Tampa Electric Company
Available Transfer Capability
Implementation Document (ATCID)
Effective Date April 1, 2011

Tampa Electric Company’s (TEC) ATCID is created in response to NERC reliability standard MOD-001-1 and MOD-028-1. The standards’ requirements are noted herein for reference.

MOD-001-1

R3. Each Transmission Service Provider shall prepare and keep current an Available Transfer Capability Implementation Document (ATCID) that includes, at a minimum, the following information: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

R3.1. Information describing how the selected methodology (or methodologies) has been implemented, in such detail that, given the same information used by the Transmission Service Provider, the results of the ATC or AFC calculations can be validated.

TEC uses the Area Interchange Methodology, in accordance with standard MOD-028. This methodology is described in Attachment C to the Company’s Open Access Transmission Tariff (“OATT”) and is posted on TEC’s OASIS. The methodology is implemented by the Florida Transmission Capability Determination Group (“FTCDG”), of which TEC is a member, using Open Access Technology, Inc.’s (“OATI”) webTrans ATC Module, the “Engine”. The FTTCS TTC/ATC Calculation Reference Document (“Reference Document”), fully describes the implementation of the methodology. Relevant parts of this document are attached. The algorithms used for the Engine’s ATC calculation are included in Mathematical Algorithm Used To Calculate Firm and Non-Firm ATC posted on TEC’s OASIS.

R3.2. A description of the manner in which the Transmission Service Provider will account for counterflows including:

3.2.1. How confirmed Transmission reservations, expected Interchange and internal counterflow are addressed in firm and non-firm ATC or AFC calculations.

3.2.2. A rationale for that accounting specified in R3.2.

Confirmed, long-term, firm transmission reservations, as well as firm contracted interchange transactions and internal Balancing Area flows resulting from expected load and generation dispatch levels, are included in the base models used to calculate ATC. Therefore, all flows and counterflows resulting from these items are reflected in the ATC calculations. Counterflows made available from short-term and non-firm transmission reservations are not reflected in posted ATC, due to the level of uncertainty associated with the scheduling of such reservations. However, any ATC made available from unscheduled reservations is released as non-firm ATC (posted back) in the Scheduling Horizon.
R3.3. The identity of the Transmission Operators and Transmission Service Providers from which the Transmission Service Provider receives data for use in calculating ATC or AFC.

Modeling data is provided by all registered Transmission Operators through the FRCC Planning Process. Outage data is received from all Transmission Service Providers through the Florida Transaction Management System (FTMS). These are shown in the NERC compliance registry, found on the NERC website.

R3.4. The identity of the Transmission Service Providers and Transmission Operators to which it provides data for use in calculating transfer or Flowgate capability.

TEC provides data to all of the entities listed in the response to R3.3.

R3.5. A description of the allocation processes listed below that are applicable to the Transmission Service Provider:

- Processes used to allocate transfer or Flowgate capability among multiple lines or sub-paths within a larger ATC Path or Flowgate.
  
  TEC does not allocate ATC within a larger path.

- Processes used to allocate transfer or Flowgate capabilities among multiple owners or users of an ATC Path or Flowgate.
  
  When a path has multiple owners, ATC is allocated in accordance with the ownership percentage.

- Processes used to allocate transfer or Flowgate capabilities between Transmission Service Providers to address issues such as forward looking congestion management and seams coordination.
  
  TEC has no instances where ATC is allocated among multiple TSPs except when there are multiple owners as discussed in the previous bullet.

R3.6. A description of how generation and transmission outages are considered in transfer or Flowgate capability calculations, including:

3.6.1. The criteria used to determine when an outage that is in effect part of a day impacts a daily calculation.

For the scheduling horizon, daily ATC is the minimum of all hours so a partial day outage will affect daily ATC for that day. In the planning horizon, only outages that impact the peak hour impact the daily ATC calculation.

3.6.2. The criteria used to determine when an outage that is in effect part of a month impacts a monthly calculation.

Monthly ATC is determined by the lowest day ATC. Thus, an outage that causes a single day to have a low ATC value will cause the monthly ATC to similarly have that value.
3.6.3. How outages from other Transmission Service Providers that cannot be mapped to the Transmission model used to calculate transfer or Flowgate capability are addressed.

The transmission model includes all of Florida and the SERC region. All relevant outages are mapped to the transmission model.

MOD-028-1

R1. Each Transmission Service Provider shall include in its Available Transfer Capability Implementation Document (ATCID), at a minimum, the following information relative to its methodology for determining Total Transfer Capability (TTC): [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

R1.1. Information describing how the selected methodology has been implemented, in such detail that, given the same information used by the Transmission Operator, the results of the TTC calculations can be validated.

See MOD-001-1 R3.1 (above)

R1.2. A description of the manner in which the Transmission Operator will account for Interchange Schedules in the calculation of TTC.

Long-term firm interchange is included in the TTC calculation and input to the process through “TSR List for Interchange” as described in the Reference Document.

R1.3. Any contractual obligations for allocation of TTC.

TEC’s only contractual obligation regarding allocation of TTC involves jointly owned facilities, as described in MOD-001-1 R3.5 (above).

R1.4. A description of the manner in which Contingencies are identified for use in the TTC process.

The contingency list used in the TTC process uses the same criteria as that used for FRCC Operations Planning studies. TEC’s entries are essentially all transmission facilities 100kV and above, and critical 69kV facilities as identified by FRCC as having an impact on the Bulk Electric System. Note that there are no 69kV facilities identified at this time.

R1.5. The following information on how source and sink for transmission service is accounted for in ATC calculations including:

See Reference Document, Service Point Definition, section 2.1.

1.5.1. Define if the source used for Available Transfer Capability (ATC) calculations is obtained from the source field or the Point of Receipt (POR) field of the transmission reservation

ATC is calculated using the Point of Receipt as shown in the Reference Document.
1.5.2. Define if the sink used for ATC calculations is obtained from the sink field or the Point of Delivery (POD) field of the transmission reservation.

ATC is calculated using the Point of Delivery as shown in the Reference Document.

1.5.3. The source/sink or POR/POD identification and mapping to the model.

List of identified POR/POD’s for which ATC is calculated. This is the same list as is in the model.

| PKU-FPC | POU-TEC | RECK-TEC | TEH-POU |
| PLK-FPC | FPC-PKU | SSO-PKU | TEC-FPC |
| POU-FPC | FPC-PLK | SSO-PLK | TEH-FPC |
| PKU-FPL | FPC-POU | SSO-POU | TEC-FPL |
| PLK-FPL | FPC-FPL | SSO-FPC | TEH-FPL |
| POU-FPL | FPC-TEC | SSO-FPL | RECK-SSO |
| PKU-SSO | VAN-TEC | SSO-TEC |
| PLK-SSO | FPL-PKU | RECK-PKU |
| POU-SSO | FPL-PLK | RECK-PLK |
| PKU-SSO | FPL-POU | RECK-POU |
| PLK-SSO | FPL-FPC | TEC-PKU |
| POU-SSO | FPL-TEC | TEC-PLK |
| PKU-TEC | RECK-FPC | TEC-POU |
| PLK-TEC | RECK-FPL | TEH-PLK |

1.5.4. If the Transmission Service Provider’s ATC calculation process involves a grouping of generation, the ATCID must identify how these generators participate in the group.

TEC uses models compiled by the FRCC for the ATC calculation process. Each generator is modeled individually and listed in the Generator Block and Priority spreadsheet, which is an input to the Engine and is discussed in the Reference Document. To the extent that multiple generators within an area are assigned the same block and priority, these generators could be considered grouped. They would participate in the group proportionally to their maximum output.
## Change/Reason Log

<table>
<thead>
<tr>
<th>Date</th>
<th>Summary of Change</th>
<th>Reason for Change</th>
<th>Changed By</th>
</tr>
</thead>
</table>
Excerpts from

FTTCS TTC/ATC Calculation Reference Document
2. Calculation Processes

2.1 TTC and ETC (Impact of Firm Transmission Service)

TTC and ETC (Impact of Firm Transmission Service) calculations take place at the frequency configured depending on the type of the selected calculation horizon. The following are the required inputs to the calculation of TTC and ETC (Impact of Firm Transmission Service):

1) FRCC Model (buses, loads, generators, branches, shunts, and any other devices or parameters defining the power system model).

2) List of Monitored Facilities: Transmission facilities where flows will be checked and for which MW/MVA limits are provided.

3) List of Contingency Branches: Branches whose outage impact is to be determined on the monitored facilities. All possible outages to all possible monitored facilities (usually known as N-1 security analysis). Some of the contingencies may be multiple branch outages to simulate multi-element outages and some of the event-based operating procedures.

4) List of all Paths wherein reservations can be made (typically BA-BA or CA-CA contract paths).

5) Balancing Area (BA) definitions in terms of network buses and associated participation factors.

6) Transmission and Generation Outage data.

7) Generation Dispatch priorities and Block Dispatch data.

8) List of all Interchange Transactions between all the given Paths and applicable to the times of the calculations for the effective horizon. These are used to compute the BA interchanges and also the base path ETC (Impact of Firm Transmission Service) values.

9) BA load demand in MW for all applicable periods of the effective horizon.
The outputs of the calculation consist of:

1) ITC between all the paths which is the BA-BA incremental transfer capability on top of the base case conditions. Two values of ITC will be computed: ITC corresponding to monitored Facility Rating B and ITC value corresponding to monitored facility Rating C. Only the latter is reported while the former is used in the calculation of the TRM value as described below.

2) ETC (Impact of Firm Transmission Service) between all the contract paths.

3) TTC between all the paths which is the sum of the ITC and the ETC (Impact of Firm Transmission Service). For the purpose of this document, the TTC terminology will be used in the remainder of the document in lieu of ITC.

4) TRM value for all contract paths. The TRM values are equal to the Difference of the ITC values for Rating C and the ITC values for Rating B.

TTC Calculation

The OATI webTrans FTCC module uses a Power Flow-Based methodology to compute TTC values. The TTC Calculator computes the Total Transfer Capacity in a Path. A Path, for the purposes of this calculation, is defined as a transfer path from a Source BA to a Sink BA.

To make the following description concrete, consider the situation where there are three BAs (A, B, C) connected among each other. The objective is to determine the Maximum Transfer of power between any two areas (transfer from A to B) such that there are no overloads in the Transmission System (or in a given subset of Monitored Branches in the Transmission System) even under the possibility of transmission contingencies in a specified set of contingencies (Contingency List).

The following are the TTCs which are calculated on each path for the Schedule Horizons:

- Scheduling Horizon (SCH): Compute hours 1-4. This computation is executed every hour.

- Operating Horizon (OP): Compute hours 5-72. This horizon computation takes place every hour.
- Hourly Short-Term Planning Horizon (STPH): Compute hours 73-168. This horizon computation takes place daily.

- Daily Short-Term Planning Horizon (STP): Compute days 8-395. This horizon will be computed weekly.

The following are the steps in the calculation:

1. Read the data from the database.
   
   a. **Model** (for example, the FRCC model) including network topology and transmission limits in all applicable facilities. The transmission limits are provided by the various Transmission Providers in the Florida Region and can be updated to reflect any outstanding conditions in the power system.

   b. **Service Points** (BA definition in terms of Network Buses). The service points define the Areas/Zones/Point of Receipt (POR) from which power can be extracted to be delivered to another Area/Zone/Point of Delivery (POD). In the example, A and B are Service Points.

   c. **List of Monitored and Contingency Branches.** The Monitored Branches (any branches of interest in the Florida Region) will be checked for overloads during the calculation of the TTC/ATC. The checks will include the possibility of contingencies as provided in the Contingency Branch List (any branches of interest in the Florida Region including external systems). Ratings A, B, and C will be selected according to the rules discussed in Sections 2 and 3.

   d. The BA interchange will be computed using the imported values in the Interchange data provided by Florida Transmission Capability Determination Group (FTCDG). The applicable values of interchanges are selected in based on the reference (FPL) load.

2. Read all **Generation and Transmission Outages** applicable to time t and update the state of the system to reflect these outages. This information is read per time period and will be used to update the model to reflect topology changes. Generation Outages include either full outages or partial outages (de-ratings). Transmission de-ratings are not part of outage data and need to be incorporated via changes to the limits of the
monitored facilities in Section 1.c above. Also, in this step the, Control Area (CA)/BA/Zone loads applicable to each step of a particular horizon are read.

3. Check the base power flow conditions against Rating A. Base power flow conditions are computed without the application of any contingencies and correspond to the pre-contingency flows in the monitored facilities. If monitored facility overloads are determined, the TTC will be calculated appropriately and it will be logged in the TTC Calculator. If the base case is not feasible (that is, there is already an overload in one or more monitored facilities without the creation of a transfer), the TTC is 0. The situation will be logged and the process terminated.

4. For time t loop over all valid pairs of Service Points A-B (here is where the calculation of period t TTC is made - the TTC will be the largest transfer that can be made between any pair of points until a Monitored Branch limit is violated given all possible contingencies.) The pairs of Service Points constitute the Source and Sink in a Transaction and are the POR and POD in a Contract Path TSR. The logic for this process is:

   a. Create a transfer of P MWs between the Source BA (A) and the Sink CA (B) in the contract path.

   b. Dispatch the generation in the Source BA for an increase of P MWs and in Sink BA for a decrease of P MWs. OATI uses Priority-based, Block-based, and Type-based dispatch. It is a full dispatch of the SP generation to meet the load plus interchange including the transfer. The dispatch can be applied to BAs with generation defined in terms of blocks, priority, and types for the whole operational range of the generators defined.

   c. Perform an N-1 security analysis using the given list of Monitored Branches and the list of Contingency branches. The transmission limits used here are the applicable limits based on date time and load level considerations as previously discussed. For the first pass of this process, use Rating B for limit checking. For the second pass through this process, use Rating C. During the limit checking, the distribution
factors (TDF)\(^1\) for a transaction between A and B for a monitored facility contingency pair will be computed and checked against a given percentage (typically 5% but may be set by the users according to their business practices). If the TDF is less than the threshold, the limits will be ignored and even if there is a violation of the limit (that is, the flow in the branch exceeds the MW capability of the line) it will not be considered as such. The TDFs will be computed on-the-fly using the appropriate topology and the applicable BA participation factors computed from the generation values obtained during the dispatch of generation in (b).

d. If there is at least one violation of a transmission limit (that is, the flow in the branch exceeds the applicable MW capability of the branch), the TTC between A and B is equal to the P MW transfer (NOTE: If no interchange reservations have been included, the result is the Incremental Transfer Capacity (ITC). The corresponding TTC is equal to the ITC plus the path ETC (Impact of Firm Transmission Service) computed from the interchange list used in 1.d above. The path ETC is the summation of the Area-Area interchange values in the interchange file.) Go to Step 5 below.

e. Increase the transfer by a delta-P MW amount and go to (b).

5. The above process is executed twice: First pass uses Rating C for monitored facility limit checking. This provides \(TTC_{RC}\). The second pass uses Rating B for monitored facility limit checking. This provides the \(TTC_{RB}\). The TRM is defined as:

\[
TRM = TTC_{RC} - TTC_{RB}
\]  

6. Record the results TTC, TRM, ETC (Impact of Firm Transmission Service), and the generation dispatch for all the Service Points (valid BA to BA pairings), along with the calculation binding constraint which will be the limiting element and associated contingency (typically a Monitored Branch/Contingency pair).

7. webTrans will incorporate the TTC values into the ATC calculation process and post applicable information to the OASIS.

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\(^1\) Transfer Distribution Factor (TDF) is the post-contingency per-unit change in flow in a branch for a transfer of 1 MW between areas A and B. That is, the TDF measures the impact of a transfer between a Source and a Sink control area on a transmission branch.
2.1.1 ETC (Impact of Firm Transmission Service) Calculation

The TTC Calculator will provide one component of the ETC (Impact of Firm Transmission Service) based on the interchange list that are included in the base model. The ETC (Impact of Firm Transmission Service) values for each segment computed by the TTC Calculator will be the summation of the TSR Interchange List on a direct path basis. MW levels for the TSRs are selected based on a given reference (FPL) load level.

2.1.2 TRM Calculation

As described above in Section 5.1.2 Step (5), the TRM is simply obtained as the difference of the TTC values computed from the two passes over the calculation. The TRM is given by Eq. (1) above where $TTC_{RB}$ is the TTC computed using Rating B, and $TTC_{RC}$ is the TTC computed using Rating C. This is the value of TRM provided from the engine to webTrans. Additionally, the Transmission Provider may provide an additional TRM value for the path which will be added to the system computed TRM value.

2.1.3 Base ATC Calculation

Given the TTC, TRM, CBM and the committed used, the ATC between any two areas A-B is then given by:

$$ATC^{A-B} = TTC^{A-B} - TRM^{A-B} - CBM^{A-B} - Committed\ Used^{A-B}$$

The above formula is an example of how the ATC can be computed. webTrans features a general and configurable way of setting up the calculations for ATC and other parameters and therefore can be adapted to TP requirements. The formula applies to both instances, Firm ATC and Non-Firm ATC, but using the corresponding Firm and Non-Firm components.

2.2 TDF Calculator

TDF calculations (for area flow path) take place at the frequency indicated in Section 2 depending on the type of horizon. The following are the given inputs obtained from the database:

1) FRCC Model.

2) Flow path definitions.
3) Service Point definitions.

The outputs of this calculation consist of the TDFs with respect to reference for all area flow paths and for all service points (matrix of size number of Service Points times Number of area flow paths).

All the outputs of this process are transferred to the ATC calculation process, and if a Transmission Provider configures the use of the data in the ATC calculation, it will be used.
3. ATC Calculation

The TTC and ATC data management component of webTrans manages the ATC calculation, TTC adjustment, and posting to OASIS. The process incorporates inputs from Transmission Provider data sources to derive the ATC available on Transmission Provider transmission paths.

3.1 Transmission Path and Segment Data Model

The transmission ATC data is managed on a segment basis in webTrans. One or more segments are linked to a single transmission path that is posted on OASIS. This data model provides the capability to have multiple OASIS paths impact a common transmission segment for ATC calculations. This supports the ‘overlapping’ path concept common in many providers’ Transmission System analysis. The transmission path capability, ATC, posted on OASIS is the minimum of the ATC of any of its segments.

Transmission cut-planes can be represented in this data model through the modeling of a common pseudo-segment associated with each transmission path. This is explained in the following example:

Three separate transmission paths have individual transmission capability, with a limit on the total capability that can be supported over the three paths. Through the modeling of the pseudo-segment with the overall limit, the impact of a reservation across any of the three paths will also impact the overall path capability.

The example uses three paths, with capability of 700, 800, and 900. The overall cut-plane limit is 1000 MW. Each of the paths is represented with three segments with the middle segment being common on all transmission paths. The common segment is segment X-Z and its TTC is 1000 MW.

<table>
<thead>
<tr>
<th>Path ATC</th>
<th>Segment 1 ATC</th>
<th>Segment 2 ATC</th>
<th>Segment 3 ATC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path 1 A-R 700 MW</td>
<td>A-X: 700 MW</td>
<td>X-Z: 1000 MW</td>
<td>Z-R: 700 MW</td>
</tr>
<tr>
<td>Path 2 B-S 800 MW</td>
<td>B-X: 800 MW</td>
<td>X-Z: 1000 MW</td>
<td>Z-S: 800 MW</td>
</tr>
<tr>
<td>Path 3 C-T 900 MW</td>
<td>C-X: 900 MW</td>
<td>X-Z: 1000 MW</td>
<td>Z-T: 900 MW</td>
</tr>
</tbody>
</table>
When a reservation is submitted across Path 3 C-T for 800 MW, the resulting ATC for each path and their segments is:

<table>
<thead>
<tr>
<th>Path ATC</th>
<th>Segment 1 ATC</th>
<th>Segment 2 ATC</th>
<th>Segment 3 ATC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path 1 A - R 200 MW</td>
<td>A-X: 700 MW</td>
<td>X-Z: 200 MW</td>
<td>Z-R: 700 MW</td>
</tr>
<tr>
<td>Path 2 B - S 200 MW</td>
<td>B-X: 800 MW</td>
<td>X-Z: 200 MW</td>
<td>Z-S: 800 MW</td>
</tr>
<tr>
<td>Path 3 C - T 100 MW</td>
<td>C-X: 100 MW</td>
<td>X-Z: 200 MW</td>
<td>Z-T: 100 MW</td>
</tr>
</tbody>
</table>

The webTrans and webOASIS Systems also support multiple transmission paths between the same POR and POD. The system will provide the ATC calculation from these transmission reservations based on the path of the reservation.

### 3.2 TTC Data Maintenance

TTC, CBM, TRM, TRM Coefficient, CBM Coefficient, and CU data can also be manually entered by transmission operations personnel or uploaded programmatically through a file interface. In this case the TTC data is entered on a directional segment basis for each time period from the TTC Calculator process. Updates to the TTC data may be entered at any time through the user interface or through the programmatic file interface. TTC updates automatically roll into ATC calculations.

### 3.3 ATC Calculation

The ATC calculation process is based on a periodic ‘initialization’ calculation and event driven ‘decrement’ (or increment) adjustments. The initialization calculation computes the ATC values based on the TTC, Capacity Benefit Margin (CBM), TRM, TRM Coefficient, Committed Use (CU), and the impact of reservations and e-Tags. As new transmission requests are confirmed, the ATC values computed in the initialization process are adjusted by the ‘decrement’ process. Each Transmission Provider can configure various ATC formulas as business requirements dictate. These include: Long-Term Firm, Firm, Non-Firm, and Secondary Non-Firm. The configurable options for inclusion in these ATC formulae are impacts from: transmission reservations, e-Tags, grandfathered reservations (off-OASIS), Committed Uses, Set-a-Sides, counter-flow impacts, and dependent segment impacts. Through the configuration of the ATC formula, Transmission Providers can also repost unused capacity.
The ATCs are calculated on each path for the following default periods based on the standard FERC requirements:

- Monthly for the current month and next 12 months.
- Daily for the next 30 days.
- Hourly for the next 168 hours.

Monthly ATCs are represented by the day with the minimum ATC for the month. Daily ATCs are represented by the hour with the minimum ATC for the day (Days 1-7).

The webTrans System supports three distinct time horizons for the purpose of calculating ATCs. The ATC formula can be configured independently for each time horizon. The three time horizons are the Scheduling, Operating, and Planning horizons. The time period of each horizon can be configured according to the Transmission Provider’s business practices. Typical time periods are: Scheduling (current - 3 hours), Operating (3 hours - end of next day), and Planning (end of next day - 3 years).

The ATC calculation is made for each time period according to the formula configuration. In general, each calculation is based on arithmetic application of each impact selected in the formulae as noted below:

**Firm ATC** = TTC - CU - TRM - CBM - MI - ΣATC Impacts configured in formula.

**Non-Firm ATC** = TTC - CU - TRM*Coef - MI - Σ ATC Impacts configured in formula.

The TSRs are included in the ATC calculation if their status matches a status value that is configured to impact the ATC. [Note: Typically Transmission Service Requests (TSRs) are included if their status is Confirmed or Accepted].

When new reservations are received by webTrans, the ATC evaluation is performed. If the amount of ATC on the affected path(s) is less than the capacity on the request, the ATC check will fail. When a transmission request is Accepted or Confirmed, the ATC formula is recalculated for the path segments based on its impact.
3.4 ATC Impact Calculation Based on e-Tag Data

The webTrans ATC calculation supports an impact calculation based on the e-Tag data. The following method is used to determine which segments are impacted.

1) Use the path on the specified OASIS reservation.

2) If no reservation exists, then use the e-Tag Path.
   a. Map to webTrans Path definition first.
   b. Map to webTrans Segment definition if no Path is found.

In the event the methodology specified above returns the same segment on multiple occurrences, the impact will only be applied once.

3.5 ATC Path Dependencies and Counter Schedule Impacts

Transmission path dependencies are included in the ATC calculation and reservation evaluation processes when a path dependency has been established. The path dependencies are configured through the user interface to allow a path impact to be reflected on other dependent paths.

Counter schedule impacts can be used to increase the transmission availability. For each time horizon, a percentage of counter schedule impact can be specified on each path. The ATC is then calculated using the counter schedule impact on the path to increase the amount of capacity posted for sale. This credit can be capped to prevent unreasonable amounts of ATC to be generated.