ATTACHMENT C

Methodology To Assess Available Transfer Capability

Purpose and Scope

This Attachment C sets forth the methodology to assess Available Transfer Capability (ATC). Any provisions herein shall be construed consistent with NERC MOD standards and any other applicable reliability standard.

Definitions

The terms defined below, to the extent defined differently than in Section 1 of Part I of the Tariff, apply only to this Attachment C.

2.1. Available Flowgate Capability (AFC)

A measure of the flow capability remaining on a Flowgate for further commercial activity over and above already committed uses.

2.2. Available Transfer Capability (ATC)

A measure of the transfer capability remaining in the physical transmission network for further commercial activity over and above already committed uses.

2.3. ATC Path

Any combination of Point of Receipt and Point of Delivery for which ATC is calculated; and any path posted on OASIS.

2.4. Balancing Authority (BA)

The responsible entity that integrates resource plans ahead of time, maintains load-interchange-generation balance within a Balancing Authority Area, and supports interconnection frequency in real time.

2.5. Balancing Authority Area (BA Area)

The collection of generation, transmission, and loads within the metered boundaries of the Balancing Authority. The Balancing Authority maintains load-resource balance within this area.

2.6. Capacity Benefit Margin (CBM)

The amount of firm transmission transfer capability preserved by the Transmission Service Provider for Load-Serving Entities (LSEs), whose loads are located on that Transmission Service Provider's system, to enable access by the LSEs to generation from interconnected systems to meet generation reliability

requirements. Preservation of CBM for an LSE allows that entity to reduce its installed generating capacity below that which may otherwise have been necessary without interconnections to meet its generation reliability requirements. The transmission transfer capability preserved as CBM is intended to be used by the LSE only in times of emergency generation deficiencies.

2.7. Existing Transmission Commitments (ETC)

Committed uses of a Transmission Service Provider's transmission system considered when determining ATC or AFC.

2.8. Flowgate

A mathematical construct, comprised of one or more monitored transmission facilities and optionally one or more contingency facilities, used to analyze the impact of power flows upon the bulk electric system.

2.9. Flowgate Methodology

The Flowgate Methodology is characterized by identification of key facilities as Flowgates. Total Flowgate Capabilities (TFCs) are determined based on facility ratings and voltage and stability limits. The impacts of Existing Transmission Commitments (ETCs) are determined by simulation. The impacts of ETC, Capacity Benefit Margin (CBM) and Transmission Reliability Margin (TRM) are subtracted from the Total Flowgate Capability, and Post backs and counter flows are added, to determine the Available Flowgate Capability (AFC) value for that Flowgate. AFCs can be used to determine Available Transfer Capability (ATC).

2.10. Generator Shift Factor (GSF)

A factor to be applied to a generator's expected change in output to determine the amount of flow contribution that change in output will impose on an identified transmission facility or Flowgate.

2.11. Interconnection Reliability Operating Limit (IROL)

A System Operating Limit that, if violated, could lead to instability, uncontrolled separation, or cascading outages that adversely impact the reliability of the bulk electric system.

2.12. Load-Serving Entity (LSE)

Secures energy and Transmission Service (and related interconnected operations services) to serve the electrical demand and energy requirements of its end-use customers.

2.13. Tag Dump

A database that contains tagging data for the Eastern Interconnection.

2.14. System Data Exchange (SDX)

A database that serves as a repository for transmission outages, generation outages, and load forecast data for the Eastern Interconnection.

2.15. Outage Transfer Distribution Factor (OTDF)

In the post-contingency configuration of a system under study, the electric Power Transfer Distribution Factor (PTDF) with one or more system facilities removed from service (outaged).

2.16. Point of Delivery (POD)

A location that the Transmission Service Provider specifies on its transmission system where an interchange transaction leaves or a Load-Serving Entity receives its energy.

2.17. Point of Receipt (POR)

A location that the Transmission Service Provider specifies on its transmission system where an interchange transaction enters or a generator delivers its output.

2.18. Power Transfer Distribution Factor (PTDF)

In the pre-contingency configuration of a system under study, a measure of the responsiveness or change in electrical loadings on transmission system facilities due to a change in electric power transfer from one area to another, expressed in percent (up to 100%) of the change in power transfer.

2.19. System Operating Limit (SOL)

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. System Operating Limits are based upon certain operating criteria. These include, but are not limited to:

- Facility ratings (applicable pre- and post-contingency equipment 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)

2.20. Total Flowgate Capability (TFC)

The maximum flow capability on a Flowgate, is not to exceed its thermal rating, or in the case of a flowgate used to represent a specific operating constraint (such as a voltage or stability limit), is not to exceed the associated System Operating Limit.

2.21. Transfer Distribution Factor (TDF)

The portion of an interchange transaction, typically expressed in per unit that flows across a transmission facility (Flowgate).

2.22. Transmission Owner

The entity that owns and maintains transmission facilities.

2.23. Transmission Reliability Margin (TRM)

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.

2.24. Transmission Service

Services provided to the transmission customer by the Transmission Service Provider to move energy from a Point of Receipt to a Point of Delivery.

2.25. Transmission Service Provider (TSP)

The entity that administers the transmission tariff and provides Transmission Service to transmission customers under applicable Transmission Service agreements.

Overview

Tapoco has chosen to use the Flowgate Methodology for calculating AFCs and the resultant ATCs for each ATC Path.

The Flowgate Methodology is based on the assumption that certain elements on the transmission system will begin to reach their limits before the other elements on the system. Therefore by monitoring the more sensitive areas on the transmission system, transfer capability calculations can be simplified in regard to the number of contingencies and monitored elements examined during each study. This allows for a greater number

of studies to be conducted with simplified input assumptions. The resulting studies focus on how power would actually flow if the Transmission Service requests were to be approved.

The Flowgate Methodology involves the calculation of AFC on Flowgates modeled in the process. ATC on posted paths is then derived from the calculated AFCs.

Two-Part AFC Calculation Process

Tapoco's AFC calculation takes place as a two part process:

1. The Model Building Process -Tapoco utilizes commercially available model building software for its model building process. This tool utilizes a starting point case that is used to derive multiple powerflow snapshot models covering defined horizons. From these snapshots, Flowgate base flows and GSFs relative to a reference bus are calculated.

2. The AFC Calculation Process - The Flowgate base flows and GSFs are then passed to an AFC engine. The transaction TDF values are computed from the GSF values by subtracting the load GSF from the source GSF. The AFC Engine is a suite of software applications that determines Transmission Service reservation impacts, calculates AFCs and ATCs, evaluates new Transmission Service requests, applies business rules, and posts ATCs on OASIS.

AFC Calculation Horizons and Frequency

Tapoco has identified three distinct horizons for the calculation of AFC and ATC: Operating, Planning, and Study. The AFC calculation horizons are defined as follows:

AFC Time Horizon	AFC Horizon Time Range
Operating	Prior to 10:00 EPT, current hour - midnight of the current day. After 10:00 EPT, current hour - midnight of the next day
Hourly Planning	End of Hourly Operating horizon - midnight of the day 6 days beyond the current day
Daily Planning	End of Hourly Planning horizon - midnight of the day 31 days beyond the current day
Monthly Study	End of Daily Planning horizon - last day of the month at least 13 calendar months from

current month

Tapoco's two-part AFC calculation process is executed at regularly scheduled intervals via automated processes. These automated processes create hourly, daily, and monthly models and derive TDFs and AFCs from those models at the following frequency:

Increment	Model Build & AFC Calculation Frequency*
Hourly	Next 48 hours calculated hourly Next 168 hours (at least) calculated daily
Daily	Next 31 days (at least) calculated daily
Monthly	Next 13 months (at least) calculated daily

*These timeframes indicate when the models are built and new AFC values are calculated from these models. AFCs and resulting ATCs, however, are continuously decremented as Transmission Service reservations are confirmed.

Flowgate Identification

Flowgates are identified by one of several methods:

- Flowgates identified as part of coordination agreements
- Flowgates requested for inclusion by another TSP
- Flowgates subject to interconnection-wide congestion management procedure within the last twelve months
- Flowgates identified by screening tests

6.1 Flowgates Identified As Part of Coordination Agreements

Tapoco includes and shares Flowgates with neighboring utilities.

Flowgates Requested For Inclusion By Another TSP

If another TSP asks Tapoco to include in our AFC process Flowgates that fall outside the TSP area, the Flowgate must be included in the requesting TSP's methodology, and the Flowgate must pass screening tests:

- Any generator within Tapoco's TSP area that has at least a 5% PTDF or OTDF impact on the Flowgate when delivered to the aggregate load of Tapoco's TSP area, or
- A transfer from Tapoco's TSP area to an adjacent BA Area has at least a

5% PTDF or OTDF impact on the Flowgate.

6.2. Flowgates Subject to Interconnection-Wide Congestion Management Procedure Within the Last Twelve Months

Tapoco will include any Flowgate within its Reliability Coordinator area that has been subjected to an interconnection-wide congestion management procedure within the last twelve months, unless the Flowgate was created to address temporary operating conditions.

6.3. Flowgates Identified By Screening Tests

Screening tests identify Flowgates that are not addressed by the aforementioned methods. These screening tests identify Flowgates that fall inside Tapoco's TSP area (internal Flowgates) as well as Flowgates that fall outside Tapoco's TSP area (external Flowgates).

Flowgates identified by screening tests are based, at a minimum, on the results of first contingency transfer analyses from adjacent BA source and sink combinations up to the path capability such that at least the first three limiting Elements and their worst associated contingency combinations with an OTDF of at least 5% are included.

Databases for AFC Processes

A collection of data exists for both the model building process and the AFC calculation process.

The database for the model building process includes all input and output data such as load forecasts, generation outages, transmission outages, generation block dispatch files, Flowgate definitions, POR/POD definitions, tagging data from Tag Dump, starting point models, output models, GSFs, and Flowgate base flows.

The database for the AFC calculation process (the AFC Engine) includes input and output data items such as Flowgate definitions, GSFs, Flowgate base flows, Transmission Service requests, Transmission Service reservations, tags, TFCs, TRMs, CBMs, Contract Path Limits, counter flow percentages, calculated AFCs, external AFCs (AFC overrides), ATCs, and Remaining Contract Path Capabilities.

Assumptions in the AFC Process

8.1. Generation Dispatch

Priority or block dispatch files for the Tapoco TSP area and for adjacent TSP areas when available are used to dispatch the generation to meet the area load and scheduled interchange requirements. For other external areas, if a priority or block dispatch is not used, then the generation dispatch in the starting point case is used and on-line generation is scaled to balance the load, interchange, and losses.

8.2. Load Forecasts

Load forecast data from the System Data Exchange (SDX) is used when available for modeling load in the Tapoco TSP area and adjacent TSP areas. Load in the starting point cases is used for the remaining areas.

8.3. Transmission and Generation Outages

Transmission and generation outages from the SDX are used to model topology information for AFC calculations. Tapoco's AFC process takes into consideration transmission and generation outages for Tapoco TSP area and adjacent TSP areas.

8.4. Coordinated AFCs

For external Flowgates identified through AFC coordination, the AFCs that Tapoco calculates will be overridden by the AFCs provided by the TSP that calculates AFC for that Flowgate.

AFC Calculation Equations

9.1. Firm AFC Calculations

In accordance with the MOD-030 reliability standard, the following equation is employed when calculating firm AFC for a Flowgate for a specified period:

$$AFC_F = TFC - ETC_{Fi} - CBM_i - TRM_i + Postbacks_{Fi} + Counterflows_{Fi}$$

Where:

AFC_F is the firm AFC for the Flowgate for that period

TFC is the Total Flowgate Capability of the Flowgate

ETC_{Fi} is the sum of the impacts of existing firm Transmission Service commitments for the Flowgate during that period

CBM_i is the impact of the CBM on the Flowgate during that period

TRM_i is the impact of the TRM on the Flowgate during that period

$Postbacks_{Fi}$ are changes to firm AFC due to a change in the use of Transmission Service for that period

$Counterflows_{Fi}$ are adjustments to firm AFC due to power flows in the opposite direction of the Flowgate

9.2. Non-Firm AFC Calculations

In accordance with the MOD-030 reliability standard, the following equation is employed in calculating non-firm AFC:

$$AFC_{NF} = TFC - ETC_{Fi} - ETC_{NFi} - CBM_{Si} - TRM_{Ui} + Postbacks_{NFi} + Counterflows_{NFi}$$

Where:

AFC_{NF} is the non-firm AFC for the Flowgate for that period

TFC is the Total Flowgate Capability of the Flowgate

ETC_{Fi} is the sum of the impacts of existing firm Transmission Service commitments for the Flowgate during that period.

ETC_{NFi} is the sum of the impacts of existing non-firm Transmission Service commitments for the Flowgate during that period

CBM_{Si} is the impact of any CBM schedules on the Flowgate during that period

TRM_{Ui} is the impact of the unreleased TRM on the Flowgate during that period

$Postbacks_{NFi}$ are changes to non-firm AFC due to a change in the use of Transmission Service for that period

$Counterflows_{NFi}$ are adjustments to non-firm AFC due to power flows in

the opposite direction of the Flowgate

9.3. Total Flowgate Capability

Tapoco utilizes summer and winter facility ratings. As such, TFCs used in the ATC calculation will reflect these seasonal ratings. In instances where there is a difference in derived limits the most limiting parameter is used when determining TFC.

TFCs will be established at least once per calendar year. If notified of a change in the facility rating by the Transmission Owner that would affect the TFC of a Flowgate used in the AFC process, the TFC will be updated within seven calendar days of the notification.

9.4. Existing Transmission Commitments

Flow impacts from committed uses of a TSP's transmission system are considered in the AFC calculation as ETC. For both firm and non-firm, ETC contains two major components: ETC_{model} and ETC_{AFC}. ETC_{model} is the impact of ETC accounted for in the model building process, and ETC_{AFC} is the impact of ETC accounted for in the AFC calculation process. Processes are in place to ensure that no double counting takes place between transmission commitment impacts accounted for in ETC_{model} and transmission commitment impacts accounted for in ETC_{AFC}.

$$ETC = ETC_{model} + ETC_{AFC}$$

9.4.1. ETC_{model} - All Horizons

For firm and non-firm AFC calculations in all horizons, the base flows that are calculated from models created in the model building process are synonymous with ETC_{model}. ETC_{model} is calculated using the following:

1. The impacts of generation to load for the Tapoco TSP area. These values are calculated from:
    a. Load forecast for the time period being calculated, and
    b. Unit commitment and generation block dispatch, including all designated network resources needed to meet the forecast load.

2. The impact of generation to load for adjacent TSP areas. These values are calculated from:

    a. Load forecast for the time period being calculated, and

    b. Unit commitment and generation block dispatch.

3. The impact of generation to load for all other TSP areas. These values are calculated from the seasonal peak load forecast included in the Multiregional Modeling Working Group (MMWG) models, Near-Term Study Group (NTSG) models, or IDC models.

4. The impact of firm Network Integration Transmission Service (NITS) modeled in the starting point case for all BA Areas in the transmission model.

5. The impact of confirmed firm Point-to-Point (PTP) Transmission Service that are modeled in the starting point case for all BA Areas in the transmission model.

6. The impact of any grandfathered firm obligations that are modeled in the starting point case for all BA Areas in the transmission model.

7. Non-firm hourly AFC calculations in the operating horizon include the additional component of tag impacts from Tag Dump. Tag impacts include confirmed tags from the Tapoco TSP area and adjacent TSP areas and are filtered to ensure that no double counting takes place between the reservation impacts and tag impacts in the model.

9.4.2. Firm ETC_{AFC-Fi} - All Horizons

For firm AFC calculations in all defined horizons, the remaining ETC impacts are captured by ETC_{AFC-Fi} in the AFC calculation process. ETC_{AFC-Fi} is calculated using the following:

1. The impact of firm NITS for the Tapoco TSP area and adjacent TSP areas for which reservations are exchanged and which are not included in the model. The reservations from

adjacent TSPs are scrubbed to ensure that no double counting takes place.

2. The impact of confirmed firm PTP Transmission Service expected to be scheduled for the Tapoco TSP area and adjacent TSP areas for which reservations are exchanged and which are not included in the model. The reservations from adjacent TSPs are scrubbed to ensure that no double counting takes place.

3. The impact of any grandfathered firm obligations expected to be scheduled or expected to flow for adjacent TSP areas for which reservations are exchanged and which are not included in the model. The reservations from adjacent TSPs are scrubbed to ensure that no double counting takes place.

9.4.3. Non-Firm $ETC_{AFC-NFi}$

9.4.3.1. Non-Firm $ETC_{AFC-NFi}$ - Operating Horizon

For non-firm AFC calculations in the operating horizon, $ETC_{AFC-NFi}$ = zero, i.e., there are no additional ETC impacts beyond what is included in the model. This approach effectively releases unscheduled firm transmission to the non-firm market.

9.4.3.2. Non-Firm $ETC_{AFC-NFi}$ - Planning and Study Horizons

$ETC_{NFi-AFC}$ in the planning and study horizons is calculated using the following:

1. The impact of non-firm NITS (secondary service) for the Tapoco TSP area and adjacent TSP areas for which reservations are exchanged. The reservations from adjacent TSPs are scrubbed to ensure that no double counting takes place.

2. The impact of confirmed non-firm PTP Transmission Service expected to be scheduled for the Tapoco TSP area and adjacent TSP areas for which reservations are exchanged. The reservations from adjacent TSPs are scrubbed to ensure that no double counting takes place.

3. The impact of any grandfathered non-firm obligations expected to be scheduled or expected to flow for adjacent TSP areas for which reservations are exchanged. The reservations from adjacent TSPs are scrubbed to ensure that no double counting takes place.

9.4.4. Transmission Service Request Rollover Rights Impact

Transmission Service reservations that have met the requirements for rollover service are considered as impact in the ETC_{AFC} calculation for the time periods when the rollover would occur.

9.5. Counter flows

When applying transmission reservation impacts in the opposite direction of flow on a Flowgate in the AFC calculations, counter flow assumptions are used. Counterflow impact percentages are defined for each Flowgate and address:

- Firm reservation counterflow impact on firm AFC calculations
- Firm reservation counterflow impact on non-firm AFC calculations
- Non-firm reservation counterflow impact on non-firm AFC calculations

Counterflow assumptions are based on operating experience of normal Flowgate flows. At times, a Flowgate may experience higher or lower than normal counterflows. If real-time or expected operating conditions change to the extent that higher or lower than normal counterflows are expected, the counterflow assumptions for the Flowgate can be changed to reflect the new conditions. Counterflow assumptions are reflected in the AFC process as a Flowgate attribute.

9.6. Post backs

The post back component of the AFC equation is implicit in the ETC_{AFC} component. Changes in reservation status are captured in the AFC Engine and are incorporated into the AFC values.

9.7. Capacity Benefit Margin (CBM)

Tapoco has not defined a need for CBM on any of its interfaces in the Operating, Planning, or Study Horizons. As such, the importing and exporting CBM on all interfaces is set to zero.

Tapoco does not address generation reliability assessments through the

utilization of CBM, so this document does not contain the methodology and assumptions for generation reliability requirements.

9.8. Transmission Reliability Margin

Tapoco's ATC Paths through the utilization of TRM, is based on the following methodology:

- Imports -TRM on ATC Paths sinking in the Tapoco Area from non-participating BA Areas is set to zero, until such time as contingency reserves are identified and contracts have been established for those interfaces.
- Exports -TRM on ATC Paths sourcing from the Tapoco Area to non-participating BA Areas is set to zero, until such time as contingency reserves are identified and contracts have been established for those interfaces.

ATC Calculation

10.1. Converting AFC to ATC

When converting AFCs to ATCs, the following equations are used:

$$ATC_{AFC} = \min(P)$$

$$P = \{PATC_1, PATC_2, \dots PATC_n\}$$

$$PATC_n = \frac{AFC_n}{DF_{np}}$$

Where:

ATC_{AFC} = the ATC derived from the AFC process

P = is the set of partial ATCs for all impacted Flowgates honored by Tapoco

$PATC_n$ = the partial ATC for a path relative to a Flowgate *n*

AFC_n = the AFC for Flowgate *n*

DF_{np} = the distribution factor for Flowgate *n* relative to path *p*

10.2. Contract Path Limit

The interface between Tapoco's transmission system and that of adjacent BA Areas is considered to be an import/export path. Each import and export path is associated with a Contract Path Limit. This Contract Path Limit is the minimum of:

- The sum of the ratings of the ties
- The maximum transfer expected to occur on the import or export path. This value is based on traditional transfer test levels. Tapoco's ATC calculation takes into consideration Contract Path Limits. This is accomplished by calculating Remaining Contract Path Capability (RCPC) for import and export paths in parallel with the AFC process. RCPC on import and export paths is calculated according to the following formula:

$$RCPC_p = Contract\ Path\ Limit_p - \sum Reservations\ or\ Schedules_p$$

Where:

RCPC$_p$ = The Remaining Contract Path Capability on import or export path *p*

Contract Path Limit$_p$ = The Contract Path Limit on import or export path *p*

Reservations or Schedules$_p$ = Reservations or Schedules (depending on the horizon) reserved or scheduled on import or export path *p*

RCPC for an import or export path is decremented based on the POR/POD of the reservation or schedule, and these reservations/schedules, whether firm or non-firm, are not netted. In other words, a reservation or schedule on the export path "Tapoco-to-Neighbor A" does not impact the RCPC for the import path "Neighbor A-to-Tapoco", and vice versa.

Pass-through reservations/schedules decrement two separate import/export paths - the import path from the POR and the export path to the POD. The RCPC used in the evaluation of a pass-through Transmission Service request is the lesser of the RCPC on the corresponding import and export path.

10.3. ATC on Posted Paths

When determining ATC $_{\text{posted path}}$, the following equation is used:

$$ATC_{posted\ path} = min[ATC_{AFC}, RCPC_p]$$

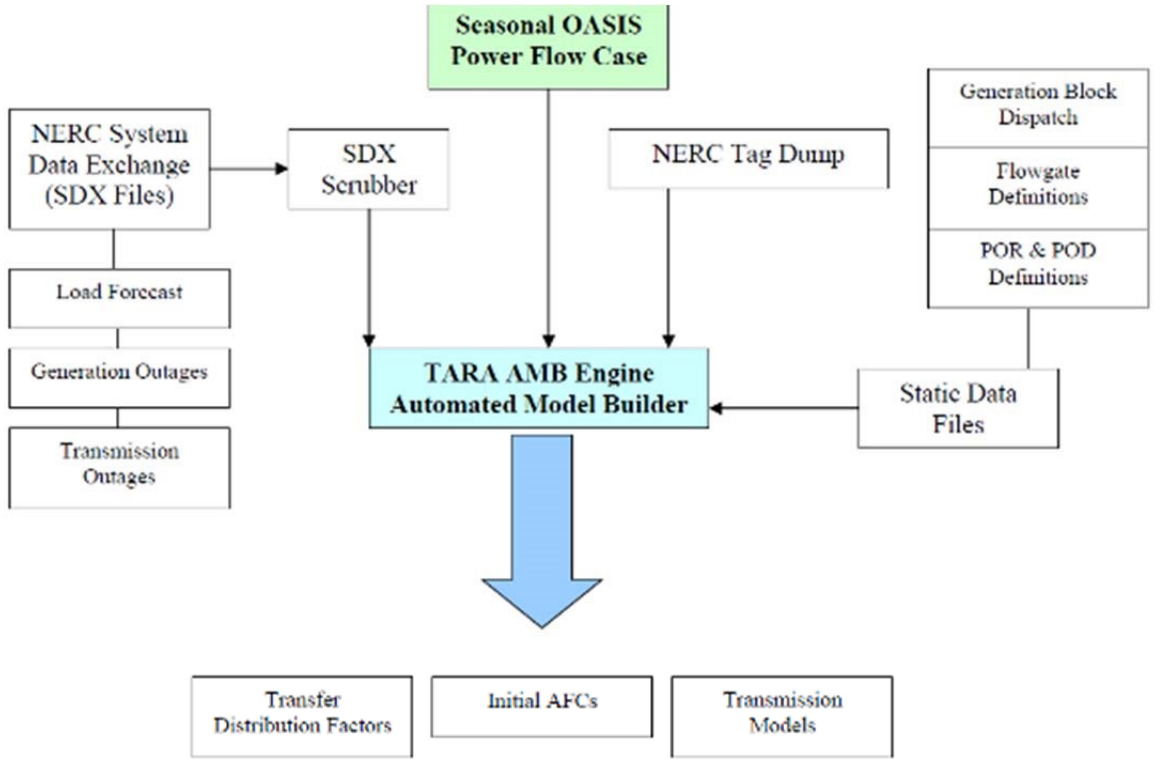
Where:

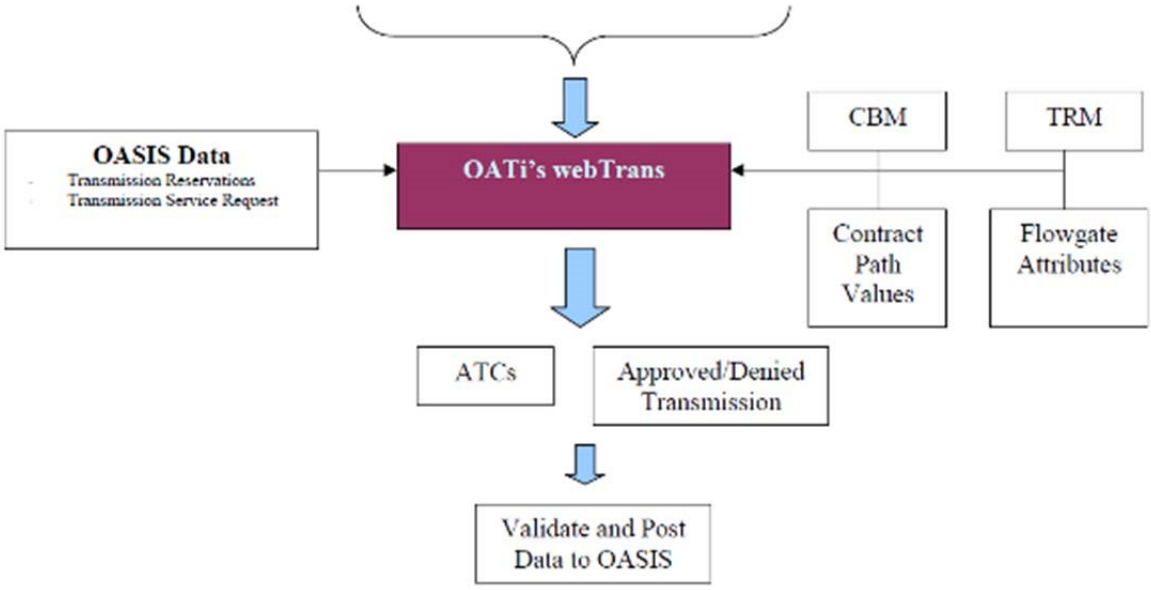
ATC $_{\text{posted path}}$ = the Available Transfer Capability for that path that is posted on OASIS

ATC_{AFC} = the ATC for that posted path derived from the AFC process

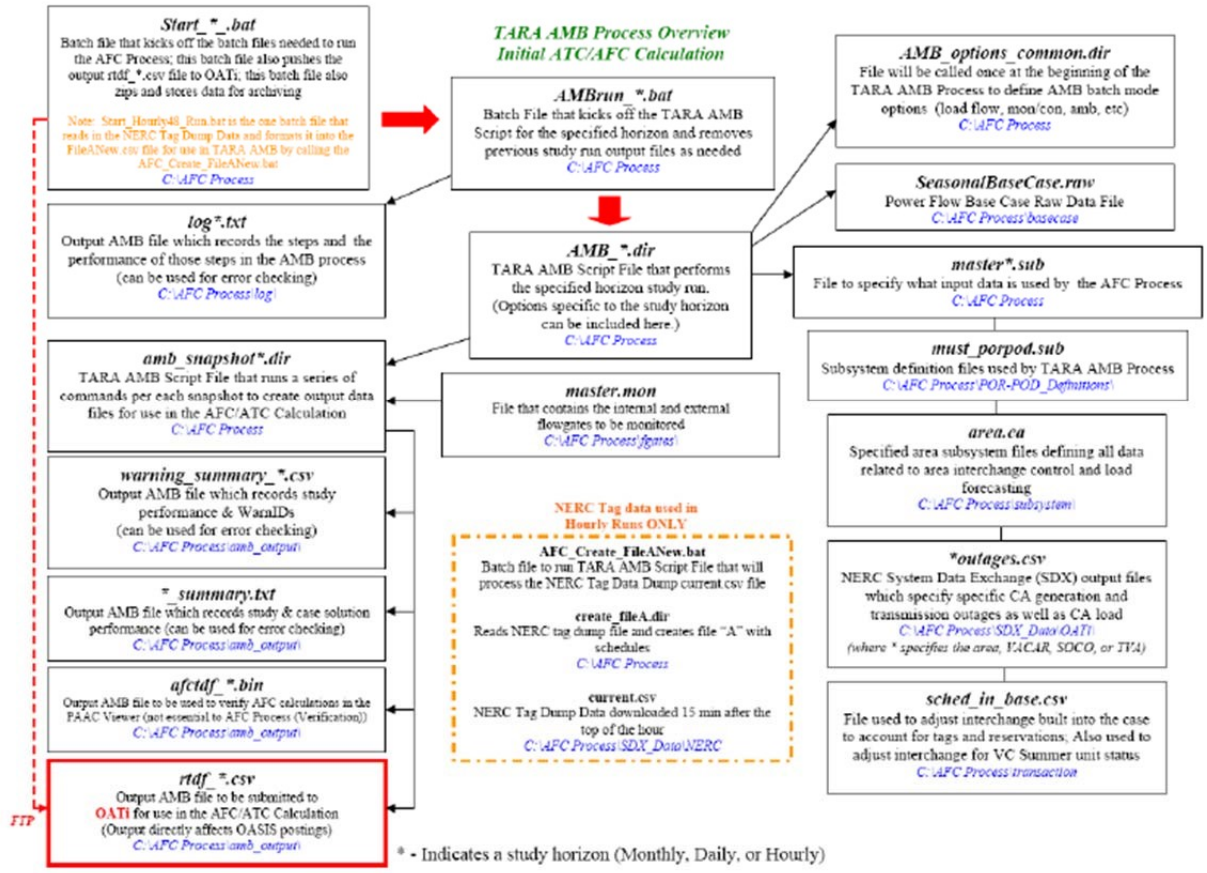
$RCPC_p$ = Remaining Contract Path Capability for the applicable import/export path *p*

Process Flow Diagrams




OASIS Data
Transmission Reservations
Transmission Service Request
OATi's webTrans
CBM
TRM
Contract Path Values
Flowgate Attributes
ATCs
Approved/Denied Transmission
Validate and Post Data to OASIS

Model Build Diagram



ATTACHMENT D

Methodology for Completing a System Impact Study

Upon receipt of a request for service pursuant to the applicable terms and conditions of this tariff, the Transmission Provider will complete a System Impact Study associated with the requested transmission service. The study procedure will use Good Utility Practice and the engineering and operating principles, standards, guidelines and criteria of the Transmission Provider, the applicable NERC Regional Entity, of which the Transmission Provider is a member, any entity of which the Transmission Provider is a member and is approved by the Commission to promulgate or apply regional or national planning and reliability standards (such as a Regional Transmission Group), NERC or any similar organization that may exist in the future of which the Transmission Provider is then a member.

The Transmission Provider shall use its sole discretion as to the scope, details and methods used to perform the Study. If necessary, a meeting between the Transmission Provider and applicant shall be held as soon as practical after execution of this Agreement to: (a) review the application and any known issue that could affect the scope of the study; and (b) develop a scope of study. The location of the meeting shall be at the Transmission Provider's offices unless another location is mutually agreed to.

Factors to be considered in determining the capacity availability on the Transmission Provider's Transmission System may include but not be limited to:

1. Steady state power flow study results;
2. Stability study results;
3. NERC, the applicable NERC Regional Entity, and the Transmission Provider's system design criteria;
4. Transmission capacity of the existing system;
5. Transmission capacity of the system after the request is added;
6. Reliability requirements of the Transmission Provider and applicant;
7. Type and terms of the service requested;
8. Capacity needed to meet current and reasonably forecasted load of Native Load Customers and Network Customers' loads; and
9. Capacity needed to meet contractual obligations that are expected before the requested Transmission Service begins.