Volume

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MAPP POLICIES AND PROCEDURES FOR TRANSMISSION OPERATIONS:

Appendix F: MAPP Regional AFC/ATC/ASTFC Calculation and Request Evaluation Process

February 1, 2007

Version 1.5

Public

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Document Change History

Issue	Reason for Issue	Date
0.1	Initial publication of changes due to the Seams Operating Agreement and MISO-MAPP Regional Tariff Administration Infrastructure improvements for review. Reviewed by the MAPP Transmission Schedules, Compensation, and Compliance Subcommittee at their conference call on January 17, 2006	January 16, 2006
0.2	Revised publication based upon comments received internally and from MidAmerican Energy Company - Transmission	January 29, 2006
1.0	Approved by the MAPP Transmission Schedules, Compensation and Compliance Subcommittee to be effective February 28, 2006	January 30, 2006
1.1	Version 1.0 was not effective on February 28, 2006 as scheduled. Updated effective date to May 16, 2006	May 14, 2006
1.2	No changes to Appendix F	July 24, 2006
1.3	Changed Section 11 based upon approval from the TSCSC at their August 9, 2006 conference call. The changes in Section 11 are to recognize the change in filtering rules used to import reservations from other OASIS nodes such as SWPP, PJM and MISO	October 5, 2006
1.4	No changes to Appendix F.	December 1, 2006
1.5	No changes to Appendix F.	February 1, 2007

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1 Introduction

This Total and Available Transfer Capability, Transfer Capability and Capacity Benefit Margins MAPP Regional methodology document is for compliance with **NERC Planning Standards I.E.1 and I.E.2**.

Transmission Providers in the MAPP Region will determine Total Transfer Capability (TTC), Available Transfer Capability (ATC), Capacity Benefit Margin (CBM) and Transmission Reliability Margin (TRM) in accordance with the **NERC and MAPP Planning Standards**, the **MAPP Reliability Handbook**, the **MAPP Policies and Procedures for Transmission Operations, and FERC Orders 888, 889 and 889A**.

The MAPP Transmission Providers use a flow-based approach to determine the committed use of the transmission system on a regional basis. Dynamic stability, voltage stability, steady-state voltage, as well as thermal constraints limit Total Transfer Capability within the MAPP Transmission System.

The term flowgate refers to a transmission facility(s) on which flow has been correlated with a limiting phenomenon. The AFC values posted for identified flowgates is the Available Flowgate Capability on a set of physical transmission facilities, rather than a control area to control area transfer capability.

The MAPP Transmission Providers also post contract path interfaces. These contract path interfaces are not limited by flow-based impacts but are posted because they provide service into and out of the MAPP Transmission System. The contract path TTC represents the total interconnection capability between a MAPP Schedule F Transmission Provider and a non-MAPP Schedule F Transmission Provider.

Transmission service under MAPP Schedule F tariff or a MAPP Regional Transmission Committee (RTC) Member's Open Access Transmission Tariff (OATT) is granted on a regional basis according to these calculated AFC/ATC values. Transmission service is made available to eligible transmission customers on a non-discriminatory basis.

1.1 NERC Principles

The following six principles are stipulated in the [NERC ATC Report]. These principles are fully recognized in developing the MAPP Regional TTC/AFC/ATC Methodologies for flowgate and contract path interfaces.

1. Available Transmission Capability (ATC) calculations must produce commercially viable results. The ATC values produced by the calculation must give a reasonable and dependable indication of transfer capabilities available to the electric power market.

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2. ATC calculations must recognize time-variant power flow conditions on the entire inter-connected transmission network. In addition, the effects of simultaneous transfers and parallel path flows throughout the network must be addressed from a reliability standpoint.
3. ATC calculations must recognize the dependency of ATC on the point of electric power injection, the directions of transfers across the interconnected network, and the point of power extraction. All entities must provide sufficient information necessary for the calculation of ATC.
4. Regional or wide-area coordination is necessary to develop and post information that reasonably reflects the ATC values of the interconnected transmission network.
5. ATC calculations must conform to NERC, Regional, sub-regional, power pool and individual system reliability planning and operating policies, criteria or guides.
6. The determination of ATC must accommodate reasonable uncertainties in system conditions and provide operating flexibility to ensure the secure operation of the inter-connected network.

1.2 NERC Definitions

Phase IIB -NERC Planning Standards, Measurements, and Compliance Templates on Transfer Capability (Section I.E.1) (Total (TTC) and Available (ATC) Transfer Capabilities) – NERC Board of Trustees, February 20, 2002.

Phase IIB -NERC Planning Standards, Measurements, and Compliance Templates on Transfer Capability Margins (Section I.E.2) (Capacity Benefit Margin (CBM) and Transmission Reliability Margin (TRM)) – NERC Board of Trustees, February 20, 2002.

1.2.1 Total Transfer Capability (TTC)

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

1.2.2 Available Transfer Capability (ATC)

Available Transfer Capability (ATC) is a measure of the transfer capability remaining in the physical transmission network for further commercial activity over and above already committed uses. It is defined as TTC less existing transmission commitments (including retail customer service), less a capacity benefit margin (CBM), less a transmission reliability margin (TRM). (The transfer capability margins — CBM and TRM — are defined under section I.E.2 of the Planning Standards document.

1.2.3 Capacity Benefit Margin (CBM)

Capacity Benefit Margin (CBM) is the amount of firm transmission transfer capability preserved by the transmission provider for load-serving entities (LSEs), whose loads are located on that transmission 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

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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.

1.2.4 Transmission Reliability Margin (TRM)

Transmission Reliability Margin (TRM) is the amount of transmission transfer capability necessary to provide reasonable assurance that the interconnected transmission network will be secure. TRM accounts for the inherent uncertainty in system conditions and the need for operating flexibility to ensure reliable system operation as system conditions change.

2 TTC Determination Methodology

The Transmission Provider(s) of the flowgates must conduct operational studies on a regular basis as per Section 2 of the **MAPP Reliability Handbook**, and is posted on the MAPP website at http://www.mapp.org/. These operational studies are used to develop the Total Transfer Capabilities (TTC) values and/or operating limits for the respective flowgate(s) in accordance with the NERC and MAPP Planning Standards and operating policies, criteria and guides. These operating studies and guides shall document TTC and the AFC/ATC components, (CBM, ETC, TRM, and TRM coefficient), of the flowgate. The MAPP Regional Request Evaluation process used to evaluate transmission service and calculate Available Transfer Capability uses the TTC and ATC components.

The methodologies and studies used to determine the AFC/ATC components for each flowgate in the MAPP Region are reviewed and sanctioned through the MAPP Regional Transmission Committee (RTC). The Transmission Operating Review (TOS) is currently vested with the authority to oversee this process.

For the planning horizon, the TOS has an established process for Transmission Provider(s) of the flowgate to present new or expanded studies for review. These studies typically include a variety of system conditions as required in the MAPP Operating Studies Manual. This manual requires load levels for the entire MAPP area to be modeled at 100% and 85% of peak summer load for summer studies and 100% and 90% of peak winter loads for winter studies. The Transmission Provider(s) of the flowgate uses these MAPP models to determine their TTC and AFC/ATC components; the models typically include interruptible demands.

In recognition of the complexity of the integrated system that must be studied, the models must be as realistic as possible. Particular attention should be given to how system conditions, limiting facilities, contingencies, transmission reservations, energy schedules, and other data is to be used to determine TTC and AFC/ATC components. Model data collected and distributed by MAPP can be used by the flowgate Transmission Provider(s) for the calculation of TTC and AFC/ATC components. These models are shared and used within the Region and with neighboring interconnected electric systems, including adjacent systems, sub-regions, and

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Regions. If these models or data are not used, an explanation and approval of the appropriate TOS working group must be made as per Section 2 of the **MAPP Reliability Handbook**.

The TOS presently does not require the border contract path interfaces to receive TOS approval through the operating studies process. However, the TOS may request an operating study be done at anytime. For an OTDF flowgate, the TTC should match the seasonal facility rating of the limiting element.

3 Transmission Reliability Margin Methodology

NERC I.E.2.S2.M6
TRM provides a reserve of transfer capability that ensures the reliability of the interconnected transmission network. All transmission system users benefit from the assurance that transmission services will be reliable under a broad range of potential system conditions. TRM accounts for the inherent uncertainty associated with TTC and ATC calculations, and the need for operating flexibility to ensure reliable system operation as system conditions change.

3.1 Uncertainty in the TTC and AFC Calculation

TTC and AFC determinations depend upon a myriad of assumptions and projections of system conditions, which may include such items as transmission system topology, projected customer demand and its distribution, generation dispatch, location of future generators, future weather conditions, available transmission facilities, and existing and future electric power transactions. Such parameters are assembled to produce a scenario to be used to project transfer capabilities under a reasonable range of transmission contingencies as specified in Regional, sub-regional, power pool, and individual system reliability operating and planning policies, criteria, or guides.

Therefore, calculations of future TTC and AFC values must consider the inherent uncertainties in projecting such system parameters over longer time periods. Generally, the uncertainties of TTC and AFC values increases for longer term projections due to greater difficulty in being able to predict the various system assumptions and parameters over longer time periods. For instance, locations of future customer demands and generation sources are often quite uncertain, and these parameters have a potentially large impact on transfer capabilities. Similarly, future electric power transactions are inherently uncertain and can have significant impacts on transmission loading. Therefore, the amount of TRM required is generally time dependent generally with a larger amount necessary for longer time projections than for near-term conditions. TRM must also have wide-area coordination and must be updated as necessary as system conditions change.

Currently, the MAPP region does not grant any variances to individual transmission providers from this Regional TRM methodology.

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3.2 Need for Operating Flexibility

TTC and AFC calculations must recognize that actual system conditions may change considerably in short periods of time due to changing operating conditions, and cannot be definitively projected without the provision of a transfer capability margin. These operational conditions include changes in dispatch of generating units, simultaneous transfers scheduled by other systems that impact the particular area being studied, parallel path flows, maintenance outages, and the dynamic response of the interconnected systems to contingencies (including the sudden loss of generating units).

3.3 Criteria for TRM

1. The nature of interfaces dictates how TRM is calculated. The same TTC value is used for both Recallable and Non-Recallable transmission capability at any point in time. Because of path interdependencies, dynamic line ratings, uncertainty of load forecasts, and conditions differing from those studied, an interface may have different amounts of transfer capability for Recallable use than for Non-Recallable use. Within MAPP, the TRM will be used to account for these differences in transfer capability for Recallable and Non-Recallable use in addition to uncertainty in TTC and ATC calculations and operating flexibility.
2. Transmission providers should calculate this margin using a method that is compliant with the NERC and MAPP Planning Standards and operating policies, provided they have documentation that can withstand audit by Regional Transmission Committee (RTC). Sensitivity studies shall be performed to determine interface sensitivity to changes in load patterns and load levels and an operating reserve component as described below.
3. For MAPP interfaces the difference between TTC values developed using simultaneous and non-simultaneous study procedures and the related interdependency of interfaces may be handled by computing a variable TRM.
4. The operating reserve component of the TRM is the amount of transmission transfer capability on a constrained interface to provide the amount of MAPP Operating Reserve associated with 100% of the greatest single contingency impacting the interface. The amount calculated should be in the direction of the constraint.
5. For determining the Operating Reserve portion of TRM, analyses shall be performed to identify the required reserve for each interface. The worst case will be determined by tripping units (or line outages when a Generation Reserve Sharing Member can request Emergency Energy for the line trip) within the MAPP Region and picking up each Generation Reserve Sharing Member's share of the Emergency Energy to replace the unit that tripped. The distribution of each company's share of the Emergency Energy among its individual generating units should be a realistic estimate for the conditions for which the TRM is being determined. The worst case will be the case that has the greatest incremental flow over the interface in the direction of the constraint. For some interfaces, the worst case may be for a unit trip within the Member's system. Other interfaces may be impacted more severely by line trips. The highest incremental flow on the constrained interface for the contingencies evaluated will be the amount of TRM required to reserve transmission to serve Operating Reserves. Although Operating Reserves are 150% of the largest unit or 100% of the most severe contingency, it is only necessary to reserve

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transmission to deliver the actual amount of Operating Reserves that will flow on the constrained interface. The additional 50% of the largest unit used in determining Operating Reserve is a generation margin and should not be factored in the TRM calculation or it would be creating a margin within a margin.

6. Sale of TRM on a non-firm (recallable) basis is allowed provided the constrained interface could be operated in compliance with MAPP operating standards. If the constrained interface cannot be operated above the TTC during the time required to readjust the system for the next contingency, then once an emergency occurs, the TRM for the operating reserve impact must be reestablished within 30 minutes. In this case, the TRM associated with operating reserves should not be made available for recallable use. Under some conditions, re-establishing the TRM for Operating Reserves might require curtailments of existing transmission schedules including non-recallable transmission service. This is interface dependent and requires documentation that can withstand an audit by the RTC.

4 Capacity Benefit Margin (CBM) Methodology

NERC I.E.2.S2.M1
NERC I.E.2.S2.M3
NERC I.E.2.S2.M4

The MAPP Transmission Operating Subcommittee (TOS) has determined that the amount of transmission capacity reserved for emergency replacement energy on MAPP flowgates should be included in TRM. Although MAPP Restated Agreement Schedule(s) allow for use of emergency replacement energy for up to six hours, the amount reserved in TRM for the first 59 minutes assures that sufficient capacity is available for the entire duration of an emergency, without the need for an additional preservation of transmission capacity in CBM.

To-date, LSEs within MAPP have not identified the need for an additional preservation of transmission capacity for CBM. The reliability criterion used for generation planning in the MAPP region is a 15% planning reserve margin. The most recent MAPP studies which have reviewed the adequacy of this planning reserve requirement have not assumed any imports on the tie-lines with other regions. Therefore it is not necessary for LSEs in the MAPP region to hold back transmission capacity as CBM. Therefore, under current definitions, MAPP has no CBM.

If and when a MAPP LSE(s) identifies the need for an additional preservation of transmission capacity as CBM, MAPP will review the transmission provider's methodology for consistency with regional planning criteria and develop a regional methodology for CBM, if appropriate. Until such time, the MAPP TOS believes posting zero CBM is consistent with current MAPP planning criteria, and effectively constitutes the MAPP CBM methodology.

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4.1 Posting a Non-Zero CBM

1. The method used by each MAPP member to determine its generation reliability requirements as the basis for CBM shall be consistent with its generation planning criteria.
2. The method used by each MAPP member to determine its generation reliability requirements as the basis for CBM shall be consistent with its generation planning criteria.
3. The generation reliability requirement and associated CBM values shall be calculated at least annually.
4. Generation unit outages considered in a transmission provider's CBM calculation shall be restricted to those units within the transmission provider's system.
5. CBM shall be preserved only on the transmission provider's system where the load-serving entity's load is located (i.e., CBM is an import quantity only).
6. Describe the inclusion or exclusion rationale for generation resources of each LSE including those generation resources not directly connected to the transmission provider's system but serving LSE loads connected to the transmission provider's system.
7. Describe the inclusion or exclusion rationale for generation connected to the transmission provider's system but not obligated to serve native/network load connected to the transmission provider's system.
8. Variances to the MAPP CBM methodology must be approved by the MAPP Transmission Operating Subcommittee and the MAPP Transmission Schedules, Compensation, and Compliance Subcommittee (TSCSC).
9. Specify how CBM is incorporated into ATC calculations, including the relationship between the generation reliability requirement and the CBM values, and the allocation of the CBM values to the appropriate transmission facilities. The sum of the CBM values allocated to all interfaces shall not exceed that portion of the generation reliability requirement that is to be provided by outside resources.
10. Describe the inclusion or exclusion rationale for the loads of each LSE, including interruptible demands and buy-through contracts (type of service contract that offers the customer the option to be interrupted or to accept a higher rate for service under certain conditions).
11. Describe the inclusion or exclusion rationale for generation reserve sharing arrangements in the CBM values.

5 MAPP AFC/ATC/ASTFC Calculation Methodology

Flowgate AFC values are calculated using a flow-based approach. Therefore, the MAPP AFC calculation requires determination of the incremental impact of each reservation on each of flowgates for each time period. This calculation is performed utilizing an Interchange Distribution Calculator (IDC) developed by Open Access Technologies International, Inc. (OATI). The IDC uses linear network analysis to determine incremental flows on a set of flowgates due to each transmission reservation.

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Contract path ATC values are calculated in a similar manner to ATC values for flowgates, except that a look-up table determines the percent impact. In this case, the percent impact is 100%, -100% or 0%, depending on the direction of the transaction and netting requirements determined by the border MAPP Transmission Provider.

The amount of Available Flowgate Capability (AFC) on a MAPP flowgate or contract path depends on the type of transmission service. For example, the amount of transmission capability available for monthly non-firm service does not include the impacts of weekly, daily and hourly non-firm service since monthly service is higher priority. In order to keep track of the transmission capability available for each type of service, 8 categories of flowgate or contract path AFC/ATC are calculated as defined below.

NATC: Transmission Capability Available for **Firm Service** under Schedule F and Member tariff service.

RATC: Transmission Capability Available for **Non-Firm Service** under Schedule F and Member tariff service.

AFC/ATC Category	Service Type*	OASIS Posting	TLR Priority
NAFC/NATC	Firm	NATC	**7**
RAFC6/RATC6	Network Non-Designated	RATC	**6**
RAFC5/RATC5	Monthly Non-firm	RATC	**5**
RAFC4/RATC4	Weekly Non-Firm	RATC	**4**
RAFC3/RATC3	Daily Non-Firm	RATC	**3**
RAFC2/RATC2	Hourly Non-Firm	RATC	**2**
RAFC1/RATC1	Secondary Non-firm	RATC	**1**

*All Member tariff transmission service types are associated with an AFC/ATC Category according to the transmission service type's NERC TLR priority.

Flowgate and contract path AFC/ATC values are calculated for each hour of the operating horizon, and each daily for one year and monthly thereafter for the three year planning horizon. Appropriate accounting of the transmission requests and outages that begin or end on any day of the month requires daily segmentation beyond the operating horizon. However, the daily AFC/ATC results are aggregated and posted on a calendar monthly basis to meet FERC posting requirements.

The posted RATC and NATC for a given month is the minimum daily value of NATC and RATC5 respectively over that calendar month.

Evaluation of the impacts on the MAPP flowgates and contract paths requires data beyond that provided by the MAPP OASIS.

The **Planning Horizon** AFC/ATC Calculation evaluates all transmission requests that have a curtailment priority of 3 or higher except for Hourly Non-designated Network service.

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The **Operating Horizon** AFC/ATC Calculation evaluates all transmission requests with a curtailment priority of 2 or less, and Hourly Non-designated Network service. This includes Hourly Non-firm and Secondary Non-firm service. Operating Horizon calculates AFC/ATC values for a sliding 36-hour period.

5.1 Significantly Impacted

The definition of each flowgate must be specified in terms of branches in the MAPP Regional Request Evaluation process powerflow model. The Transmission Providers must supply this data to the Contractor. The MAPP Regional Request Evaluation process monitors both PTDF and OTDF flowgates.

5.1.1 Pre-contingent Flowgate

A pre-contingent flowgate is considered to be **Significantly Impacted** if the Power Transfer Distribution Factor (PTDF) of the transmission request is greater than 5% on the flowgate.

5.1.2 Post-contingent Flowgate

A post-contingent flowgate is considered to be Significantly Impacted if the Outage Transfer Distribution Factor (OTDF) of the transmission request is greater than 3% on the flowgate.

5.1.3 Contract Path

A contract path is considered to be Significantly Impacted if the Distribution Factor of the transmission request is 100% on the contract path.

5.2 Flowgate Definition

5.2.1 MAPP Transmission Provider Flowgates

Approval is required from the Transmission Operating Subcommittee (TOS) and the Transmission Schedules, Compensation, and Compliance Subcommittee (TSCSC) under the MAPP Regional Transmission Committee (RTC) for any new MAPP Transmission Provider flowgates in the MAPP Request Evaluation process, or changes to the methodology or studies supporting the development of Reliability Components/AFC/ATC Components on an existing MAPP Transmission Provider flowgate. A change in the definition of an existing MAPP Transmission Provider flowgate is considered a new flowgate.

5.2.2 Non-MAPP Transmission Provider Coordinated or Reciprocally Coordinated Flowgates

Non-MAPP Transmission Provider flowgates are included in the MAPP Regional Request Evaluation processed based upon criteria in Section 3 of Attachment B of the **MISO-MAPPCOR Seams Operating Agreement**.

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5.3 Contract Path Definition

Border transmission providers must work with the Contractor in order to set up the data necessary to define Contract Paths. This data includes the following:

- Associated border service points
- Netting requirements for the Operating and Planning Horizons
- Scheduling Participant associated with the border service points
- Existing reservations that impact the Contract Path
- ATC Components

5.4 Transmission Outages

The transmission outages entered into the NERC System Data Exchange (SDX) are used in the MAPP Regional Request Evaluation process. **The MAPP Transmission Provider is responsible for submitting AFC/ATC Components on a MAPP Transmission Provider flowgates if the MAPP Transmission Provider submits an ETC component for that impacted flowgate and must maintain coordination between the AFC/ATC Components and the NERC System Data Exchange (SDX) as system conditions change.**

5.5 Netting Impacts in the MAPP AFC/ASTFC/ATC

NERC I.E.1.S1.M1.i
MAPP Transmission Provider flowgate counterflow methodologies are posted on the MAPP OASIS.

5.5.1 Netting Impacts on a MAPP Transmission Provider flowgate (non-coordinated)

A MAPP Transmission Provider may elect to use the counterflow methodology outlined in Section 1.2.2 of Attachment A of the MISO-MAPPCOR Seams Operating Agreement for flowgates that are not identified as Reciprocally Coordinated Flowgate instead the methodology identified below.

5.5.1.1 Netting Impacts in the Planning Horizon

Simultaneous transmission reservations in the Planning Horizon may not have corresponding energy schedules associated with them in the Operating Horizon. In order to resolve this problem, for the approval of Non-recallable (firm) transmission service in the Planning Horizon, incremental impacts are added only in the direction of the flowgate when evaluating transmission reservations. Impacts in the opposite direction are added only if the PTDF of the reservation is greater than -5%. The -5% PTDF threshold was chosen because ±5% was considered to be within the error margin of the impact calculation. In order to avoid accumulating errors in one direction, impacts of reservations with less than 5% PTDF are added regardless of direction. The same logic applies for an OTDF flowgate except the impacts in opposite direction are added when the OTDF is greater than -3%.

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For approval of non-firm service in the Planning Horizon, the Provider for each flowgate may choose to include all or part of the non-firm or firm counter-flow impacts that have a distribution factor less than the flowgate threshold.

5.5.1.2 Netting Impacts in the Operating Horizon

In the Operating Horizon, when the energy schedules are known, impacts of the energy schedules are added or subtracted to determine Recallable AFC. Recallable AFC in the Operating Horizon is based on the scheduled amount for all reservations except hourly non-firm. The reserved amount is used for hourly non-firm reservations if no schedule has been submitted. If a NERC e-tag has been submitted, that amount is always used. If a schedule for hourly non-firm service has not been received by 20 minutes prior to the hour for the next hour, the Recallable AFC values for the next hour do not include the impacts of those reservations. This is done to account for approved hourly reservations given the lag between the time the request is submitted and accepted on the OASIS, and the time a schedule is submitted to MAPP. Regardless, impacts are always netted for Recallable AFC in the Operating Horizon.

Non-Recallable AFC is always based on transmission reservations rather than energy schedules in both the Planning and the Operating Horizons. Therefore the counterflow impacts are never included in the Non-Recallable AFC values.

5.5.2 Netting Impacts on a MAPP Transmission Provider Reciprocally Coordinated Flowgate

MAPP Transmission Provider Reciprocally Coordinated flowgates counterflow factors shall be determined by Section 1.1.2 in Attachment A of the MISO-MAPPCOR Seams Operating Agreement.

5.5.3 Netting Impacts on a Contract Path

The border POR and/or POD chosen in the request for transmission service determines the contract path impacted. A look-up table determines the percent impact of a transaction.

6 Existing Transmission Commitments (ETC)

The ETC value is used to account for committed use of a flowgate or contract path other than transmission reservations made after November 1, 1996. Both NETC and RETC are determined by the MAPP Transmission Providers to account for the impacts on a flowgate due to load serving, losses, and transmission commitments grandfathered under the old MAPP Agreement. NETC includes the effect of only firm transmission commitments, and may reflect flows expected under the most limiting conditions for a given time period. RETC only the effects of non-firm transmission commitments, and may reflect average conditions for a given time period.

In addition, all service coming into, through, or out of MAPP will be reserved on the MAPP OASIS node and will not be included in ETC. All transmission requests will be

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made on the MAPP OASIS node and be evaluated through the MAPP Request Evaluation Process.

6.1 Planning Horizon Flowgate ETC

A MAPP Transmission Provider may elect to submit the ETC value for the Planning Horizon, or utilize a forecasted ETC value.

The Planning Horizon ETC value will be comprise of the generation-to-load impacts which are calculated using the most recent NERC SDX load forecast data, MAPP control area generating unit merit order information(block loading), designated network resource, and joint owned unit information. In addition, MISO will provide expected market flow impacts on MAPP Transmission Provider flowgates.

Generation to Load Distribution Factors are used to determine the control area load impact on each MAPP Transmission Provider flowgate.

6.2 Operating Horizon Flowgate ETC

A MAPP Transmission Provider can elect to submit the ETC value for the Operating Horizon, or utilize a forecasted ETC value.

In the Operating Horizon, transmission schedules should be submitted on all MAPP to Non MAPP reservations, including "grandfathered" transactions; so hourly ETC values on contract paths should be zero.

6.2.1 Transmission Provider Submitted

It is very important that hourly ETC values are submitted if they are different than the daily and monthly values. Otherwise, if the MAPP Request Evaluation can't find an hourly value, it will default to the daily or monthly values.

6.2.2 Calculated ETC Value

6.2.2.1 Pre-Contingent Flowgate ETC Forecast

In the Operating Horizon, an ETC value is calculated for the previous hour using the previous hour's real-time metered flow data.

$$ETC_A^{pre} = Flow_A - NSCH_A - RSCH_A$$

Where,

ETC_A^{pre} = Calculated ETC value for the previous hour monitored interface A

$Flow_A$ = Real - time metered flow on monitored interface A

$NSCH_A$ = Total Non - recallable impacts on monitored interface A

$RSCH_A$ = Total Recallable impacts on monitored interface A

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6.2.2.2 Post-Contingent Flowgate ETC Forecast

In the Operating Horizon, an ETC value is calculated for the previous hour using the a previous hour's real-time metered flow data.

$$ETC_{AB}^{post} = (Flow_A + Flow_B \times LODF_{AB}) - NSCH_{AB} - RSCH_{AB}$$

Where,

ETC_{AB}^{post} = Calculated ETC value for the previous hour on monitored interface *A*

$Flow_A$ = Real - time metered flow on monitored interface *A*

$Flow_B$ = Real - time metered flow on contingent element *B*

$LODF_{AB}$ = Line Outage Distribution Factor of monitored interface *A* for an outage of contingent interface *B*

$NSCH_{AB}$ = Total Non - Recallable impacts on monitored interface *A*

$RSCH_{AB}$ = Total Recallable impacts on monitored interface *A*

6.3 Forecasted ETC Value

The Flowgate Monitor forecasts flows and ETC on MAPP Transmission Provider flowgates for each hour of the Operating Horizon using historical flow information and reported energy schedules. The forecasting algorithm uses a weighted average of metered flows from previous hours and comparable hours from previous days. These forecasts are updated hourly. Flowgate Monitor results can be used to evaluate expected flows on the transmission system and predict TLR events.

Next hour forecasted ETC value,

$$ETC_i = ETC_{i-1}$$

The subsequent forecasted ETC values after the next hour are calculated using the following methodology,

$$ETC_{i+t} = a \times ETC_{i+t}^{agg} + b \times ETC_{i+t}^{avg}$$

$$t = 1,2 \ldots n$$

Where,

$$ETC_{i+t}^{agg} = c \times ETC_{i+t(hist)}^{agg(x)} + d \times ETC_{i+t}^{yest}$$

$$ETC_{i+t}^{avg} = \frac{(ETC_{i+t-3}) \times Flow_{i+t-3} + (ETC_{i+t-2}) \times Flow_{i+t-2} + (ETC_{i+t-1}) \times Flow_{i+t-1}}{(Flow_{i+t-3} + Flow_{i+t-2} + Flow_{i+t-1})}$$

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i = The next hour

$i-1$ = The current hour

n = The number of hours remaining in the Operating Horizon

x = Type of ETC aggregate value; Weekday, Saturday, or Sunday

ETC_i = Next hour forecasted ETC value

ETC_{i+t} = Forecasted ETC value at time $i+t$

$ETC_{i+t}^{agg(x)}$ = ETC aggregate value used to calculate the forecasted ETC at time $i+t$

ETC_{i+t}^{yest} = Previous day's calculated ETC value at time $i+t$

$ETC_{i+t(hist)}^{agg(x)}$ = Historical ETC aggregate value for each type of day x

ETC_{i+t}^{avg} = Average ETC value at time $i+t$ for the last 3 hours using the real - time metered flows values as weighting

$Flow_{i+t}$ = Real - time metered flow value at $i+t$

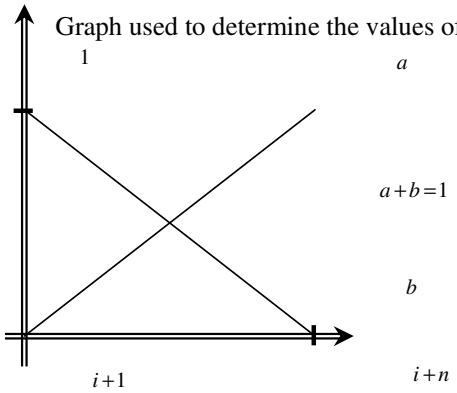
a = ETC aggregate weighting coefficient

b = ETC average weighting coefficient

c = Historical ETC aggregate value weighting coefficient

d = Previous day's calculated ETC value weighting coefficient

Graph used to determine the values of coefficients a and b.



7 Power flow Model

The seasonal NERC IDC power flow model is used to determine the incremental impacts on the flowgates to assess transfer capability. Since this model is being used to calculate incremental flows only, the power flow model used in the impact calculation need only reflect the correct connectivity of the power system. There is no need to update transaction and generation dispatch data for this purpose.

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8 Service Point Definition

NERC I.E.1.S1.M1.c

The Source and Sink on the transmission service request are used, as the ultimate point of injection and extraction. The ultimate service points correspond to one or more generation or load busses in the power flow model. Each bus has a participation factor for an ultimate point, the sum of the participation factor for an ultimate point must sum to 1 and act as aliases to one or more generator or load buses in the power flow model. Each Transmission Provider must submit a list of Sources and Sinks to the Contractor with their corresponding bus number definitions and participation factors. All non-MAPP control areas are modeled as their individual control area. The control area modeling is comparable to the modeling that NERC uses in the IDC.

Border service points, such as a Point-of-Receipt or Point-of-Delivery, are used for service entering or leaving the MAPP Transmission System region. They are used to identify which control area to control area interconnection capability is being used between any Transmission Provider. Border service points are used to determine the Contract Path used for the transaction, and the Member scheduling participant for the transaction.

9 Posting TTC, ATC, TRM and CBM values

NERC I.E.1.S1.M1.e

The MAPP Transmission Providers post TTC, AFC/ATC, TRM and CBM values on the MAPP Open Access Same-time Information System (OASIS) for two types of interfaces; flowgates and contract paths.

- The flowgate interface methodology builds upon a flow-based analysis to determine the committed use of the transmission system on a regional basis.
- The contract path interface represents the contractual or physical transfer limitations between a MAPP Schedule F Transmission Provider control area and a non-MAPP Schedule F Transmission Provider control area.

Flowgate and contract path TTC, AFC/ATC, TRM and CBM values are posted under System Data on the OASIS. In addition, a summary of the individual impacts of all approved requests is available on the MAPP OASIS. Flowgate AFC values are posted on the MAPP OASIS, and contract path ATC values are posted on the Transmission Provider's OASIS page.

The Daily and longer AFC/ATC values are calculated and posted at least every six hours. Hourly Non-firm AFC/ATC values are calculated and posted at least every three hours.

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Methodology

NERC I.E.1.S1.M1.f
The MAPP planning reserve requirement (15% reserves based on actual peak), and MAPP utilities are heavily motivated to interrupt load on peak if possible. The MAPP transmission models generally do not include interruptible loads, except by explicitly understood exceptions. These, however, are general practices, not documented requirements.

11 AFC Coordination

11.1 OASIS Reservations

The MAPP Regional AFC Calculation process imports non-MAPP Transmission Provider confirmed OASIS reservations according to the criteria set forth in Section 1.2.2 of Attachment of the MISO-MAPPCOR Seams Operating Agreement. The MAPP Regional AFC Calculation process will not include reservations that another transmission providers does not include in its own calculation.

The coordination process will not import a reservation if a transmission service request is required under MAPP Schedule F or under at least one MAPP Member Tariff OATT.

11.1.1 Study status reservations

The MAPP Regional AFC Calculation process imports transmission service requests with a status of study under the MISO OATT and which meet the reservation importing rules in Section 1.2.2 of Attachment A of the SOA. These transmission service requests are included in the AFC calculation on MAPP Transmission Provider Reciprocally Coordinated Flowgates.

11.1.2 Excluded reservations

The assumptions made in the Generation to Load forecast (ETC calculation) and the Projected Market Flow component already account for the impacts from MISO, SWPP and PJM internal network OASIS reservations.
The MAPP Regional AFC Calculation may exclude reservations in order to avoid double counting of impacts on MAPP flowgates.

11.2 Non-MAPP Flowgate AFC Values

The MAPP Regional AFC Calculation process imports AFC values for non-MAPP Transmission Provider flowgates.

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12 On/Off Path Methodology

The MAPP Regional Request Evaluation process utilizes the POR/POD and Source/Sink information on the OASIS transmission service request to determine the set of flowgates that the transmission service request shall be evaluated against and decrement.

The determination of the flowgates is based upon the AFC Coordination OASIS reservation methodology, Section 1.2.2 of Attachment A of the MISO-MAPPCOR SOA. The intent is to minimize the risk that a request for transmission service is evaluated twice against the same flowgate.

In general, the source MAPP Transmission Provider transmission service request is evaluated against its own and third party flowgates, a sink or wheel transmission service request is only evaluated against its own flowgates.

13 MAPP AFC Calculation

13.1 Non-Recallable AFC Computation for a Pre-contingent MAPP Transmission Provider Flowgate

The following equation describes the computation of Non-recallable Available Flowgate Capability (NAFC) for each Pre-contingent Constrained Flowgate for each time period.

$$NAFC_i^t = TFC_i^t - CBM_i^t - TRM_i^t - NETC_i^t - \left(MF_i^t\right)_n - NRES_i^t$$

Where,

$NAFC_i^t$ = Non - recallable (firm) AFC on interface *i* at time *t*

TFC_i^t = Total Flowgate Capability on interface *i* at time *t*

CBM_i^t = Capacity Benefit Margin value used for NAFC calculation on interface *i* at time *t*

TRM_i^t = Transmission Reliability Margin on interface *i* at time *t*

$NETC_i^t$ = Non - recallable Existing Transmission Commitments on interface *i* at time *t*

$\left(MF_i^t\right)_n$ = Market Flow for RTO *n* on interface *i* at time *t*

$NRES_i^t$ = Non - recallable (firm) transmission reservation impacts on interface *i* at time *t*

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$NRES_i^t$ is calculated by summing all transmission reservation *r*, at each time *t*, on each interface *i* as follows

$$NRES_i^t = \underbrace{CNRES_i^t}_{Confirmed} + \underbrace{ANRES_i^t}_{Accepted} + \underbrace{SNRES_i^t}_{Study} + \underbrace{ROFRNRES_i^t}_{Rollover\ Rights}$$

$$CNRES_i^t = \left(CNRES_i^t\right)_1 + \left(CNRES_i^t\right)_2$$

Where,

$$\left(CNRES_i^t\right)_1 = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0 \text{ or } \left|PTDF_i^t\right|_r \le Flowgate\ Threshold$$

$$\left(CNRES_i^t\right)_2 = \sum_r \left(\Delta P_i^t\right)_r * \left(d_i^{firm}\right)_{\text{NAFC}} \text{ if } \left(\Delta P_i^t\right)_r < 0 \text{ and } \left|PTDF_i^t\right|_r > Flowgate\ Threshold$$

and

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

The $\left(d_i^{firm}\right)_{\text{NAFC}}$ value is the directionality coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable counter-flow impacts.

13.1.1 Reciprocally Coordination Flowgate

$$CNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * FirmFGNegativeFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $FirmFGPositiveFactor_{NAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable positive impacts in the NAFC calculation. **Each Reservation Status Impact Category has its own factor**

The $FirmFGNegativeFactor_{NAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all

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or none of the non-recallable counter-flow impacts in the NAFC calculation. **Each Reservation Status Impact Category has its own factor**

Where,

$$\left(\Delta P_i^t\right)_r = \left(PTDF_i^t\right)_r \times \left(CAP^t\right)_r$$

And,

$\left(PTDF_i^t\right)_r$ = Power Transfer Distribution Factor of the transmission reservation r, at time t on interface i

$\left(CAP^t\right)_r$ = Megawatt capacity of the transmission reservation r, at time t

$CNRES_i^t$ = Committed (Confirmed) Non - recallable (firm) reservation impacts on interface i at time t

$ANRES_i^t$ = Accepted, Counteroffer, and Rebid Non - recallable (firm) reservation impacts on interface i at time t

$SNRES_i^t$ = Study Non - recallable (firm) reservation impacts on interface i at time t

$ROFRNRES_i^t$ = Right of First Refusal Impacts(Rollover Rights) Non - recallable (firm) reservation impacts on interface i at time t

And,

The formula to use is configured on a per flowgate basis.

13.2 Recallable AFC Computation for a Pre-contingent MAPP Transmission Provider Flowgate

For each Flowgate, six AFC values are calculated for the evaluation of Recallable service in order to determine the AFC within each service priority group. The following equations describe the computation of these Recallable Available Transfer Capability (RAFC) values for each Flowgate for each time period for each service priority.

Recallable Planning Horizon AFC Computation for a Pre-contingent Constrained Flowgate

$$RAFC6_i^t = TFC_i^t - \left(CBM_i^t \times CBMCOEF_i^t\right) - \left(TRM_i^t \times TRMCOEF_i^t\right) - RETC_i^t - NRES_i^t - \left(MF_i^t\right)_n - NETC_i^t - RRES6_i^t$$

$$RAFC5_i^t = RAFC6_i^t - RRES5_i^t$$

$$\vdots$$

$$RAFCN_i^t = RAFC[N+1]_i^t - RRESN_i^t$$

Where,

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$RAFC_{N_i^t}$ = Recallable (firm) AFC on interface *i* at time *t* for TLR priority *N*

TFC_i^t = Total Flowgate Capability on interface *i* at time *t*

CBM_i^t = Capacity Benefit Margin value used for RATC calculation on interface *i* at time *t*

$CBMCOEF_i^t$ = Capacity Benefit Margin Coefficient on interface *i* at time *t*

TRM_i^t = Transmission Reliability Margin on interface *i* at time *t*

$TRMCOEF_i^t$ = Transmission Reliability Margin Coefficient on interface *i* at time *t*

$RETC_i^t$ = Recallable Existing Transmission Committments on interface *i* at time *t*

$NETC_i^t$ = Non - Recallable Existing Transmission Committments on interface *i* at time *t*

$\left(MF_i^t\right)_n$ = Market Flow for RTO *n* on interface *i* at time *t*

$NRES_i^t$ = Non - recallable (firm) transmission reservation impacts on interface *i* at time *t*

$RRES_{N_i^t}$ = Recallable (Non - firm) transmission reservation impacts on interface *i* at time *t* for TLR priority *N*

The $TRMCOEF_i^t$ component allows the MAPP Transmission Provider to sell all or a portion of the TRM as recallable transmission service.

The $CBMCOEF_i^t$ component allows the MAPP Transmission Provider to sell all or a portion of the CBM as recallable transmission service.

The computation of $NRES_i^t$ and $RRES_{N_i^t}$ is somewhat different from those of Non-recallable ATC computation.

$$NRES_i^t = \underbrace{CNRES_i^t}_{Confirmed} + \underbrace{ANRES_i^t}_{Accepted} + \underbrace{SNRES_i^t}_{Study} + \underbrace{ROFRNRES_i^t}_{Rollover\ Rights}$$

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$$CNRES_i^t = \left(CNRES_i^t\right)_1 + \left(CNRES_i^t\right)_2$$

Where,

$$\left(CNRES_i^t\right)_1 = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0 \text{ or } \left|PTDF_i^t\right|_r \leq \textit{Flowgate Threshold}$$

$$\left(CNRES_i^t\right)_2 = \sum_r \left(\Delta P_i^t\right)_r * \left(d_i^{firm}\right)_{\text{RAFC}} \text{ if } \left(\Delta P_i^t\right)_r < 0 \text{ and } \left|PTDF_i^t\right|_r > \textit{Flowgate Threshold}$$

and

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

Reciprocally Coordinated Flowgate

$$CNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * FirmFGNegativeFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $FirmFGPositiveFactor_{RAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable positive impacts in the RAFC calculation. **Each Reservation Status Impact Category has its own factor**

The $FirmFGNegativeFactor_{RAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable counter-flow impacts in the RAFC calculation. **Each Reservation Status Impact Category has its own factor**

And,

$$RRES_{N_i^t} = \underbrace{CRRES_{N_i^t}}_{\textit{Committed}} + \underbrace{ARRES_{N_i^t}}_{\textit{Accepted}} + \underbrace{SRRES_{N_i^t}}_{\textit{Study}}$$

$$CRRES_{N_i^t} = (CRRES_{N_i^t})_1 + (CRRES_{N_i^t})_2$$

Where,

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$$(CRRES_{N_i^t})_1 = \sum_r (\Delta P_i^t)_r \quad \text{if } (\Delta P_i^t)_r > 0 \text{ or } \left|PTDF_i^t\right|_r \leq Flowgate\,Threshold$$

$$(CRRES_{N_i^t})_2 = \sum_r (\Delta P_i^t)_r \times \left(d_i^{nonfirm}\right)_{RAFC} \text{ if } (\Delta P_i^t)_r < 0 \text{ and } \left|PTDF_i^t\right|_r > Flowgate\,Threshold$$

The summation of the recallable impacts is for all reservations with TLR priority level *N*.

The $\left(d_i^{firm}\right)_{\text{RAFC}}$ and $\left(d_i^{nonfirm}\right)_{RAFC}$ values are the directionality coefficients (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable and/or recallable counter-flow impacts.
Or for a Reciprocally Coordinated Flowgate

Reciprocally Coordinated Flowgate

$$CRRES_i^t = \sum_r (\Delta P_i^t)_r * NonFirmFGPositiveFactor_{RAFC} \text{ where } (\Delta P_i^t)_r > 0$$

$$+ \sum_r (\Delta P_i^t)_r * NonFirmFGNegativeFactor_{RAFC} \text{ where } (\Delta P_i^t)_r < 0$$

$$ARRES_i^t = \sum_r (\Delta P_i^t)_r * NonFirmFGPositiveFactor_{RAFC} \text{ where } (\Delta P_i^t)_r > 0$$

$$SRRES_i^t = \sum_r (\Delta P_i^t)_r * NonFirmFGPositiveFactor_{RAFC} \text{ where } (\Delta P_i^t)_r > 0$$

The $NonFirmFGPositiveFactor_{RAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the recallable positive impacts in the RAFC calculation. **Each Reservation Status Impact Category has its own factor**

The $NonFirmFGNegativeFactor_{RAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the recallable counter-flow impacts in the RAFC calculation. **Each Reservation Status Impact Category has its own factor**

Recallable Operating Horizon AFC Computation for a Pre-contingent Constrained Flowgate

$$RAFC6_i^t = TFC_i^t - (CBM_i^t \times CBMCOEF_i^t) - (TRM_i^t \times TRMCOEF_i^t) - FETC_i^t - NSCH_i^t - \left(NMF_i^t\right)_n - RSCH6_i^t$$

$$RAFC5_i^t = RAFC6_i^t - RSCH5_i^t$$

$$\vdots$$

$$RAFCN_i^t = RAFC[N+1]_i^t - RSCHN_i^t$$

Where,

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$RAFC_{N_i^t}$ = Recallable (firm) AFC on interface *i* at time *t* for LLR priority *N*

TFC_i^t = Total Flowgate Capability on interface *i* at time *t*

CBM_i^t = Capacity Benefit Margin value used for RATC calculation on interface *i* at time *t*

$CBMCOEF_i^t$ = Capacity Benefit Margin Coefficient on interface *i* at time *t*

TRM_i^t = Transmission Reliability Margin on interface *i* at time *t*

$TRMCOEF_i^t$ = Transmission Reliability Margin Coefficient on interface *i* at time *t*

$FETC_i^t$ = Forecasted Existing Transmission Commitments on interface *i* at time *t*

$\left(NMF_i^t\right)_n$ = Non - recallable (firm) Market Flow for RTO *n* on interface *i* at time *t*

$NSCH_i^t$ = Total impact of all Non - recallable energy schedules on interface *i* at time *t*

$RSCH_{N_i^t}$ = Total impact of all Recallable (Non - firm) energy schedules on interface *i* at time *t* for TLR priority *N*

And,

$$\underbrace{FETC_i^t}_{Forecasted} = \underbrace{NETC_i^t}_{Non-recallable} + \underbrace{RETC_i^t}_{\text{Re}callable}$$

The Forecasted ETC value can be based upon the sum of NETC and RETC values submitted by the Transmission Provider, or the Transmission Provider can rely on the ETC Forecaster to predict the ETC value in the Operating Horizon.

$$(NSCH_i^t)_1 = \sum_r \left(\Delta P_i^t\right)_r$$

$$(RSCH_{N_i^t})_2 = \sum_r \left(\Delta P_i^t\right)_r$$

Where,

$$\left(\Delta P_i^t\right)_r = \left(PTDF_i^t\right)_r \times \left(SCH^t\right)_r$$

$\left(PTDF_{i^t}\right)_r$ = Power Transfer Distribution Factor of the transmission reservation *r*, at time *t* on interface *i*

$\left(SCH^t\right)_r$ = Megawatt energy schedule of the transmission reservation *r* or capacity of the priority 2 and hourly priority 6 reservation *r* for which a schedule does not exist, at time *t*

The $TRMCOEF_i^t$ component allows the MAPP Transmission Provider to sell all or a portion of the TRM as recallable transmission service.

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The $CBMCOEF_i^t$ component allows the MAPP Transmission Provider to sell all or a portion of the CBM as recallable transmission service.

13.3 Non-Recallable AFC Computation for a Post-contingent MAPP Transmission Provider Flowgate

A Monitored Interface and a Contingency interface pair define each Post-contingent flowgate. Each Monitored Interface and Contingency Interface may be made up of one or more transmission elements.

The following equation describes the computation of Non-recallable Available Flowgate Capability (NAFC) for each Post-contingent Flowgate for each time period.

$$NAFC_i^t = TFC_i^t - CBM_i^t - TRM_i^t - NETC_i^t - \left(NMF_i^t\right)_n - NRES_i^t$$

Where,

$NAFC_i^t$ = Non - recallable (firm) AFC on interface *i* at time *t*

TFC_i^t = Total Flowgate Capability on interface *i* at time *t*

CBM_i^t = Capacity Benefit Margin value used for NAFC calculation on interface *i* at time *t*

TRM_i^t = Transmission Reliability Margin on interface *i* at time *t*

$NETC_i^t$ = Non - recallable Existing Transmission Commitments on interface *i* at time *t*

$\left(NMF_i^t\right)_n$ = Non - recallable (firm) Market Flow for RTO *n* on interface *i* at time *t*

$NRES_i^t$ = Non - recallable (firm) transmission reservation impacts on interface *i* at time *t*

$NRES_i^t$ is calculated by summing all transmission reservation r, at each time t, on each interface i as follows,

$$NRES_i^t = \underbrace{CNRES_i^t}_{Confrimed} + \underbrace{ANRES_i^t}_{Accepted} + \underbrace{SNRES_i^t}_{Study} + \underbrace{ROFRNRES_i^t}_{Rollover\ Rights}$$

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$$CNRES_i^t = \left(CNRES_i^t\right)_1 + \left(CNRES_i^t\right)_2$$

Where,

$$\left(CNRES_i^t\right)_1 = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0 \text{ or } \left|OTDF_i^t\right|_r \leq \textit{Flowgate Threshold}$$

$$\left(CNRES_i^t\right)_2 = \sum_r \left(\Delta P_i^t\right)_r * \left(d_i^{firm}\right)_{\text{NAFC}} \text{ if } \left(\Delta P_i^t\right)_r < 0 \text{ and } \left|OTDF_i^t\right|_r > \textit{Flowgate Threshold}$$

and

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

The $\left(d_i^{firm}\right)_{\text{NAFC}}$ value is the directionality coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the recallable counter-flow impacts.

Reciprocally Coordinated Flowgate

$$CNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * FirmFGNegativeFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $FirmFGPositiveFactor_{NAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable positive impacts in the NAFC calculation. **Each Reservation Impact Category has its own factor**

The $FirmFGNegativeFactor_{NAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable counter-flow impacts in the NAFC calculation. **Each Reservation Impact Category has its own factor**

Where,

$$\left(\Delta P_i^t\right)_r = \left(OTDF_i^t\right)_r \times \left(CAP^t\right)_r$$

And,

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$\left(OTDF_i^t\right)_r$ = Outage Transfer Distribution Factor of the transmission reservation r, at time t on interface i

$\left(CAP^t\right)_r$ = Megawatt capacity of the transmission reservation r, at time t

$CNRES_i^t$ = Committed (Confirmed) Non - recallable (firm) reservation impacts on interface i at time t

$ANRES_i^t$ = Accepted, Counteroffer, and Rebid Non - recallable (firm) reservation impacts on interface i at time t

$SNRES_i^t$ = Study Non - recallable (firm) reservation impacts on interface i at time t

$ROFRNRES_i^t$ = Right of First Refusal Impacts(Rollover Rights) Non - recallable (firm) reservation impacts on interface i at time t

13.4 Recallable AFC Computation for a Post-contingent MAPP Transmission Provider Flowgate

For each Flowgate, six AFC values are calculated for the evaluation of Recallable service in order to determine the AFC within each service priority group. The following equations describe the computation of these Recallable Available Flowgate Capability (RAFC) values for each Flowgate for each time period for each service priority.

(Recallable Planning Horizon AFC Computation for a Post-contingent Constrained Flowgate

$$RAFC6_i^t = TFC_i^t - \left(CBM_i^t \times CBMCOEF_i^t\right) - \left(TRM_i^t \times TRMCOEF_i^t\right) - RETC_i^t - NRES_i^t - \left(NMF_i^t\right)_n - NETC_i^t - RRES6_i^t$$

$$RAFC5_i^t = RAFC6_i^t - RRES5_i^t$$

$$\vdots$$

$$RAFCN_i^t = RAFC[N+1]_i^t - RRESN_i^t$$

Where,

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$RAFC_{Ni}^{t}$ = Recallable (firm) AFC on interface *i* at time *t* for TLR priority *N*

TFC_i^t = Total Flowgate Capability on interface *i* at time *t*

CBM_i^t = Capacity Benefit Margin value used for RATC calculation on interface *i* at time *t*

$CBMCOEF_i^t$ = Capacity Benefit Margin Coefficient on interface *i* at time *t*

TRM_i^t = Transmission Reliability Margin on interface *i* at time *t*

$TRMCOEF_i^t$ = Transmission Reliability Margin Coefficient on interface *i* at time *t*

$RETC_i^t$ = Recallable Existing Transmission Committments on interface *i* at time *t*

$NETC_i^t$ = Non - Recallable Existing Transmission Committments on interface *i* at time *t*

$\left(NMF_i^t\right)_n$ = Non - recallable (firm) Market Flow for RTO *n* on interface *i* at time *t*

$NRES_i^t$ = Non - recallable (firm) transmission reservation impacts on interface *i* at time *t*

$RRES_{Ni}^{t}$ = Recallable (Non - firm) transmission reservation impacts on interface *i* at time *t* for TLR priority *N*

The $TRMCOEF_i^t$ component allows the MAPP Transmission Provider to sell all or a portion of the TRM as recallable transmission service.

The $CBMCOEF_i^t$ component allows the MAPP Transmission Provider to sell all or a portion of the CBM as recallable transmission service.

The computation of $NRES_i^t$ and $RRES_{Ni}^{t}$ is somewhat different from those of Non-recallable ATC computation.

$$NRES_i^t = \underbrace{CNRES_i^t}_{Confirmed} + \underbrace{ANRES_i^t}_{Accepted} + \underbrace{SNRES_i^t}_{Study} + \underbrace{ROFRNRES_i^t}_{Rollover\ Rights}$$

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$$CNRES_i^t = \left(CNRES_i^t\right)_1 + \left(CNRES_i^t\right)_2$$

Where,

$$\left(CNRES_i^t\right)_1 = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0 \text{ or } \left|OTDF_i^t\right|_r \leq \textit{Flowgate Threshold}$$

$$\left(CNRES_i^t\right)_2 = \sum_r \left(\Delta P_i^t\right)_r * \left(d_i^{firm}\right)_{\text{RAFC}} \text{ if } \left(\Delta P_i^t\right)_r < 0 \text{ and } \left|OTDF_i^t\right|_r > \textit{Flowgate Threshold}$$

and

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

Reciprocally Coordinated Flowgate

$$CNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * FirmFGNegativeFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $FirmFGPositiveFactor_{RAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable positive impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor**

The $FirmFGNegativeFactor_{RAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable counter-flow impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor**

And

$$RRES_{Ni}^t = \underbrace{CRRES_{Ni}^t}_{\textit{Committed}} + \underbrace{ARRES_{Ni}^t}_{\textit{Accepted}} + \underbrace{SRRES_{Ni}^t}_{\textit{Study}}$$

$$CRRES_{Ni}^t = (CRRES_{Ni}^t)_1 + (CRRES_{Ni}^t)_2$$

Where,

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$$(CRRESN_i^t)_1 = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0 \text{ or } \left|OTDF_i^t\right|_r \le \textit{Flowgate Threshold}$$

$$(CRRESN_i^t)_2 = \sum_r \left(\Delta P_i^t\right)_r \times \left(d_i^{nonfirm}\right)_{RAFC} \text{ if } \left(\Delta P_i^t\right)_r < 0 \text{ and } \left|OTDF_i^t\right|_r > \textit{Flowgate Threshold}$$

The summation of the recallable impacts is for all reservations with TLR priority level N.

The $\left(d_i^{firm}\right)_{\text{RAFC}}$ and $\left(d_i^{nonfirm}\right)_{RAFC}$ values are the directionality coefficients (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable and/or recallable counter-flow impacts.

Or for a Reciprocally Coordinated Flowgate

$$CRRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * NonFirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * NonFirmFGNegativeFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ARRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * NonFirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SRRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * NonFirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $NonFirmFGPositiveFactor_{RAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the recallable positive impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor**

The $NonFirmFGNegativeFactor_{RAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the recallable counter-flow impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor**

Recallable Operating Horizon ATC Computation for a Post-contingent Constrained Flowgate

$$RAFC6_i^t = TFC_i^t - \left(CBM_i^t \times CBMCOEF_i^t\right) - \left(TRM_i^t \times TRMCOEF_i^t\right) - FETC_i^t - NSCH_i^t - \left(NMF_i^t\right)_n - RSCH6_i^t$$

$$RAFC5_i^t = RAFC6_i^t - RSCH5_i^t$$

$$\vdots$$

$$RAFCN_i^t = RAFC[N+1]_i^t - RSCHN_i^t$$

Where,

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$RAFC_{N_i^t}$ = Recallable (firm) AFC on interface *i* at time *t* for LLR priority *N*

TFC_i^t = Total Flowgate Capability on interface *i* at time *t*

CBM_i^t = Capacity Benefit Margin value used for RATC calculation on interface *i* at time *t*

$CBMCOEF_i^t$ = Capacity Benefit Margin Coefficient on interface *i* at time *t*

TRM_i^t = Transmission Reliability Margin on interface *i* at time *t*

$TRMCOEF_i^t$ = Transmission Reliability Margin Coefficient on interface *i* at time *t*

$FETC_i^t$ = Forecasted Existing Transmission Commitments on interface *i* at time *t*

$\left(NMF_i^t\right)_n$ = Non - recallable (firm) Market Flow for RTO *n* on interface *i* at time *t*

$NSCH_i^t$ = Total impact of all Non - recallable energy schedules on interface *i* at time *t*

$RSCH_{N_i^t}$ = Total impact of all Recallable (Non - firm) energy schedules on interface *i* at time *t* for TLR priority *N*

And,

$$\underbrace{FETC_i^t}_{Forecasted} = \underbrace{NETC_i^t}_{Non-recallable} + \underbrace{RETC_i^t}_{\text{Re}callable}$$

The Forecasted ETC value can be based upon the sum of NETC and RETC values submitted by the Transmission Provider, or the Transmission Provider can rely on the ETC Forecaster to predict the ETC value in the Operating Horizon.

$$(NSCH_i^t)_1 = \sum_r \left(\Delta P_i^t\right)_r$$

$$(RSCH_{N_i^t})_2 = \sum_r \left(\Delta P_i^t\right)_r$$

Where,

$$\left(\Delta P_i^t\right)_r = \left(OTDF_i^t\right)_r \times \left(SCH^t\right)_r$$

$\left(OTDF_{i^t}\right)_r$ = Outage Transfer Distribution Factor of the transmission reservation *r*, at time *t* on interface *i*

$\left(SCH^t\right)_r$ = Megawatt energy schedule of the transmission reservation *r* or capacity of the priority 2 and hourly priority 6 reservation *r* for which a schedule does not exist, at time *t*

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The $TRMCOEF_i^t$ component allows the MAPP Transmission Provider to sell all or a portion of the TRM as recallable transmission service.

The $CBMCOEF_i^t$ component allows the MAPP Transmission Provider to sell all or a portion of the CBM as recallable transmission service.

13.5 Non-Recallable ATC Computation on a Contract Path

$$NATC_i^t = TTC_i^t - CBM_i^t - TRM_i^t - NETC_i^t - NRES_i^t$$

$NATC_i^t$ = Non - recallable (firm) ATC on contract path *i* at time *t*

TTC_i^t = Total Transfer Capability on contract path *i* at time *t*

CBM_i^t = Capacity Benefit Margin value used for NATC calculation on contract path *i* at time *t*

TRM_i^t = Transmission Reliability Margin on contract path *i* at time *t*

$NETC_i^t$ = Existing Transmission Commitment value used for NATC calculation on contract path *i* at time *t*

$NRES_i^t$ = Non - recallable (firm) transmission reservation impacts on contract path *i* at time *t*

$NRES_i^t$ is calculated by summing all transmission reservation r, at each time t, on each contract path i as follows

$$NRES_i^t = \underbrace{CNRES_i^t}_{Confirmed} + \underbrace{ANRES_i^t}_{Accepted} + \underbrace{SNRES_i^t}_{Study} + \underbrace{ROFRNRES_i^t}_{Rollover\ Rights}$$

$$CNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * FirmCPNegativeFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $FirmCPPositiveFactor_{NAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable positive impacts in the NAFC calculation. **Each Reservation Impact Category has its own factor**

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The $FirmCPNegativeFactor_{NAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable counter-flow impacts in the NAFC calculation. **Each Reservation Impact Category has its own factor**

Where,

$$\left(\Delta P_i^t\right)_r = \left(DF_i^t\right)_r \times \left(CAP^t\right)_r$$

And,

$\left(DF_i^t\right)_r$ = DF is the percent impact, [0, 100, -100%] of the transmission reservation r, at time t on contract path i

$\left(CAP^t\right)_r$ = Megawatt capacity of the transmission reservation r, at time t

13.6 Recallable ATC Computation on a Contract Path

For each Contract Path, one ATC is calculated for the evaluation of Recallable service. The following equation describes the computation of these Recallable Available Transfer Capability (RATC) values for each Contract Path for each time period.

Recallable Planning Horizon ATC Computation for a Contract Path

$$RATC6_i^t = TTC_i^t - \left(CBM_i^t \times CBMCOEF_i^t\right) - \left(TRM_i^t \times TRMCOEF_i^t\right) - RETC_i^t - NRES_i^t - NETC_i^t - RRES6_i^t$$

$$RATC5_i^t = RATC6_i^t - RRES5_i^t$$

$$\vdots$$

$$RATC_{N_i}^t = RATC_{[N+1]_i}^t - RRES_{N_i}^t$$

Where,

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$RATC_{N_i^t}$ = Recallable (firm) ATC on interface *i* at time *t* for TLR priority *N*

TTC_i^t = Total Contract Path Capability on interface *i* at time *t*

CBM_i^t = Capacity Benefit Margin on interface *i* at time *t*

$CBMCOEF_i^t$ = Capacity Benefit Margin Coefficient on interface *i* at time *t*

TRM_i^t = Transmission Reliability Margin on interface *i* at time *t*

$TRMCOEF_i^t$ = Transmission Reliability Margin Coefficient on interface *i* at time *t*

$RETC_i^t$ = Recallable Existing Transmission Committments on interface *i* at time *t*

$NETC_i^t$ = Non - Recallable Existing Transmission Committments on interface *i* at time *t*

$NRES_i^t$ = Non - recallable (firm) transmission reservation impacts on interface *i* at time *t*

$RRES_{N_i^t}$ = Recallable (Non - firm) transmission reservation impacts on interface *i* at time *t* for TLR priority *N*

The $TRMCOEF_i^t$ component allows the MAPP Transmission Provider to sell all or a portion of the TRM as recallable transmission service.

The $CBMCOEF_i^t$ component allows the MAPP Transmission Provider to sell all or a portion of the CBM as recallable transmission service.

The computation of $NRES_i^t$ and $RRES_{N_i^t}$ is somewhat different from those of Non-recallable ATC computation.

$$NRES_i^t = \underbrace{CNRES_i^t}_{Confrimed} + \underbrace{ANRES_i^t}_{Accepted} + \underbrace{SNRES_i^t}_{Study} + \underbrace{ROFRNRES_i^t}_{Rollover\ Rights}$$

$$CNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * FirmCPNegativeFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $FirmCPPositiveFactor_{RAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable positive impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor**

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The $FirmCPNegativeFactor_{RAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the non-recallable counter-flow impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor**

And

$$RRES_{N_i^t} = \underbrace{CRRES_{N_i^t}}_{Committed} + \underbrace{ARRES_{N_i^t}}_{Accepted} + \underbrace{SRRES_{N_i^t}}_{Study}$$

$$CRRES_{N_i^t} = (CRRES_{N_i^t})_1 + (CRRES_{N_i^t})_2$$

Where,

$$CRRES_i^t = \sum_r (\Delta P_i^t)_r * NonFirmCPPositiveFactor_{RAFC} \text{ where } (\Delta P_i^t)_r > 0$$

$$+ \sum_r (\Delta P_i^t)_r * NonFirmCPNegativeFactor_{RAFC} \text{ where } (\Delta P_i^t)_r < 0$$

$$ARRES_i^t = \sum_r (\Delta P_i^t)_r * NonFirmCPPositiveFactor_{RAFC} \text{ where } (\Delta P_i^t)_r > 0$$

$$SRRES_i^t = \sum_r (\Delta P_i^t)_r * NonFirmCPPositiveFactor_{RAFC} \text{ where } (\Delta P_i^t)_r > 0$$

The $NonFirmCPPositiveFactor_{RAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the recallable positive impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor**

The $NonFirmCPNegativeFactor_{RAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP Transmission Provider can choose to include all or none of the recallable counter-flow impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor**

Where,

$$(\Delta P_i^t)_r = (DF_i^t)_r \times (CAP^t)_r$$

And,

$(DF_i^t)_r$ = DF is the percent impact, [0, 100, -100%] of the transmission reservation r, at time t on contract path i

$(CAP^t)_r$ = Megawatt capacity of the transmission reservation r, at time t

Recallable Operating Horizon ATC Computation for a Contract Path

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$$RATC6_i^t = TTC_i^t - \left(CBM_i^t \times CBMCOEF_i^t\right) - \left(TRM_i^t \times TRMCOEF_i^t\right) - NETC_i^t - RETC_i^t - NSCH_i^t - RSCH6_i^t$$

$$RATC5_i^t = RATC6_i^t - RSCH5_i^t$$

$$\vdots$$

$$RATCN_i^t = RATC[N+1]_i^t - RSCHN_i^t$$

$RATC_i^t$ = Recallable (firm) ATC on contract path *i* at time *t*

TTC_i^t = Total Transfer Capability on contract path *i* at time *t*

CBM_i^t = Capacity Benefit Margin value on contract path *i* at time *t*

$CBMCOEF_i^t$ = Capacity Benefit Margin Coefficient on interface *i* at time *t*

TRM_i^t = Transmission Reliability Margin on contract path *i* at time *t*

$TRMCOEF_i^t$ = Transmission Reliability Margin Coefficient on contract path *i* at time *t*

$NETC_i^t$ = Non - Recallable Existing Transmission Commitment value on contract path *i* at time *t*

$RETC_i^t$ = Recallable Existing Transmission Commitment value on contract path *i* at time *t*

$NSCH_i^t$ = Total impact of all Non - recallable energy schedules on icontract path *i* at time *t*

$RSCH_i^t$ = Total impact of all Recallable (Non - firm) energy schedules on contract path *i* at time *t*

And,

$$NSCH_i^t = \sum_r \left(\Delta P_i^t\right)_r$$

$$RSCH_i^t = \sum_r \left(\Delta P_i^t\right)_r$$

Where,

$$\left(\Delta P_i^t\right)_r = \left(DF_i^t\right)_r \times \left(SCH^t\right)_r$$

And,

$\left(DF_i^t\right)_r$ = DF is the percent impact, [0, 100, -100%] of the transmission reservation *r*, at time *t* on contract path *i*

$\left(SCH^t\right)_r$ = Megawatt energy schedule of the transmission reservation *r* or capacity of the priority 2 and hourly priority 6 reservation *r* for which a schedule does not exist, at time *t*

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The $COEF_i^t$ component allows the MAPP Transmission Provider to sell all or a portion of the TRM and/or CBM as recallable transmission service.

14 ASTFC Calculation

All firm transmission service reserved under MAPP Schedule F or a MAPP Member OATT is subject to the Forward Coordination Process under Attachment B to the MISO-MAPPCOR Seams Operating Agreement. Under this process, an allocation of flowgate capability between MAPP and MISO (as well as between other Reciprocal Entities such as PJM, SWPP, and TVA) is performed to determine each party's share of capability to determine each parties Available Share of Total Flowgate Capability (ASTFC). The ASTFC is evaluated similarly to an AFC evaluation.

14.1 Any transmission service request, which passes the AFC/ATC evaluation, is then subjected to an ASTFC evaluation. Firm ASTFC Computation for a Pre-Contingent Constrained Flowgate

The following equation describes the computation of Firm ASTFC for each Pre-Contingent Constrained Flowgate for each time period:

$$ASTFC_{i,t} = STFC_{i,t} - MAPPNGLF_{i,t} - NRES_{i,t}$$

Where:

$ASTFC_{i,t}$ = *Firm* Shared Capacity For MAPP on the RCF Flowgate i at time t

$STFC_{i,t}$ = S*hared* Flowgate Capacity on interface *i* at time *t*.

$MAPPNGLF_{i,t}$ = Net Gen to Load Flow Impacts of interface *i* at time *t*.

$NRES_{i,t}$ = Non - Recallable (Firm) transmission reservation impacts on interface *i* at time *t*.

The Value of $MAPPNGLF_{i,t}$ on Reciprocal Coordinated Flow gate is calculated by summing all forward MAPP control area Gen to Load flow Impacts (Down to Zero %) and all reverse MAPP control area Gen to load flow impacts (down to 0 %) on the RCF interface I at time t.

The value of $NRES_{i,t}$ on Reciprocal coordinated Flowgate is calculated by summing all transmission reservation *r*, at each time *t*, on each interface *i* as follows:

$$NRES_{i,t} = \sum_k \left\{ NRES_{k,i,t} \mid k \in \left\{ confirmed,^{+}\ confirmed,^{-}\ accepted,\ study,\ rollover, \right\} \right\}$$

Where:

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$$NRES_{confirmed^+,i,t} = \Phi NF_{confirmed^+,i} \times \sum_r \left\{ PTDF_{r,i,t} \times CAP_{r,t} \mid PTDF_{r,i,t} \geq 0 \text{ and } RT_r = confirmed \right\}$$

$$NRES_{confirmed^-,i,t} = \Phi NF_{confirmed^-,i} \times \sum_r \left\{ PTDF_{r,i,t} \times CAP_{r,t} \mid PTDF_{r,i,t} < 0 \text{ and } RT_r = confirmed \right\}$$

$$NRES_{accepted,i,t} = \Phi NF_{accepted,i} \times \sum_r \left\{ PTDF_{r,i,t} \times CAP_{r,t} \mid PTDF_{r,i,t} > 0 \text{ and } RT_r = accepted \right\}$$

$$NRES_{study,i,t} = \Phi NF_{study,i} \times \sum_r \left\{ PTDF_{r,i,t} \times CAP_{r,t} \mid PTDF_{r,i,t} > 0 \text{ and } RT_r = study \right\}$$

$$NRES_{rollover,i,t} = \Phi NF_{rollover,i} \times \sum_r \left\{ PTDF_{r,i,t} \times CAP_{r,t} \mid PTDF_{r,i,t} > 0 \text{ and } RT_r = rollover \right\}$$

And:

$NRES_{confirmed^+,i,t}$ = Positive Committed (Confirmed) Non - Recallable (Firm) reservation impacts on interface *i* at ti

$NRES_{confirmed^-,i,t}$ = Negative Committed (Confirmed) Non - Recallable (Firm) reservation impacts on interface *i* at t

$NRES_{accepted,i,t}$ = Accepted, Counteroffer, and Rebid Non - Recallable (Firm) reservation impacts on interface *i* at

$NRES_{study,i,t}$ = Study Non - Recallable (Firm) reservation impacts on interface *i* at time *t*.

$NRES_{rollover,i,t}$ = Right of First Refusal Impacts(Rollover Rights) Non - Recallable (Firm) reservation impacts on interface *i* at time *t*.

$\Phi NF_{k,i}$ = non - recallable (firm) directionality coefficient for reservation class *k* and interface *i*.

RT_r = type of transmission reservation *r*.

$PTDF_{r,i,t}$ = Power Transfer Distribution Factor for reservation *r*, on interface *i* at time *t*.

$CAP_{r,t}$ = Megawatt capacity of the transmission reservation *r*, at time *t*.

For Reciprocally Coordinated MAPP flow gates $\Phi NF_{k,i}$ can vary between 0.0 and 1.0

The MAPP Transmission Provider transmission reservation data set is used for calculating $NRES_{i,t}$ in the ASTFC calculation is same as that used for the AFC calculations, except that reservations source/sink are mapped to control area points. The reservation impacts are calculated using Control area to Control area definitions.

14.2 Firm ASTFC Computation for a Post-Contingent Flowgate

The following equation describes the computation of Firm ASTFC for each Pre-Contingent Constrained Flowgate for each time period:

$$ASTFC_{i,t} = STFC_{i,t} - MAPPNGLF_{i,t} - NRES_{i,t}$$

Where:

$ASTFC_{i,t}$ = *Firm* Shared Capacity For MAPP on the RCF Flowgate i at time t

$STFC_{i,t}$ = S*hared* Flowgate Capacity on interface *i* at time *t*.

$MAPPNGLF_{i,t}$ = Net Gen to Load Flow Impacts of interface *i* at time *t*.

$NRES_{i,t}$ = Non - Recallable (Firm) transmission reservation impacts on interface *i* at time *t*.

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The Value of $MAPPNGLF_{i,t}$ on Reciprocal Coordinated Flow gate is calculated by summing all forward MAPP control area Gen to Load flow Impacts (Down to Zero %) and all reverse MAPP control area Gen to load flow impacts (down to 0 %) on the RCF interface I at time t.

The value of $NRES_{i,t}$ on Reciprocal coordinated Flowgate is calculated by summing all transmission reservation *r*, at each time *t*, on each interface *i* as follows:

$$NRES_{i,t} = \sum_{k} \left\{ NRES_{k,i,t} \mid k \in \left\{ confirmed,^{+}\ confirmed,^{-}\ accepted,\ study,\ rollover, \right\} \right\}$$

Where:

$$NRES_{confirmed^{+},i,t} = \Phi NF_{confirmed^{+},i} \times \sum_{r} \left\{ OTDF_{r,i,t} \times CAP_{r,t} \mid OTDF_{r,i,t} \geq 0 \text{ and } RT_{r} = confirmed \right\}$$

$$NRES_{confirmed^{-},i,t} = \Phi NF_{confirmed^{-},i} \times \sum_{r} \left\{ OTDF_{r,i,t} \times CAP_{r,t} \mid OTDF_{r,i,t} < 0 \text{ and } RT_{r} = confirmed \right\}$$

$$NRES_{accepted,i,t} = \Phi NF_{accepted,i} \times \sum_{r} \left\{ OTDF_{r,i,t} \times CAP_{r,t} \mid OTDF_{r,i,t} > 0 \text{ and } RT_{r} = accepted \right\}$$

$$NRES_{study,i,t} = \Phi NF_{study,i} \times \sum_{r} \left\{ OTDF_{r,i,t} \times CAP_{r,t} \mid OTDF_{r,i,t} > 0 \text{ and } RT_{r} = study \right\}$$

$$NRES_{rollover,i,t} = \Phi NF_{rollover,i} \times \sum_{r} \left\{ OTDF_{r,i,t} \times CAP_{r,t} \mid OTDF_{r,i,t} > 0 \text{ and } RT_{r} = rollover \right\}$$

And:

$NRES_{confirmed^{+},i,t}$ = Positive Committed (Confirmed) Non - Recallable (Firm) reservation impacts on interface *i* at ti

$NRES_{confirmed^{-},i,t}$ = Negative Committed (Confirmed) Non - Recallable (Firm) reservation impacts on interface *i* at t

$NRES_{accepted,i,t}$ = Accepted, Counteroffer, and Rebid Non - Recallable (Firm) reservation impacts on interface *i* at

$NRES_{study,i,t}$ = Study Non - Recallable (Firm) reservation impacts on interface *i* at time *t*.

$NRES_{rollover,i,t}$ = Right of First Refusal Impacts(Rollover Rights) Non - Recallable (Firm) reservation impacts on interface *i* at time *t*.

$\Phi NF_{k,i}$ = non - recallable (firm) directionality coefficient for reservation class *k* and interface *i*.

RT_{r} = type of transmission reservation *r*.

$OTDF_{r,i,t}$ = Outage Transfer Distribution Factor for reservation *r*, on interface *i* at time *t*.

$CAP_{r,t}$ = Megawatt capacity of the transmission reservation *r*, at time *t*.

For Reciprocally Coordinated MAPP flow gates $\Phi NF_{k,i}$ can vary between 0.0 and 1.0

The MAPP Transmission Provider transmission reservation data set is used for calculating $NRES_{i,t}$ in the ASTFC calculation is same as that used for the AFC calculations, except that reservations source/sink are mapped to control area points. The reservation impacts are calculated using Control area to Control area definitions.

14.3 Evaluation of Reciprocal Coordinated Flowgates

The Reciprocal Flowgate check is required in the request evaluation process abide by the joint agreements with neighboring transmission organizations.

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All firm MAPP schedule F and MAPP Member Tariff Firm service shall be evaluated using the shared capacity (ASFTC) value on reciprocal flow gates.

Both ASTFC and AFC evaluation shall be performed for the time frame when a posted ASTFC values are available.If ASTFC values are is not available only an AFC evaluation is required.

A valid transmission service request will be evaluated through the AFC evaluation.

Reciprocal Coordinated Flowgates are treated same as Coordinated Flowgate for impact calculation process. The only difference between a Reciprocal Coordinated Flowgate and Coordinate Flowgate is that, the evaluation of a transmission service request should be done using the MAPP shared values on the Reciprocal Coordinated Flowgates.

If a transmission service request fails the ASTFC evaluation, then additional analysis will be performed to determine if there is adequate ASTFC from another reciprocal entity to either share or transfer allocation in order to grant the transmission service.

For Schedule F service, the MAPP Transaction Coordinator will make that determination. The MAPP Transmission Providers must contact the MAPP Transaction Coordinator if service under their OATT was denied due to the ASTFC calculation. The MAPP Transaction Coordinator will determine if there is capacity available to share or transfer from MISO or other Reciprocal Entities.

Allocation sharing is a manual process, which may increase the typical response time.

Allocation sharing will be administered per Appendix B of Attachment B to the MISO-MAPPCOR Seams Operating Agreement.

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