Methodology to Assess Available Transfer Capability

1.0 Introduction

This document outlines the methodology used by the Newfoundland and Labrador System Operator (NLSO) to determine the Total Transfer Capability (TTC) and the Available Transmission Capability (ATC) between the NLSO and its neighbouring utilities. All capitalized terms in this document are defined in Section 2.0 of the NL Transmission Policies and Procedures.

2.0 Mathematical Algorithm Used to Calculate Firm and Non-Firm ATC

ATC is the transfer capability remaining in a physical transmission network for further commercial activity over and above already committed uses as determined using the methodologies and procedures set forth in this document. Mathematically, ATC is defined as the TTC less the Existing Transmission Commitments (ETC), less the Capacity Benefit Margin (CBM) less the Transmission Reliability Margin (TRM). ATC is calculated for firm and non-firm transmission service. An ATC path is a portion of a transmission system between a Point of Receipt (POR) and a Point of Delivery (POD) for which ATC and TTC is calculated. The NLSO uses the rated system path methodology as prescribed in the North American Electric Reliability Corporation (NERC) standard MOD-029-2a in the assessment of firm and non-firm ATC.

2.1 Firm ATC

The formula used by the NLSO for calculation of firm ATC for a given time period is:

$$\mathbf{ATC_F = TTC - ETC_F - CBM - TRM}$$

Where:

ATC_F is the firm Available Transfer Capability for the ATC path for that period.

TTC is the Total Transfer Capability of the ATC path for that period, determined in accordance with Section 4.1.

ETC_F is the sum of Existing Firm Transmission Commitments for the ATC path during that period, determined in accordance with Section 4.2.

CBM is the Capacity Benefit Margin for the ATC path during that period, determined in accordance with Section 4.3.

TRM is the Transmission Reliability Margin for the ATC path during that period, determined in accordance with Section 4.4.

2.2 Non-Firm ATC

The formula used by the NLSO for calculation of non-firm ATC for a given time period is:

$$\mathbf{ATC_{NF} = TTC - ETC_F - ETC_{NF} - CBM_S - TRM_U}$$

Where:

ATC_{NF} is the non-firm Available Transfer Capability for the ATC Path for that period.

TTC is the Total Transfer Capability of the ATC Path for that period, determined in accordance with Section 4.1.

ETC_F is the sum of Existing Firm Transmission Commitments for the ATC Path during that period, determined in accordance with Section 4.2.

ETC_{NF} is the sum of Existing Non-Firm Transmission Commitments for the ATC Path during that period, determined in accordance with Section 4.2.

CBM_S is the Capacity Benefit Margin for the ATC Path that has been scheduled during that period, determined in accordance with Section 4.3.

TRM_U is the Transmission Reliability Margin for the ATC Path that has not been released for sale (unreleased) as non-firm capacity by the NLSO during that period, determined in accordance with Section 4.4.

3.0 ATC Process Flow Diagram

The following process flow diagram illustrates the various steps through which ATC is calculated. Similar ATC calculations are performed for each ATC path, service type and time period.

4.0 Description of Calculations for Each ATC Component

4.1 Total Transfer Capability (TTC)

The NLSO determines TTC using the rated system path method adapted from the North American Electric Reliability Corporation (NERC) standard, MOD-029-2a. For the purposes of this procedure, TTC will be determined for all ATC paths in both directions, connecting to the scheduling point designated as the NL Point. The NLSO conducts technical studies to identify the system conditions that impact TTC and ATC. The resulting equations derived from those system conditions are used to calculate TTC.

4.1.1 Definition of TTC

TTC is the amount of electric power that can be moved or transferred reliably from one area to another area of interconnected transmission systems by way of all transmission lines (or paths) between those areas under specified system conditions.

4.1.2 TTC Calculation Methodology

TTC for any Island Interconnected System ATC path will be determined as the most restrictive of the thermal, voltage, or stability rating of that path. The Island Interconnected System is the bulk energy transmission system on the island portion of NL, operating at a voltage level of 230 kV or higher but excluding any part of the Maritime Link (ML) and any part of the Labrador-Island Link (LIL).

The NLSO conducts technical studies to determine TTC for Island Interconnected System ATC paths, as required. These studies include static power flow analyses (load flows) and dynamic contingency analyses (transients) and may cover multiple timeframes. The NLSO models include representation of the NL Transmission System (initially just for the Island Interconnected System), the NL Subtransmission System and the Nova Scotia power system. The Nova Scotia system may be modelled as an electrical equivalent. Representation of the Quebec system will be included when the LIL and Labrador Transmission Assets (LTA) are placed in service.

The NLSO models use regularly updated data appropriate for the timeframe being evaluated, reflecting load forecasts, generation information (including additions and retirements), transmission system information (including additions and retirements), special protections systems (including runback schemes) and all other system information, including planning contingencies, that are impactive or potentially impactive on the determination of TTC. Facility ratings used for transmission and generation shall be provided by the facility owner.

Within seven (7) days following the completion of applicable studies, supporting documentation that describes the evaluation of TTC and the calculated TTC values will be made available to the NLSO for each ATC path. Since the NLSO is both the Transmission Operator (TOP) and Transmission Service Provider (TSP) for NL, communication within NL will be an internal transfer of information. The NLSO posts its TTC and ATC values on its OASIS.

4.1.3 TTC Assessment Assumptions

In the calculation of TTC and ATC, the assumptions used for operational timeframes shall be no more restrictive than those assumptions used for longer-term planning studies.

For steady state conditions, transmission elements will be modelled at or below their continuous rating. For transient simulations of contingencies, transmission elements will not exceed their post-contingency emergency ratings and uncontrolled separation shall not occur.

The NLSO will identify instances where the TTC for one path has adverse impacts on the TTC of another path and shall include the resolution of this impact in its study report.

If a System Operating Limit (SOL) exists for the ATC path being studied, the TTC shall be the lesser of the SOL or the value calculated through reliability studies.

System Operating Limit is defined by NERC as the value (such as MW, MVAR, amperes, frequency or volts) that satisfies the most limiting of the prescribed operating criteria for a specified system configuration to ensure operation within acceptable reliability criteria. SOLs are based upon certain operating criteria. These include, but are not limited to:

- facility ratings (applicable pre- and post- contingency equipment ratings or facility ratings)
- transient stability ratings (applicable pre- and post- contingency stability limits)
- voltage stability ratings (applicable pre- and post-contingency voltage stability)
- system voltage limits (applicable pre- and post-contingency voltage limits)

4.2 Existing Transmission Commitments (ETC)

4.2.1 Definition of ETC

ETCs are defined as the committed uses of the NL Transmission System considered when determining ATC. As with ATC, ETC is calculated for firm and non-firm transmission service.

4.2.2 Firm ETC Calculation Methodology

The formula used by the NLSO for calculation of firm ETC for a given time period is:

$$\mathbf{ETC_F = NL_F + NITS_F + PTP_F + ROR_F + OS_F}$$

Where:

NL_F is the firm capacity set aside to serve peak native load forecast commitments for the time period being calculated, to include losses, and native load growth, not otherwise included in TRM.

$NITS_F$ is the firm capacity reserved for Network Integration Transmission Service serving load, to include losses, and load growth, not otherwise included in TRM.

PTP_F is the firm capacity reserved for confirmed Point-to-Point Transmission Service.

ROR_F is the firm capacity reserved for roll-over rights for contracts granting Transmission Customers the right of first refusal to take or continue to take transmission service when the Transmission Customer's transmission service contract expires or is eligible for renewal.

OS_F is the firm capacity reserved for any other service(s), contract(s), or agreement(s) not specified above using firm transmission service.

4.2.3 Non-Firm ETC Calculation Methodology

The formula used by NLSO for calculation of non-firm ETC for a given time period is:

$$\mathbf{ETC_{NF} = NITS_{NF} + PTP_{NF} + OS_{NF}}$$

Where:

$NITS_{NF}$ is the non-firm capacity set aside for Network Integration Transmission Service serving load (i.e., secondary service), to include losses, and load growth not otherwise included in TRM or CBM.

PTP_{NF} is non-firm capacity reserved for confirmed Point-to-Point Transmission Service.

OS_{NF} is the non-firm capacity reserved for any other service(s), contract(s), or agreement(s) not specified above using non-firm transmission.

4.3 Capacity Benefit Margin (CBM)

The NLSO does not use CBM and therefore is not adopting any process, procedure or assumptions for the calculation of CBM or CBM_S for inclusion in the determination of ATC. A value of zero (0) is assumed for CBM or CBM_S in the calculation of ATC.

4.4 Transmission Reliability Margin (TRM)

TRM is the amount of transmission transfer capability necessary to provide reasonable assurance that the interconnected transmission network will be secure. TRM accounts for the inherent uncertainty in system conditions and the need for operating flexibility to ensure reliable system operation as system conditions change. The following factors, if applicable, may be used in establishing TRM:

- Aggregate load forecast
- Load distribution uncertainty
- Forecast uncertainty in transmission system topology (including, but not limited to, forced or unplanned outages and maintenance outages)
- Allowances for parallel path (loop flow) impacts
- Allowances for simultaneous path interactions
- Variations in generation dispatch (including, but not limited to, forced or unplanned outages, maintenance outages and location of future generation)
- Short-term system operator response (operating reserve actions)
- Reserve sharing requirements
- Inertial response and frequency bias

The NLSO has elected to set TRM at 0 MW.