatch scenarios.
- Controllable Loads and Demand Side Management.
- Duration or timing of known Transmission outages.

For the Planning Assessment, the Long-Term Transmission Planning Horizon portion of the steady state analysis shall be assessed annually and be supported by the following annual current study, supplemented with qualified past studies.

System peak load conditions for one of the years in the Long-Term Transmission Planning Horizon shall be studied and the rationale for why that year was selected shall be provided.

The short circuit analysis portion of the Planning Assessment shall be conducted annually addressing the Near-Term Transmission Planning Horizon and can be supported by current or qualified past studies. The analysis shall be used to determine whether circuit breakers have interrupting capability for Faults that they will be expected to interrupt using the System short circuit model with any planned generation and Transmission Facilities in service which could impact the study area.

For the Planning Assessment, the Near-Term Transmission Planning Horizon portion of the Stability analysis shall be assessed annually and be supported by current or qualified past studies.

The following Stability studies are required:

- System peak Load for one of the five years. System peak load levels shall include a load model which represents the expected dynamic behavior of loads that could impact the study area, considering the behavior of induction motor Loads. An aggregate System load model which represents the overall dynamic behavior of the load is acceptable.

- System Off-Peak load for one of the five years.

For each of the stability studies, sensitivity case(s) may be utilized to demonstrate the impact of changes to the basic assumptions used in the model, as discussed above.

For the Planning Assessment, the Long-Term Transmission Planning Horizon portion of the stability analysis shall be assessed to address the impact of proposed material generation additions or changes in that timeframe and be supported by current or qualified past studies and shall include documentation to support the technical rationale for determining material changes.

Past studies may be used to support the Planning Assessment if technical rationale can be provided to demonstrate that the results of an older study are still valid.

When the analysis indicates an inability of the System to meet the performance requirements, the Planning Assessment shall include Corrective Action Plan(s) addressing how the performance requirements will be met. Revisions to the Corrective Action Plan(s) are allowed in subsequent Planning Assessments but the planned System shall continue to meet the performance requirements. Corrective Action Plan(s) do not need to be developed solely to meet the performance requirements for a single sensitivity case analyzed. The Corrective Action Plan(s) shall:

- List System deficiencies and the associated actions needed to achieve required System performance. Examples of such actions include:
    - Installation, modification, retirement, or removal of Transmission and generation Facilities and any associated equipment.
    - Installation, modification, or removal of Protection Systems or Special Protection Systems.
    - Installation or modification of automatic generation tripping as a response to a single or multiple Contingency to mitigate performance violations.
    - Installation or modification of manual and automatic generation runback/tripping as a response to a single or multiple Contingency to mitigate steady state performance violations. Use of Operating Procedures specifying how long they will be needed as part of the Corrective Action Plan.
    - Use of new technologies, or other initiatives.

- Include actions to resolve performance deficiencies identified in multiple sensitivity studies or provide a rationale for why actions were not necessary.
- Be reviewed in subsequent Annual Planning Assessments for continued validity and implementation status of identified System Facilities and Operating Procedures.

If situations arise that are beyond the control of the Transmission Planner or Planning Coordinator that prevent the implementation of a Corrective Action Plan in the required timeframe, then the Transmission Planner or Planning Coordinator is permitted to utilize Non-Consequential Load Loss and curtailment of Firm Transmission Service to correct the situation that would normally not be permitted, provided that the Transmission Planner or Planning Coordinator documents that they are taking actions to resolve the situation. The Transmission Planner or Planning Coordinator shall document the situation causing the problem, alternatives evaluated, and the use of Non-Consequential Load Loss or curtailment of Firm Transmission Service.

For short circuit analysis, if the short circuit current interrupting duty on circuit breakers exceeds their Equipment Rating, the Planning Assessment shall include a Corrective Action Plan to address the Equipment Rating violations. The Corrective Action Plan shall:

- List System deficiencies and the associated actions needed to achieve required System performance.
- Be reviewed in subsequent annual Planning Assessments for continued validity and implementation status of identified System Facilities and Operating Procedures.

4.3 Requirements for Steady State Analysis

For the steady state portion of the Planning Assessment, the NLSO Transmission Planning Department shall perform studies for the Near-Term and Long-Term Transmission Planning Horizons. The studies shall be based on PSS®E computer simulation models.

Studies shall be performed for planning events to determine whether the Newfoundland and Labrador Interconnected System meets the performance requirements based on the Contingency list described in the NLSO Standard Transmission Planning Criteria.

Studies shall be performed to assess the impact of the extreme events which are identified by the list described in the NLSO Standard Transmission Planning Criteria.

Contingency analyses for Steady State Analysis shall:

- Simulate the removal of all elements that the Protection System and other automatic controls are expected to disconnect for each Contingency without operator intervention. The analyses shall include the impact of subsequent:
    - Tripping of generators where simulations show generator bus voltages or high side of the generation step up (GSU) voltages are less than known or assumed minimum generator steady state or ride through voltage limitations. Include in the assessment any assumptions made.
    - Tripping of Transmission elements where relay loadability limits are exceeded.
- Simulate the expected automatic operation of existing and planned devices designed to provide steady state control of electrical system quantities when such devices impact the study area. These devices may include equipment such as phase-shifting transformers, load tap changing transformers, and switched capacitors and inductors/reactors.

4.4 Requirements for Stability Analysis

For the Stability portion of the Planning Assessment, the NLSO Transmission Planning Department shall perform the contingency analyses for contingencies listed in the NLSO Standard Transmission Planning Criteria. The studies shall be based on PSS®E computer simulation models.

Studies shall be performed for planning events to determine whether the transmission system meets the performance requirements on the Contingency list described in the NLSO Standard Transmission Planning Criteria.

For single contingency planning events (N-1): No generating unit shall pull out of synchronism. A generator being disconnected from the System by fault clearing action or by a Special Protection System is not considered pulling out of synchronism.

For multiple contingency planning events (N-1-1) or (N-2): When a generator pulls out of synchronism in the simulations, the resulting apparent impedance swings shall not result in the tripping of any Transmission system elements other than the generating unit and its directly connected Facilities.

For contingency planning events, power oscillations shall exhibit acceptable damping as established by the NLSO Standard Transmission Planning Criteria.

Contingency analyses for the Stability Analysis shall:

- Simulate the removal of all elements that the Protection System and other automatic controls are expected to disconnect for each Contingency without operator intervention. The analyses shall include the impact of subsequent:
    - Successful high speed (less than one second) reclosing and unsuccessful high speed reclosing into a Fault where high speed reclosing is utilized.
    - Tripping of generators where simulations show generator bus voltages or high side of the GSU voltages are less than known or assumed generator low voltage ride through capability. Include in the assessment any assumptions made.
    - Tripping of Transmission lines and transformers where transient swings cause Protection System operation based on generic or actual relay models.
    - Simulation of the expected automatic operation of existing and planned devices designed to provide dynamic control of electrical system quantities when such devices impact the study area. These devices may include equipment such as generation exciter control and power system stabilizers, static var compensators, power flow controllers, and DC Transmission controllers.

The NLSO Transmission Planning Department shall coordinate with adjacent Planning Coordinators and Transmission Planners to ensure that Contingencies on adjacent Systems which may impact the Newfoundland and Labrador Interconnected System are included in the NLSO Transmission Planning Criteria Contingency list.

4.5 Requirements for Voltage Limits

The NLSO transmission voltage limits for the Annual Planning Assessment shall be as provided in the NLSO Standard Transmission Planning Criteria.

4.6 Requirements to Document Criteria

The NLSO Transmission Planning Department shall include its planning criteria as part of reports concerning transmission assessment.

4.7 Identification of Responsibilities

The responsibility of completing required studies for the Planning Assessment for the Newfoundland and Labrador Interconnected System rests with the Transmission Planning Department of the NLSO. Inputs are required from the Generation Planning group for resource additions and from the Market Analysis section for both near and long-term load forecasts. Inputs are required from Transmission and Generation Owners with respect to data associated with their facilities including proposed modifications in both the near- and long-term horizons.

4.8 Requirements for Planning Assessment Distribution

The NLSO Transmission Planning Department shall submit its planning assessment within 90 calendar days of completion to the reliability regulator (taken as the Newfoundland and Labrador Board of Commissioners of Public Utilities – PUB).

The NLSO Transmission Planning Department shall provide an annual update of its Planning Assessment to the Maine Atlantic Technical Planning Committee (MATPC).

The NLSO Transmission Planning Department shall distribute its planning assessment to any recognized functional entity that has a reliability related need and submits a written request for the information within 30 calendar days of such a request.

Where a recipient of the Planning Assessment provides documented comments on the results of the Planning Assessment, the NLSO Transmission Planning Department shall provide a documented response to the recipient within 90 calendar days of receipt of those comments.

5 Reference Documents

TP-S-007 NLSO Standard - Transmission Planning Criteria.