TWG Recommendation
Approved by the TWG 09-26-07
Proposed New Tariff Attachment C
Replacing Current Attachment C

ATTACHMENT C
METHODOLOGY TO ASSESS AVAILABLE TRANSFER CAPABILITY

1. General

1.1. General Statement.

This Attachment C prescribes the specific methodology for calculating Available Transfer Capability ("ATC") posted on the Transmission Provider's OASIS, as required in Section 4 of this OATT. The Transmission Provider utilizes a Flowgate network response methodology for calculating ATC..

1.2. Definitions

The terms used in this Attachment C shall have the meanings as defined in this section 1.2 or as otherwise defined in this OATT.

1.2.1 Available Flowgate Capacity ("AFC")

The amount of transfer capability over a Flowgate that remains available for additional transmission service reservations above and beyond existing uses of that flowgate capacity.

1.2.2 Available Transfer Capability ("ATC")

A measure of the transfer capability remaining in the Transmission System for further commercial activity over and above already committed uses.

1.2.3 Base Loading

The determined loading on a Flowgate resulting from the net effect of modeled existing transmission service commitments for the purpose of serving firm network load from Network Resources ("NR") and impacts from existing OASIS commitments, including rollover rights as established in section 2.2 of the OATT.

1.2.4 Capacity Benefit Margin ("CBM")

The amount of transmission interconnection capacity reserved by load serving entities to ensure access to generation from interconnected systems to meet generation reliability requirements. A copy of "SPP TRM and CBM Practices" is available at http://sppoasis.spp.org/documents/swpp/transmission/cbm.html.

1.2.5 Contractual Limit

Contractual arrangements among two or more Transmission Owners that define transfer capability.

1.2.6 Flowgate

A selected individual or group of transmission elements or facilities acting as a proxy for the transmission network representing potential thermal, voltage, stability and contractual system constraints to power transfer. The process by which a Flowgate is selected is outlined in section 2.

1.2.7 Operating Procedure

Any policy, practice or system adjustment that may be automatically implemented, or manually implemented by the system operator within a specified time frame, to maintain the operational integrity of the interconnected electric systems. If an Operating Procedure is submitted to the Transmission Provider in writing and states that it is an unconditional action to implement the procedure without regard to economic impacts or existing transfers, then the Operating Procedure will be used to allow transfers to a higher level.

1.2.8 Outage Transfer Distribution Factor ("OTDF")

The percentage of a power transfer that flows through the monitored element of a Flowgate for a particular transfer when the contingency element of the Flowgate is out of service.

1.2.9 Power Transfer Distribution Factor ("PTDF")

The percentage of power transfer flowing through a Flowgate for a particular transfer when there are no contingencies.

1.2.10 SPP Reliability Coordination Area

The collection of generation, transmission, and load that operate within the boundaries of the Balancing Authority Areas for which SPP provides Reliability Coordination services.

1.2.11 Transfer Distribution Factor ("TDF")

A general term, which may refer to either PTDF or OTDF. The TDF represents the relationship between the participation adjustment of two areas and the Flowgates within the system.

1.2.12 Transmission Reliability Margin ("TRM")

The amount of Flowgate capacity necessary to ensure that the interconnected transmission network is secure under a reasonable range of uncertainties in system conditions. A copy of "SPP TRM and CBM Practices" is available at http://sppoasis.spp.org/documents/swpp/transmission/cbm.html.

1.2.13 TRM multipliers ("a" & "b")

"a"-multiplier; a factor between 0 and 1 indicating the amount of TRM not available for non-firm use during the Planning Horizon
"b"-multiplier; a factor between 0 and 1 indicating the amount of TRM not available for non-firm use during the Operating Horizon

2. Flowgates

2.1. Identification of Flowgates

A Flowgate is a selected power transmission element or group of elements that act as a proxy for the power transmission system capability and represent potential thermal, voltage, stability and/or contractual system limits to power transfer. There are two types of Flowgates:

OTDF Flowgate: Composed of usually two power transmission elements in which the loss of one (contingency element) can cause the other power transmission element (monitored element) to reach its emergency rating.

PTDF Flowgate: Composed of one or more power transmission elements in which the total pre-contingency flow over the flowgate cannot exceed a predetermined limit. Either with the power transmission system intact or with a contingency elsewhere, the Flowgate can be selected to represent a thermal, voltage, stability or contractual limit.

Once a set of limiting elements have been identified as potential transfer constraints they can be grouped with their related components and identified as unique Flowgates. The rating of the Flowgate is called the Total Flowgate Capacity (TFC) of the Flowgate and is monitored and used for evaluation of all viable transfers for commerce. The TFC values are consistent with those used for planning purposes.

2.2 Updating Flowgates

Updating the list of Flowgates is a continual process. Flowgate additions and deletions and changes in TFC are the result of studies, analyses, and operating experience of the Transmission Provider and its member Transmission Owners. At any time during the

year, the owner of transmission facilities may request that a Flowgate be added to protect equipment or maintain system reliability, regardless of the ownership of that Flowgate. Updating the Flowgate list may or may not require running a study. The following requirements apply when adding a Flowgate to the list:

- OTDF Flowgates may be added, provided that the contingency is valid, the TFC represents the total amount of power that can flow during the contingency without violating the emergency rating of the monitored facility, and no Operating Procedures apply to that Flowgate.

- PTDF Flowgates may be added, provided that it is a single facility Flowgate, the TFC is equal to the normal rating of the single facility, and no Operating Procedures apply to that Flowgate.

- Flowgates may be added when required to maintain system reliability.

2.3 Total Flowgate Capacity

TFC is the mega-watt flow limit of the monitored element(s) of a Flowgate. It shall be equal to the lesser of the following:

- Thermal limits under normal operating conditions or linked contingency events,
- Voltage limits under normal operating conditions or linked contingency events,
- Stability limits under normal operating conditions or linked contingency events, and
- Contractual limits.

3. ATC Calculations

3.1 ATC Mathematical Equations.

The following equations are used in calculating ATC:

3.1.1 Firm Existing Transmission Commitments (Firm ETC)[1]

Operating Horizon

Firm ETC = 0

[1] Applicable pre-emption requirements of lower priority service types will be considered when evaluating requests for transmission service. Impacts resulting from queued Study reservations will be applied according to priority when evaluating requests for transmission service.

Planning Horizon

Firm ETC = (Impacts of NR serving load within the same Balancing Authority Area) + (Σ Positive Impacts due to Firm OASIS Commitments, Confirmed, Accepted, and Study) - (Σ Counter Impacts > 3% due to Confirmed NR OASIS Commitments)

Study Horizon

Firm ETC = (Impacts of NR serving load within the same Balancing Authority Area) + (Σ Positive Impacts > 3% due to Firm OASIS Commitments, Confirmed, Accepted, and Study)

3.1.2 Non-Firm Existing Transmission Commitments (Non-Firm ETC)

Operating Horizon

Non-Firm ETC = (Impacts of NR serving load within the same Balancing Authority Area) + (Σ Positive and Counter Impacts due to Firm and Non-Firm Schedules) + (Σ Positive Impacts > 3% due to Non-Firm OASIS Commitments, Confirmed, Accepted and Study that have not been scheduled)

Planning Horizon

Non-Firm ETC = (Impacts of NR serving load within the same Balancing Authority Area) + (Σ Positive Impacts due to Firm and Non-Firm OASIS Commitments, Confirmed, Accepted, and Study) - (Σ 50% of Counter Impacts due to Confirmed and Accepted Firm OASIS Commitments)

Study Horizon

Non-Firm ETC = (Impacts of NR serving load within the same Balancing Authority Area) + (Σ Positive Impacts due to Firm and Non-Firm OASIS Commitments, Confirmed, Accepted, and Study)

3.1.3 Firm AFC:

- Firm AFC = (TFC) – (TRM) – (CBM) – (Firm ETC)

3.1.4 Non-Firm AFC (Operating Horizon):

- Non-Firm AFC = (TFC) – (b*TRM) – (CBM) – (Non-Firm ETC)

3.1.5 Non-Firm AFC (Planning and Study Horizons):

• Non-Firm AFC = (TFC) – (a*TRM) – (CBM) – (Non-Firm ETC)

3.1.6 Firm ATC:

• Firm ATC = Most limiting value from associated Flowgates = Min {Firm AFC/TDF of appropriate path}

3.1.7 Non-Firm ATC:

• Non-Firm ATC = Most limiting value from associated Flowgates = Min {Non-Firm AFC, TDF of appropriate path}

3.2 AFC Calculation Horizons

AFC and ATC values are calculated for three different time periods:

- Operating Horizon, including all hours of the current day (Day 1), and after 12:00 p.m., all hours of the next day (Day 2);
- Planning Horizon, which extends from the end of the Operating Horizon through the thirty-first day (Day 31)
- Study Horizon, which extends from the end of the Planning Horizon through the sixteenth month (month 16).

OASIS Automation calculates both Firm and Non-Firm AFC for all three Horizons.

4. Base Case Models

The AFC process generates a base case model that simulates anticipated system conditions. The base system conditions include projected load, generation dispatch, system configuration/outages, and base flow transactions. The AFC calculation of the Operating and Planning Horizon are performed by the SPP EMS Real-Time Response Factor Calculator (RTRFCALC) applications in combination with OASIS Automation. OASIS Automation receives the base flows and TFC for all Flowgates as well as the TDFs for all paths from RTRFCALC.

Model base flows provide the basis for which to begin determination of AFC. However, there are many transactions within the monthly models that are duplicated on the OASIS. A record of the network model flows of each Flowgate as found in the solved network models is used as a beginning point to account for impacts of base case transactions and existing commitments.

The impacts on Flowgates due to transactions outside the purpose of representing Designated Resource exchange is removed by applying the TDFs determined to each transaction identified in the base case. In addition to adjusting the model flow in this manner, positive and counter impacts of existing OASIS commitments is applied according to the type of Base Loading (Firm or Non-Firm) under consideration. 50% of counter impacts resulting from firm Confirmed reservations act to reduce the Non-Firm Base Loading. This process establishes the Base Loading expected with each control area serving its Network Load.

The base flows are based on AC power flow calculations performed by RTRFCALC using the following data:

- Network topology
- Hourly load forecast data of the Balancing Authority Areas
- Net interchange of the Balancing Authority Areas
- Unit dispatch data

4.1 Operating Horizon

The AFC calculations of the Operating and Planning Horizon (192 time points) are performed by RTRFCALC in combination with OASIS Automation.

OASIS Automation receives the following information from RTRFCALC:

- base flows for all Flowgates,
- TDFs for all paths, and
- TFC values for all Flowgates.

The base flows are the product of the AC powerflow calculations performed by RTRFCALC using following data:

4.1.1 Network Topology

Network topology is provided by the State Estimator and adjusted with hour to hour outage data of generators, transmission lines and transformers. Such outage data shall be as submitted by Balancing Authorities within the SPP Reliability Coordination Area and approved by the Reliability Coordinator. The Transmission Provider shall also include outage data from neighboring Reliability Coordinators that is available through NERC System Data Exchange (SDX).

4.1.2 Load Forecast

The hourly load forecast data (for day 1 – day 7) is created by the Transmission Provider for the State Estimator model from the short-term and mid-term load forecast tools that

use weather data from weather stations spread over the Transmission System and historical actual load data received from Balancing Authorities within the SPP Reliability Coordination Area. The Transmission Provider also includes load forecast data from neighboring Reliability Coordinators that is available through NERC SDX. The Transmission Provider derives load forecast data for day 8 – day 31 from the data of day 1 – day 7 by applying a factor that represents an historical increase or decrease of load on weekly basis during the year.

4.1.3 Net Interchange

The net interchange of the Balancing Authority Areas that are part of the State Estimator Model is based on the existing schedules at the time the RTRFCALC application perform its hourly Operating Horizon run (at xx.40). The schedule data is retrieved from NERC Tagdump and from SPP's scheduling system (RTOSS).

4.1.4 Unit Dispatch

RTRFCALC utilizes unit dispatch data for all units of the Balancing Authority Areas within the Transmission System and for the Balancing Authority Areas adjacent to the Transmission System. The unit dispatch data of commonly dispatched units of a Balancing Authority Area is based on real time behavior of the units in the last 3 weeks. The unit dispatch data of units not commonly dispatched with the other units of a Balancing Authority Area, is based on the Firm confirmed reservations that have the units' zone name identified as the source on the reservations.

4.2 Planning Horizon

The AFC calculations of the Operating and Planning Horizon (192 time points) are performed by RTRFCALC application in combination with OASIS Automation.

OASIS Automation receives the following information from RTRFCALC:

- base flows for all Flowgates,
- TDFs for all paths, and
- TFC values for all Flowgates.

The base flows are a product of the AC power flow calculations performed by RTRFCALC using following data:

4.2.1 Network Topology

Network topology is provided by the State Estimator and adjusted with hour to hour outage data of generators, transmission lines and transformers. Such outage data shall be as submitted by Transmission Operators and Generation Operators that are within the

SPP Reliability Coordination Area and approved by the Reliability Coordinator. The Transmission Provider shall also include outage data from neighboring Reliability Coordinators that is available through NERC SDX.

4.2.2 Load Forecast

The hourly load forecast data (for day 1 – day 7) is created by the Transmission Provider for the State Estimator from the short-term and mid-term load forecast tools that use weather data from weather stations spread over the Transmission System and historical actual load data received from Transmission Operators within the SPP Reliability Coordination Area. The Transmission Provider also includes load forecast data from neighboring Reliability Coordinators that is available through NERC SDX. The Transmission Provider derives load forecast data for day 8 – day 31 from the data of day 1 – day 7 by applying a factor that represents an historical increase or decrease of load on weekly basis during the year.

4.2.3 Net Interchange

The net interchange of the Balancing Authority Areas that are part of the State Estimator Model is based on the existing confirmed and accepted reservations (Firm plus Non-Firm) at the time the RTRFCALC application performs its Planning Horizon run (4 times a day: approximately midnight, 5AM, 8AM, 4PM) . The reservation data is retrieved from the Transmission Provider's OASIS. Reservations of other Transmission Providers can be included by adding them to an OASIS Automation configuration file.

4.2.4 Unit Dispatch

RTRFCALC utilizes unit dispatch data for all units of the Balancing Authority Areas within the Transmission System and for the Balancing Authority Areas adjacent to the Transmission System. The unit dispatch data of commonly dispatched units of a Balancing Authority Area is based on real time behavior of the units in the last 3 weeks. The unit dispatch data of units not commonly dispatched with the other units of a Balancing Authority Area is based on the Firm confirmed reservations that have the units' zone identified as the source on the reservations.

4.3 Study Horizon

The AFC calculations of the Study Horizon (15 Monthly values for Month 2 – Month 16) are performed by offline power flow calculations that make use of off line planning models. OASIS Automation receives the base flows from those off line power flow calculations for all Flowgates and the TDFs for all paths. The following data is used by the off line planning models:

4.3.1 Network Topology

Network topology is provided by the posted MDWG planning models and adjusted for outages of generators, transmission lines and transformers. Such outage data shall be as submitted by Transmission Operators and Generation Operators that are within the SPP Reliability Coordination Area and approved by the Reliability Coordinator. The Transmission Provider also includes outage data from neighboring Reliability Coordinators that is available through NERC SDX. The Transmission Provider considers approved planned outages lines and generators which are active on 15th of the month and last more than 15 days.

4.3.2 Load Forecast

The Transmission Provider utilizes monthly forecast data from the EIA411 – 2007 Report. For Balancing Authority Areas not included in the EIA411 – 2007 Report, the Transmission Provider uses forecast data that is available through NERC SDX.

4.3.3 Net Interchange

Initially, the offline planning model assumes net interchange of the Balancing Authority Areas is 0, meaning all Balancing Authority Areas are supplying their native load. If a Balancing Authority Area has a confirmed network reservation from a NR outside the Balancing Authority Area boundary, that reservation is incorporated into the net interchange of both Balancing Authority Areas. That particular network reservation will be added to the exclude file of OASIS Automation to prevent double counting of impacts.

4.3.4 Unit Dispatch

The Transmission Provider's planning model assumes merit order dispatch for all units of the Balancing Authority Areas within the Transmission System and for Balancing Authority Areas adjacent to the Transmission System. The units that are not commonly dispatched with the other units of a Balancing Authority Area, are assigned a 0 MW generation level.

4.4 Exclusion of Reservations in the Calculations of AFC Values

The Transmission Provider shall exclude or limit certain reservations under the following conditions:

- If total sum of reservations (Confirmed, Accepted, Study) impacting a specific corridor exceeds the total capacity of the corridor,
- If total sum of reservations (Confirmed, Accepted, Study) sinking in a Balancing Authority Area exceeds the total load of the Balancing Authority Area,

- If total sum of reservations (Confirmed, Accepted, Study) sourcing from a group of commonly dispatched units exceeds the total available generation capacity of that group of units.
- If the reservation is a network reservation from a DR outside the Balancing Authority Area boundary and that particular reservation is already included in the base flow calculations of the Study Horizon.

4.5 Resynchronization of Base Loading Values

The Transmission Provider uses OASIS Automation to evaluate Transmission Service requests that are submitted by Transmission Customers on OASIS. RTRFCALC recalculates the base flows and TDF values of the Operating Horizon every hour at xx.40 and the results are updated in OASIS Automation every hour at xx.55.

RTRFCALC recalculates the base flows and TDF values of the Planning Horizon 4 times a day (approximately midnight, 5 AM, 8 AM, 4 PM).

The base flows of the Study Horizon are calculated and updated in OASIS Automation once a month. Every month the Transmission Provider reviews the changes to outage data and, if necessary, recalculates the base flows for the Study Horizon to account for the changes in outage data.

Finally, OASIS Automation recalculates Firm and Non-Firm Base Loading upon each change of status of a reservation that impacts the relevant Base Loading. OASIS Automation makes adjustments to Firm and Non-Firm Base Loading upon the change of the following inputs:

For Firm ETC

• The transmission capability utilized in serving native load commitments, to include native load growth, load forecast error and losses not otherwise included in TRM or CBM.

• The impact of Firm Network Integration Transmission Service serving Network Load, to
include load forecast error and losses not otherwise included in TRM or CBM.

• The impact of grandfathered Firm Transmission Service agreements and bundled contracts for energy and transmission, where executed prior to the effective date of a Transmission Service Provider's OATT or Safe Harbor Tariff accepted by FERC.

• The impact of Firm Point-to-Point Transmission Service.

• The impact of maintaining roll-over rights for Firm Transmission Service contracts, five years or longer in duration, granting Transmission Customers the right of first refusal to take or continue to take Transmission Service from a Transmission Owner when the Transmission Customer's Transmission Service contract expires or is eligible for renewal.

• The impact of any Ancillary Services not otherwise included in CBM or TRM.

• Post-backs of redirected or released Firm services.

• The impact of counter-flows not otherwise accounted for in the AFC calculation.

• The impact of any other services, contracts, or agreements not specified above using transmission that serves native load or Firm Network Integration Transmission Service.

• The impact of any relevant third-party Firm Transmission Service that has not already been accounted for.

For Non-Firm ETC,

• The impact of Non-Firm Network Integration Transmission Service serving load, to include load forecast error and losses not otherwise included in TRM or CBM.

• The impact of grandfathered non-firm Transmission Service Agreements and bundled contracts for energy and transmission, where executed prior to the effective date of a Transmission Service Provider's OATT or Safe Harbor Tariff accepted by FERC.

• The impact of Non-firm Point-to-Point Transmission Service.

• The impact of counter flows not otherwise accounted for in the ATC calculation.

• Capacity utilized for TRM that the Transmission Service Provider has elected to be released for as Non-Firm ATC.

• Postbacks due to the reinstating of Firm from a "Firm-to-Non-Firm" redirect.

• The impact of any relevant third-party Non-Firm Transmission Service that has not already been accounted for.

5. TRM

The Transmission Provider calculates TRM for each Flowgate at least once a year and additionally, if needed. SPP utilizes TRM only to accommodate SPP's Operating Reserve Sharing Program. The TRM calculation for each Flowgate is designed to replicate the outage of the unit that has the largest impact on the Flowgate, assuming that the loss of generation is compensated by other generators that participate in the SPP Operating Reserve Sharing pool according to the reserve sharing rules and the capacity necessary to accommodate that compensation by other generators. The TRM calculations are performed with the off line planning model.

SPP withholds TRM in the Planning Horizon from Firm sales. TRM is sold as Non-Firm in Operating and Planning Horizons. OASIS Automation calculates ATC accordingly.

For external Flowgates monitored by the Transmission Provider, it will use appropriate CBM and TRM values provided and justified by the owner of the external Flowgate.

6. CBM

The Transmission Provider does not utilize CBM.

7. Coordination with Neighbors

The Transmission Provider shall make the following information available in a manner consistent with the rules as defined by NAESB and NERC. Additional data, that is considered to be proprietary, may be provided on a reciprocal basis.

7.1 Transmission Outage Schedules

The Transmission Provider will provide the projected status of transmission outage schedules above 230 kV over the next twelve (12) months or more if available. This data shall be updated no less than once daily for the full posting horizon and more often as required by system conditions. The data will include current, accurate and complete transmission facility maintenance schedules, including the "outage date" and "return date" of a transmission facility from a scheduled or forced outage. If the status of a particular transmission facility operating at voltages less than 230 kV is critical to the determination of TTC and ATC/AFC of the neighboring transmission provider, the status of this facility will also be provided.

7.2 Transmission Service Requests

(a) The Transmission Provider will make available, on an FTP site, actual transmission service request information for integration into the neighboring transmission provider's TTC/ATC/AFC determination process.

(b) The Transmission Provider will provide the neighboring transmission provider with the procedures developed and implemented to model requests for transmission service between the transmission providers.

(c) The Transmission provider shall also create, maintain and provide a list of reservations from its OASIS that should not be considered in ATC/AFC calculations. The reasons for these exceptions may include, for example, grandfathered agreements that grant access to more transmission than is necessary for the related generation capacity and unmatched partial path reservations.

7.3 Load Data.

The Transmission Provider shall provide peak load data for each period (*e.g.*, daily, weekly, and monthly). It shall either supply hourly load forecasts or daily peak load forecasts with a load profile for the next seven day horizon. All load forecasts will be provided on a Balancing Authority Area basis, with further granularity provided to reflect load forecasts by company within the Balancing Authority Area, as available.

7.4 Calculated Firm and Non-firm Available Flowgate Capability

The Transmission Provider will provide Firm and Non-firm AFC for all relevant flowgates.

7.5 Total Flowgate Capacity

The Transmission Provider will provide (seasonal, normal and emergency) TFCs as well as all limiting conditions (thermal, voltage, or stability). It will update this information in a timely manner as required by changes on the transmission system.

7.6 Identification of External Flowgates.

The Transmission Provider shall consider in its TTC and ATC/AFC determination process all external Flowgates: (i) that may initiate a TLR event, (ii) that are significantly impacted by the Transmission Provider's transactions, or (iii) as mutually agreed between the Transmission Provider and the neighboring transmission provider.

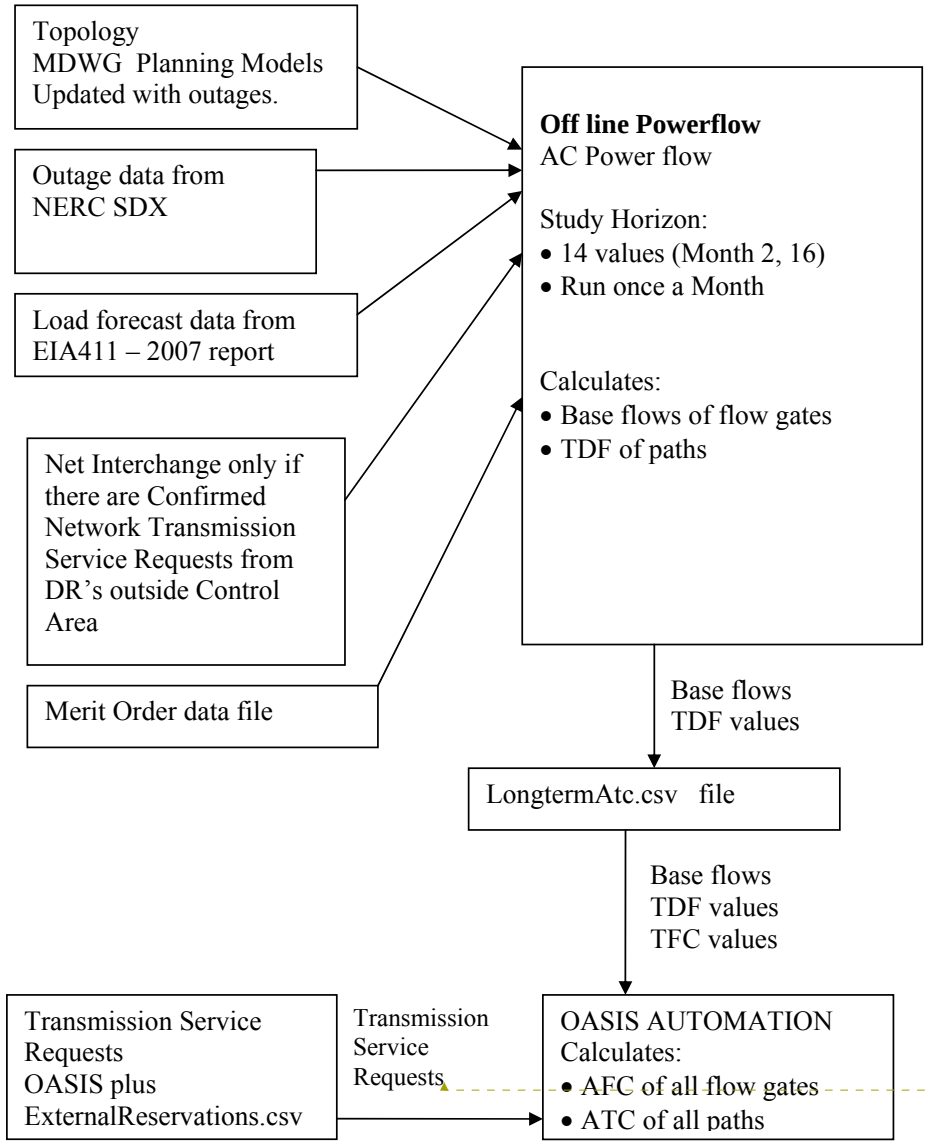
7.7 Configuration/Facility Changes (for power system model updates)

(a) The Transmission Provider shall, upon request, work with a neighboring transmission provider to address all significant system changes that need to be incorporated in the Transmission Provider's TTC/ATC/AFC calculation model.

(b) The Transmission Provider shall provide TTC/ATC/AFC calculation models of its transmission system as soon as mechanisms can be established to facilitate the neighboring transmission provider's request.

8. AFC Flowchart

Process Flow diagram Study Horizon



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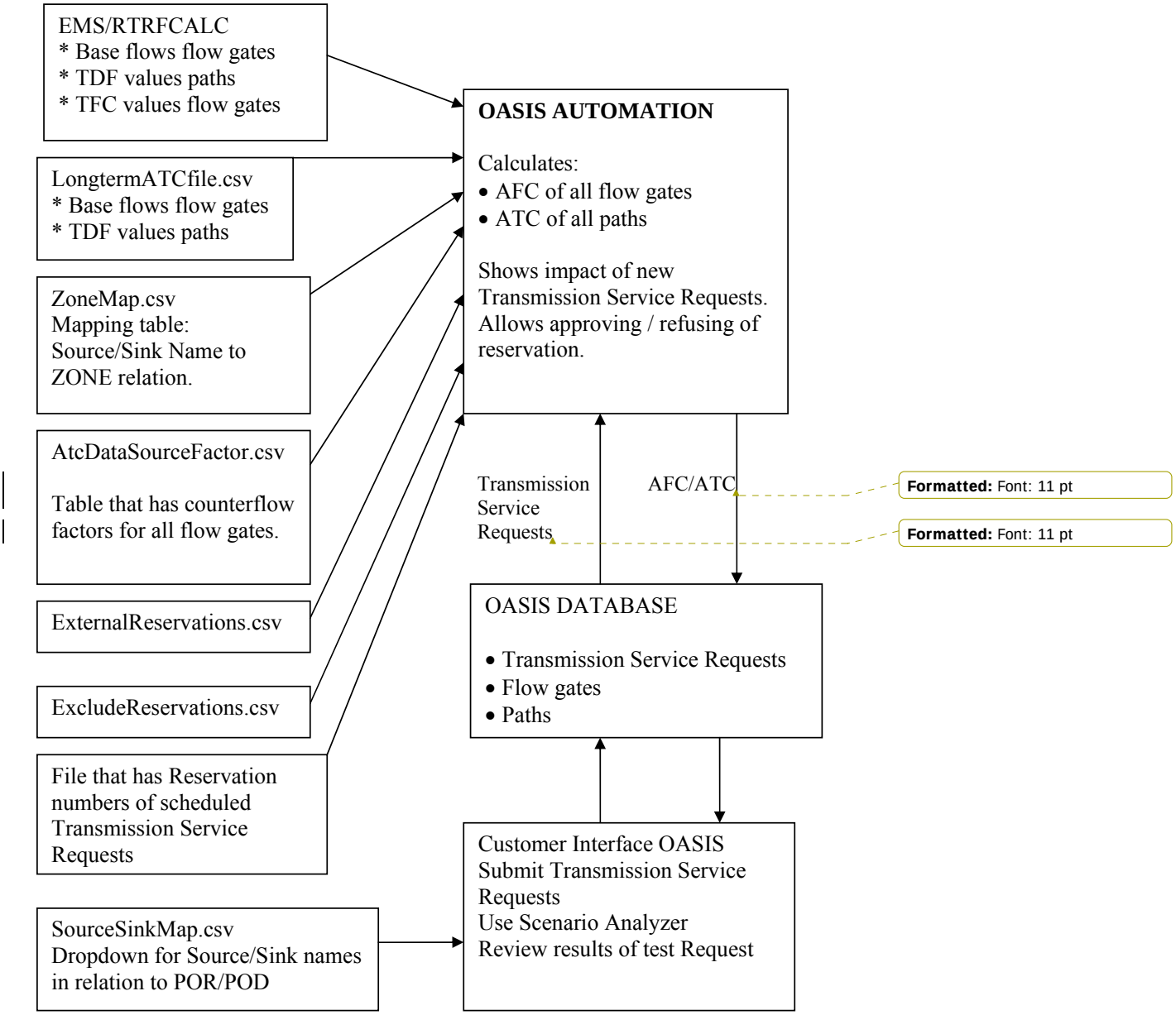
Process Diagram Oasis Automation



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Process diagram UC Application