Attachment C

Methodology to Assess Available Transfer Capability

This Attachment C outlines the Transmission Service Provider's methodology for determining Available Transfer Capability.

1. Definitions

1.1 Available Transfer Capability (ATC) – The amount of transfer capability remaining in the transmission network available over and above committed uses. Mathematically, ATC is defined as the Total Transfer Capability less the Transmission Reliability Margin, less the Capacity Benefit Margin and less the sum of existing transmission commitments.

1.2 Capacity Benefit Margin (CBM) – The amount of transmission transfer capability reserved by load serving entities to ensure access to generation from interconnected systems to meet generation reliability requirements.

1.3 Counter-flows – The scheduled energy values utilizing either a firm or non-firm transmission service on the opposite path for which ATC is being calculated.

1.4 Existing Transmission Commitments (ETC) – Committed uses of the Transmission Service Provider's transmission system when determining ATC.

1.5 Firm Existing Transmission Commitments (ETC_F) – As defined in section 4.2.2 of this Attachment C.

1.6 Non- Firm Existing Transmission Commitments (ETC_{NF}) – As defined in section 4.2.3 of this Attachment C.

1.7 Operating Horizon – The period of time that begins at the end of the Scheduling Horizon and extends through 168 hours.

1.8 **Planning Horizon** – The period of time that begins at the end of the Operating Horizon and extends through the end of the posting period.

1.9 **Postbacks** – Changes to firm ATC due to a change in the use of transmission service for that period.

1.10 **Scheduling Horizon** – The period of time that begins with the current hour and extends out one hour.

1.11 **Total Transfer Capability (TTC)** – The amount of electric power that can be transferred over the interconnected transmission network in a reliable manner while meeting all of a specific set of pre-defined pre- and post-contingency system conditions.

1.12 **Transmission Reliability Margin (TRM)** – The amount of Total Transfer Capability necessary to ensure that the interconnected transmission network is secure under a possible range of uncertainties in system conditions.

1.13 **Transmission Service Provider** – BC Hydro as the entity that administers the OATT and provides transmission service to transmission customers under applicable transmission service agreements.

1.14 **Transmission Service Request (TSR)** – a request for transmission service submitted pursuant to the Transmission Service Provider's OATT.

2. Description of Mathematical Algorithm Used to Calculate Firm and Non-Firm ATC

The Transmission Service Provider uses the Rated System Path Methodology as prescribed in the North American Electric Reliability Corporation (**NERC**) reliability standard MOD-029 in the assessment of firm and non-firm ATC for all ATC Paths in the Scheduling Horizon, Planning Horizon, and Operating Horizon. ATC is calculated using software which uses variable parameter settings and calculation adjustments to establish formulas for the various firm and non-firm ATCs consistent with the mathematical algorithms used by the Transmission Service Provider.

The mathematical algorithms for firm and non-firm ATC consist of the following general formulas:

$ATC_F = TTC - ETC_F - CBM - TRM + Postbacks_F + Counter\text{-}flows_F$

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.

ETC_F is the sum of existing firm Transmission commitments for the ATC Path during that period.

CBM is the Capacity Benefit Margin for the ATC Path during that period.

TRM is the Transmission Reliability Margin for the ATC Path during that period.

$ATC_{NF} = TTC - ETC_F - ETC_{NF} - CBM_S - TRM_U + Postbacks_{NF} + Counter\text{-}flows_{NF}$

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.

ETC_F is the sum of existing firm Transmission commitments for the ATC Path during that period.

ETC_{NF} is the sum of existing non-firm Transmission commitments for the ATC Path during that period.

CBM_S is the Capacity Benefit Margin for the ATC Path that has been scheduled during that period.

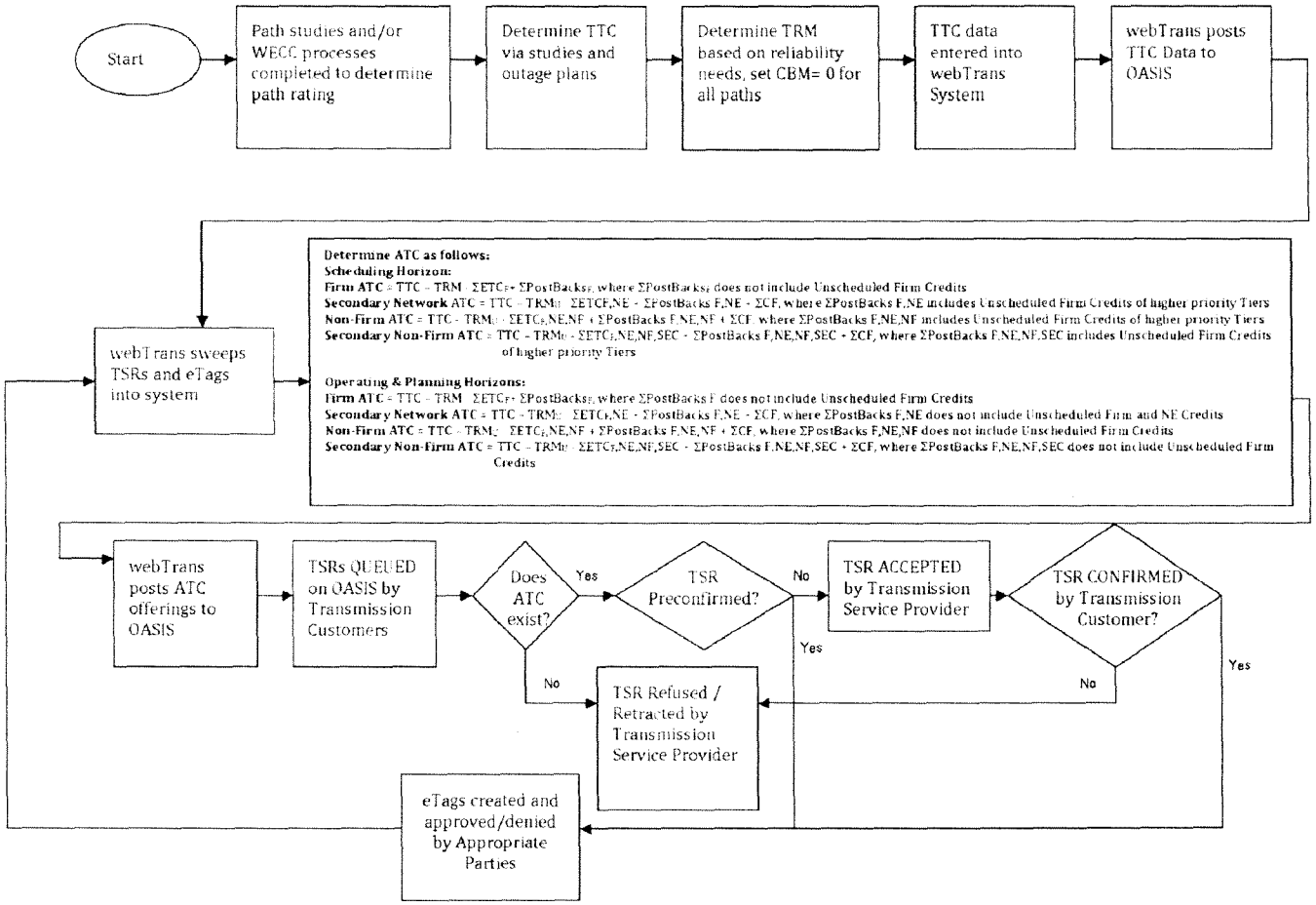
TRM_U is the Transmission Reliability Margin for the ATC Path that has not been released for sale (unreleased) during that period.

Postbacks$_{NF}$ are changes to non-firm ATC due to a change in the use of Transmission Service for that period, as defined in the Transmission Service Provider's ATCID.

Counterflows$_{NF}$ are adjustments to non-firm ATC specified in the Transmission Service Provider's ATCID.

The components of the above formulas are further described in detail in this Attachment C. The specific mathematical algorithms are described in the TTC/ATC Business Practice posted on the Transmission Service Provider's website at: http://transmission.bchydro.com/transmission_scheduling/business_practices/.

3. Process Flow Diagram Illustrating ATC Calculation



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4. Description of How Each ATC Component is Calculated for the Operating and Planning Horizons

4.1. Total Transfer Capability (TTC)

4.1.1. Calculation Methodology

When performing the technical studies to determine the TTC for those ATC Paths, the Transmission Service Provider will follow MOD-029 — Rated System Path Methodology.

a. Power system simulation software is used to model the transmission system, adjust the generation pattern and load levels to determine the TTC (either a maximum flow or reliability limit) that can be simulated on each ATC path while satisfying all NERC/WECC reliability standards in effect in British Columbia (**B.C.**) and BC Hydro planning criteria.

b. TTC will be determined either prior to a new transmission element being brought into service or when a modification to a transmission element would affect the TTC.

c. Once the TTC determination is made, it remains fixed and changes only if there is a physical or operational change to the transmission system or a transmission component which requires a change to TTC.

d. When either transmission facilities are either jointly owned, or capacity on the ATC Path is limited by contract, the TTC will be set at the lesser of the maximum allowable limit based upon the capacity allocated by contract or pursuant to joint ownership arrangements and the reliability limit.

Additional information regarding determination of TTC for special conditions for specific paths may be posted and updated from time to time on the Transmission Service Provider's OASIS.

4.1.2. Databases Used in TTC Assessments

The Transmission Service Provider uses the transmission system model database from the up to date system base cases that are developed annually by WECC for its member use in planning and operating studies. WECC base cases include:

- All contiguous transmission systems within the WECC regional interconnection.
- Initial condition models of system elements are modeled as in service as consistent for the time period and conditions being studied.
- All generation and control system parameters (either a single generator or multiple generators) greater than 20 MVA at the point of interconnection are represented.
- Load is allocated to appropriate buses based on load forecasts developed by the balancing authorities for time period and conditions being studied.
- Transmission and generation facility additions and retirements are represented consistent with the time period represented. Series compensation is modeled at the expected operating level.
- Facility ratings are modeled as provided by the transmission and generator owners for the time period being studied.
- Phase shifters are modeled with automatic controls disabled.
- Special protection systems and/or remedial action schemes are modeled, as appropriate, if they are currently in place or are projected to be implemented within the studied time horizon.

4.1.3. Assumptions Used in TTC Assessments

When performing technical studies to determine the TTC for ATC Paths, the Transmission Service Provider will use data and assumptions consistent with the requirements for NERC

reliability standard MOD-029. The assumptions used in the studies are further described as follows:

4.1.3.1. Load Levels

TTC is based upon initial system conditions where all transmission elements are modeled as in service consistent for the time period being studied. System conditions affecting TTC, including load levels typical for the posting period (e.g., heavy summer period) determine the starting point for study conditions.

4.1.3.2. Generation Dispatch

Generation resources internal and external to the Transmission Provider's service territory are adjusted (within their capabilities) to provide a maximum TTC.

4.1.3.3. Modeling of Planned and Contingency Outages

Values for TTC on all ATC Paths are the same for both the Planning and Operating Horizons.

- Power transfers into the service territory are increased until a maximum transfer limit is reached or until a critical contingency with a limiting element is identified that limits the TTC. Contingencies for screening are defined as Category B and C contingencies in NERC/WECC reliability standards. System performance for outages must meet the NERC/WECC reliability standards in effect in B.C. and BC Hydro reliability criteria.

- Planned outages are screened using contingencies defined as Category B and Category C contingencies in the NERC/WECC reliability standards. System performance for outages must meet the requirements as outlined in the NERC/WECC standards in effect in B.C. and BC Hydro reliability criteria. Any significant reductions in ATC Path capability from the system normal TTC are posted on OASIS as necessary.

4.2. Existing Transmission Capacity

4.2.1. Determination Methodology

Existing transmission commitments can be separated into two categories firm or non-firm transmission commitments. This distinction defines their impacts on the calculation of firm or non-firm ATC.

4.2.2. Firm Existing Transmission Commitments

The following algorithm is used when calculating firm ETC (**ETC_F**) for all time horizons:

$$ETC_F = NITS_F + GF_F + PTP_F + ROR_F + OS_F$$

Where:

$NITS_F$ is the firm capacity reserved for network integration transmission service for servicing load to include losses and load growth otherwise not included in TRM and CBM.

GF_F is the firm capacity set aside for grandfathered transmission service and energy contracts and/or transmission service agreements, where executed prior to the effective date of the Transmission Service Provider's OATT.

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 transmission service agreements granting transmission customers the right of first refusal to take or continue to take transmission services when a transmission service agreement expires or is eligible for renewal.

OS_F is the firm capacity reserved from any other service(s), energy contracts, or transmission service agreements not specified above using transmission service.

4.2.3. Non-Firm Existing Transmission Commitments

$ETC_{NF} = NITS_{NF} + GF_{NF} + PTP_{NF} + OS_{NF}$

Where:

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

GF_{NF} is the non-firm capacity set aside for grandfathered transmission service and energy contracts and/or transmission service agreements, where executed prior to the effective date of the Transmission Service Provider's OATT.

PTP_{NF} is the non-firm capacity reserved for confirmed point-to-point transmission service.

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

4.3. Transmission Reliability Margin

4.3.1. Calculation Methodology

The Transmission Service Provider sets aside certain transmission capacity amounts for Transmission Reliability Margin (**TRM**) to account for the components of uncertainty of aggregate load forecast, variations in generation dispatch and inertial response and frequency bias, and transmission system topology uncertainty for each ATC Path.

The capacity amount set aside to account for the components of uncertainty of aggregate load forecast, variations in generation dispatch and inertial response and frequency bias have been established based on operating experience; they have proven sufficient and effective.

For calculating ATC_F, the Transmission Service Provider may set aside additional capacity amount to account for transmission system topology uncertainty due to unplanned and forced

outages and maintenance outages. The capacity amount required for this component of uncertainty is determined based on applicable system operating orders.

For more information, refer to the Transmission Service Provider's TRM implementation document posted on the Transmission Service Provider's website located at: http://transmission.bchydro.com/transmission_system/reliability/.

4.4. Capacity Benefit Margin

4.4.1. Practice

BC Hydro does not set aside CBM and therefore has established a CBM of zero for calculation purposes on all transmission paths.

4.5. Counter-flows

4.5.1. Practice

Firm Counter-flows will add capacity to the calculation of non-firm ATC in the Scheduling Horizon. Counter-flows are further described in the ATC implementation document posted on the Transmission Service Provider's website located at: http://transmission.bchydro.com/transmission_system/reliability/.

5. Firm Transmission Service on BCHA – AESO Path

Notwithstanding any other provision in this Tariff, the Transmission Service Provider shall limit sales of firm transmission service on the BCHA - AESO path to 480 MW.