ATTACHMENT C

Methodology To Assess Available Transfer Capability

1. DEFINITIONS

All definitions in this Attachment C are as provided in the North American Electric Reliability Corporation ("NERC") Glossary of Terms Used in Reliability Standards or Module A to the MISO Tariff unless noted below:

1.1 AFC Flowgate List – A list of Flowgates for which Available Flowgate Capability ("AFC") is calculated.

1.2 AFC Override Value – Flowgate AFC value for a specific time increment calculated by the Transmission Provider where the Flowgate is located. For Flowgates in the AFC Flowgate List that are not under the control of the Transmission Provider, the final AFC values used to evaluate transmission service requests are the AFC Override Values received from other transmission providers.

1.3 Automatic Reserve Sharing ("ARS") Component – One component of the Transmission Reliability Margin ("TRM") attribute for a Flowgate under the control of the Transmission Provider. ARS provides reasonable assurance that transmission capacity will be available to accommodate generation reserve sharing upon notification of a reserve sharing event.

1.4 Power Transfer Distribution Factor ("PTDF") – A PTDF Flowgate is a Flowgate that monitors the flow on a single or multiple transmission elements without a contingency.

1.5 Outage Transfer Distribution Factor ("OTDF") – An OTDF Flowgate is a Flowgate that monitors the flow on a single or multiple transmission elements for the loss of other

transmission elements.

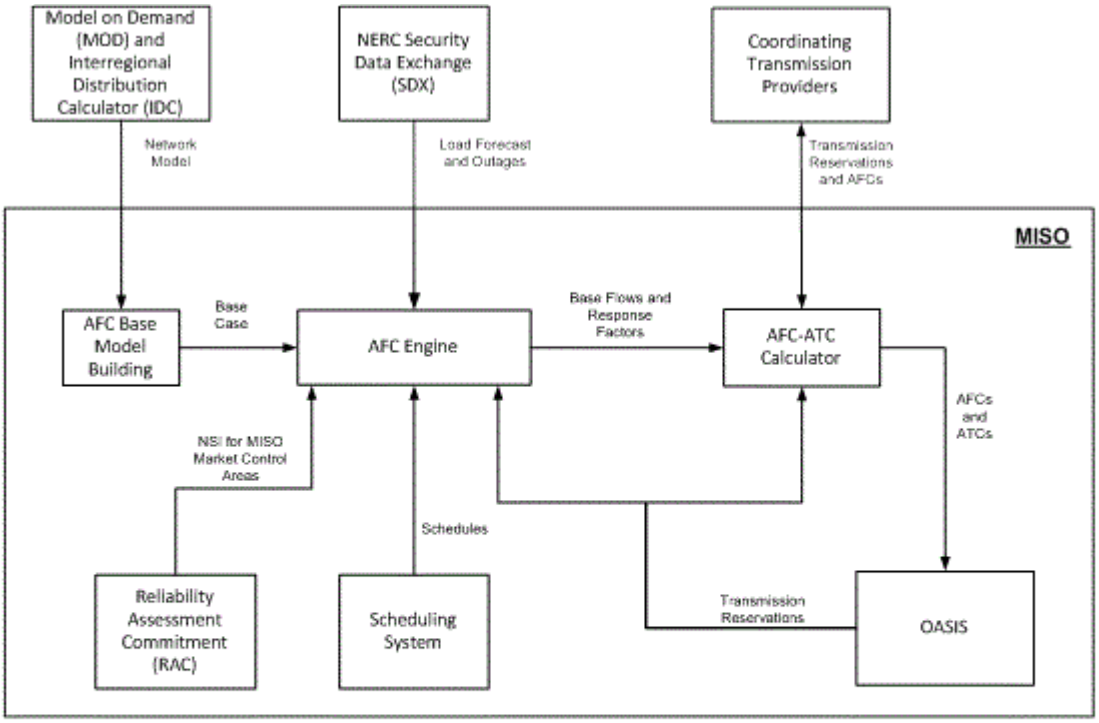
1.6 webTrans– OATI webTrans software is one component of the Transmission Provider's AFC calculation process described in Section 2.

2. EVALUATING REQUESTS FOR TRANSMISSION SERVICE

The Transmission Provider will respond to a valid Application for Transmission Service Requests ("TSRs"), with duration of less than a year as defined in Module B of this Tariff, by performing calculations pursuant to this Attachment C to assess whether sufficient transfer capability would be available to accommodate the service requested in the Application. TSRs will be evaluated using the Flowgate Methodology to determine the capability of the interconnected network to accommodate the TSR. System Impact Studies ("SISs") are performed for TSRs that are submitted for a duration longer than one year and in accordance with Attachment D to the Tariff. TSRs are evaluated against a limited set of Flowgates determined by webTrans to be the most significantly impacted Flowgates ("most limiting Flowgates"). The most limiting Flowgate for a particular path would be the Flowgate whose AFC value when divided by its Distribution Factor for the path results in the least amount of ATC available. The list of Flowgates used to evaluate a particular TSR is re-determined during resynchronization.

Distribution Factors are used to decrement the AFC of Flowgates for the impacts caused by the TSR. TSRs are accepted, counter-offered, refused, or declined in accordance with the Business Practices Manual for Module B of the Tariff.

AFC AND DISTRIBUTION FACTOR CALCULATION



The table listed below describes the various horizons with their time range, increments, and minimum frequency of AFC calculation:

Table 1: Horizons in Transmission Provider AFC Calculations*

Horizon	Time Range	Increment	Frequency
Operating	0 – 48	Hourly	Hourly
Planning	49-168	Hourly	Daily
Planning	2-33	Daily	Daily
Study	2-36	Monthly	Weekly

* When an AFC resynchronization increment overlaps for the same time points, the more granular increment is used for AFC values and evaluation of TSRs.

AFC resynchronizations occur via webTrans on the above-referenced frequency utilizing inputs to the AFC equation as described below. These AFC resynchronizations occur on the schedule described above to ensure that webTrans remains updated with the most current model-related data and information. These resynchronizations may occur more frequently if necessary. More specifically, MISO will attempt to resynchronize the Planning horizon for hours 49 - 168 every six hours and the Study horizon daily.

AFC is recalculated when TSRs are submitted or their status is modified such that their impact upon AFC must be removed or recalculated. Accordingly, recalculations of AFC values via webTrans occur frequently via its algebraic functionality. More specifically, when a TSR is updated, webTrans algebraically updates the impacted AFC values. These updated AFC values are then available for use in evaluating subsequent TSRs. Because this algebraic process occurs when a TSR is updated, MISO's AFC values remain current throughout the day. Completion of

an algebraic update of AFC values by webTrans will be considered a successful recalculation and update of AFC. To the extent that a scheduled resynchronization by webTrans as described above is not completed, the last valid AFC calculation by webTrans is used to evaluate TSRs. During resynchronization, new TSRs are modeled in the Flowgate Methodology through two phases, power flow model building and webTrans, as described in more detail below.

2.1. POWER FLOW MODEL BUILDING

The power flow case is built from a base network topology model and the most current data inputs as follows: Load Forecast, generation and transmission outages, and net interchange of the Transmission Provider's Local Balancing Authority Areas ("LBAs") and first tier areas. Generation is dispatched within the power flow model according to merit order block dispatch files provided by the Transmission Provider and adjacent transmission providers. Once the model for a specific interval is built, it is solved to monitor the initial flows of the Flowgates. The Distribution Factors utilized in webTrans Simulation described below are topology dependent and are computed from the solved power flow model.

Additionally, to produce credible AFC values for a Flowgate, the Transmission Provider must also consider the effects of parallel flows on its transmission system and honor AFC values for Flowgates as calculated by the transmission provider on whose system the Flowgate is located. The Transmission Provider has committed to honor the AFC of Flowgates of neighboring transmission providers to the extent these transmission providers honor their own Flowgates as required by the Transmission Provider's coordination agreements. This calculation and exchange of AFC values for Flowgates allows transmission providers using the same

Flowgates to honor the calculated AFC value of the Flowgate as they sell transmission service that may impact such Flowgates. Further, the Transmission Provider has also agreed to exchange Reservations with adjacent transmission providers as required by the Transmission Provider's seams agreements and as needed to facilitate inclusion of the appropriate level of detail in the power flow model.

2.1.1. INPUT DATA AND ASSUMPTIONS USED IN POWER FLOW MODEL BUILDING

Power Flow Model: The Transmission Provider uses its Model on Demand database and the NERC Interconnection Distribution Calculator ("IDC") to develop base power flow models. The Model on Demand database contains the most recent Eastern Interconnection Reliability Assessment Group ("ERAG") planning model data and topology updates provided by MISO Transmission Owners. The modeling inputs and data described below are applied to the "base models" when resynchronizing AFC values. Additional details are provided in the Transmission Provider's Available Transfer Capability Implementation Document ("ATCID").

Load Forecast: Load Forecast information is obtained from the most recent NERC System Data Exchange ("SDX") file. It is applied to MISO and, if available, other control areas by scaling the load value obtained from the SDX by the load profile in the base power flow model or as specified by an adjacent transmission provider. Additional details are provided in the Transmission Provider's ATCID.

Outages: Transmission and Generation outage information is obtained from the most recent NERC SDX file. Outages to transmission facilities in the Transmission Provider's area, adjacent

transmission providers' areas, and transmission providers' areas with which coordination agreements have been executed are applied if the facilities are within the scope of the model being used for AFC calculations and occur within the time periods described below. More specifically, outages are applied for the below model time increments if they occur within the following time periods as described below:

- For the hourly modeling increment, outages are applied if they occur within the hour itself
- For the daily modeling increment, outages are applied if the duration of the outage is greater than 50% of the time period 12:00 – 16:00 on the day being modeled.
- For the monthly modeling increment, outages are applied if the duration of the outage is greater than 50% of the time period 12:00 – 16:00 on the 3rd Wednesday of the month.

Note that all times are expressed as prevailing system time for the Transmission Provider. Additional details are provided in the Transmission Provider's ATCID.

Generation Dispatch Order: Generation dispatch order information is used to dispatch the power flow case. This information is derived from the Transmission Provider's historical market dispatch information for Transmission Provider generation. To the extent it is provided, generation dispatch order information will also be used to dispatch external generation that is deemed to have impact to MISO's AFC calculation. Additional details are provided in the Transmission Provider's ATCID.

Reservations: Reservations obtained from the Transmission Provider's OASIS are used to develop control area net scheduled interchange values beyond the scheduling horizon. Additional details are provided in the Transmission Provider's ATCID.

Flowgate Data: A list of Flowgates for which AFC values are calculated is identified in the Transmission Provider's AFC Flowgate List. The Flowgate's attributes (i.e. TFC, TRM value, CBM value) are captured in input files so that AFCs are calculated correctly. Refer to Section 5 of this document and the Transmission Provider's ATCID for additional information on the criteria for inclusion, removal, or revision of a Flowgate.

Total Flowgate Capability ("TFC"): The Transmission Provider uses the transmission facility ratings provided by Transmission Owners, based upon the Ambient Adjusted Rating and Seasonal Transmission Facility Ratings determined in accordance with Attachment M to establish TFCs. The TFC utilized in AFC calculations respects System Operating Limits ("SOLs") and Interconnection Reliability Operating Limits ("IROLs") as identified by Planning of Operations. The TFC may be adjusted by Transmission Owners, by the Transmission Provider, or by the Reliability Coordinator with the approval of the applicable Transmission Owner(s) as needed, to account for expected conditions under study.

2.2. WEBTRANS SIMULATION

The solved power flow process generates a set of base flows and Distribution Factors for Flowgates from the AFC Flowgate List. The Transmission Provider uses webTrans to apply the remaining Existing Transmission Commitments ("ETCs") as defined in Section 6.2.1 and simulate the final flows for Flowgates. The Transmission Provider uses a threshold for

Distribution Factors to decide whether a path has a significant impact on a Flowgate and the Flowgate should be included in the list of Most Limiting Flowgates to evaluate a TSR. If the Transmission Provider has a Flowgate that has a monitored element(s) with no contingent element, a five percent (5%) threshold is used to indicate a significant impact. If the Transmission Provider has a Flowgate that is a combination of a monitored element and a contingent element(s), a three percent (3%) threshold is used to indicate a significant impact.

Additionally, historically, the Transmission Provider has observed some Flowgates located on its Transmission System that experience more congestion in the real-time operating environment more often than other Flowgates located on its Transmission System. To facilitate the calculation of more accurate AFC values for Flowgates, the Transmission Provider considers counter flow and positive direction flow differently for Flowgates using webTrans. The webTrans process allows the Transmission Provider to calculate the most accurate flows that are expected to occur by considering the impact of a TSR and applying specific positive flow and counter flow rules to the Flowgate. The AFC Flowgate List contains the positive flow and counter flow adjustments for the Flowgate expressed as a percentage of total flow. The Transmission Provider reviews and updates these adjustment factors annually (or more often as needed). If the Distribution Factor calculated for a Flowgate for a particular Source/Sink is greater than 0, then the positive flow attribute for that Flowgate is utilized to adjust the impact of a TSR for that specific Source/Sink pair. Conversely, if the Distribution Factor calculated for a Flowgate for a particular Source/Sink is less than 0, then the counter flow attribute for that Flowgate is utilized to adjust the impact of a TSR for that specific Source/Sink pair. Additional

detail regarding the application of positive flow and counter flow to specific Flowgates is provided in the Transmission Provider's ATCID.

The webTrans simulation multiplies the capacity of a TSR or Reservation by the Distribution Factor and the appropriate positive or counter flow adjustment factor to establish the impact or amount of energy from the Reservation expected to flow across that Flowgate. For Flowgates under the control of neighboring transmission providers, the Transmission Provider substitutes the AFC value calculated by other transmission providers, to the extent available, for the AFC value calculated by the Transmission Provider.

3. TRM METHODOLOGY

The TRM value of a Flowgate is established by summing an ARS component and a percentage of the Flowgate TFC to account for uncertainties in modeling of the Transmission System. These uncertainties include those associated with calculating AFCs for future time periods as Transmission System conditions can change from the point of an AFC calculation to Real Time. Two percent (2%) of the Flowgate TFC is used to compensate for these uncertainties. The ARS component utilized to establish TRM is calculated from a study that simulates the additional flows that may result from generators responding to the loss of generation in the Transmission Provider's footprint.

The TRM value is considered an individual attribute of a Flowgate, is recorded in the Transmission Provider's AFC Flowgate List, and is also input into webTrans where it is available to be decremented as discussed below. Additional detail regarding the establishment of

TRM values is provided in the Transmission Provider's Transmission Reliability Margin Implementation Document ("TRMID")

3.1. CONDITIONS FOR THE USE OF TRM IN AFC CALCULATION

TRM is decremented from Flowgate TFC as described in the firm and non-firm AFC equations noted below and is not available for sale as Transmission Service.

4. CBM METHODOLOGY

The transmission transfer capability preserved as CBM is established at least every thirteen (13) months based on verifiable historical, state, Regional Transmission Organization ("RTO"), or regional generation reliability criteria. A Loss of Load Expectation ("LOLE") study is used to determine the Generation Capacity Import Requirement ("GCIR") of a CBM study zone. For a CBM study zone, a set of source regions that would be expected to deliver its GCIR are identified. CBM is calculated from a study that simulates the additional flows that may result from generators in the source regions providing the GCIR of the CBM study zone. Upon completion of the CBM study, the Transmission Provider performs a comparison of the ARS component of TRM to the calculated CBM value of the Flowgate to determine whether CBM needs to be preserved on that Flowgate. If the ARS component on a Flowgate is greater than the calculated CBM value, CBM will not be preserved on that Flowgate. If the ARS component on a Flowgate is less than the calculated CBM value, the difference between the calculated CBM value and the ARS component of TRM will be preserved as the established CBM value for that Flowgate. This process ensures that there is no double counting of the ARS component of TRM and CBM of the Flowgate.

The CBM value is considered an individual attribute of a Flowgate, is recorded in the Transmission Provider's AFC Flowgate List, and is input to webTrans where it is available to be decremented as discussed below. Additional detail regarding the establishment of CBM values is provided in the Transmission Provider's Capacity Benefit Margin Implementation Document ("CBMID").

4.1. USE OF CBM

As a single Balancing Authority, MISO performs a centralized security constrained unit commitment and generation dispatch to serve its entire load. MISO will utilize CBM that is needed only when experiencing a declared NERC Energy Emergency Alert ("EEA") 2 or higher. CBM is decremented from Flowgate TFC as described in the firm AFC equation noted below and is not available for sale as Transmission Service. CBM is decremented from Flowgate TFC as described in the non-firm AFC equation noted below when requesting use of firm transfer Capability set aside as CBM on Flowgates within MISO's footprint. Additional details describing this process and criteria is described in the MISO Market Capacity Emergency Procedure, SO-P-EOP-00-002.

5. FLOWGATE ADDITION AND ELIMINATION CRITERIA

Flowgate additions and eliminations are requested for various reasons: (1) to manage existing congestion, (2) to manage congestion for future time periods, or (3) to manage congestion expected to occur as a result of planned transmission facility outages. The criteria for which Transmission Facilities will be considered as Flowgates in AFC calculations, permanent

and temporary, include: whether the Flowgate has been subject to an Interconnection-wide congestion management procedure within the past 12 months; whether the Flowgate has at least a five percent OTDF impact as the result of a first contingency transfer analysis; and whether a Flowgate requested for inclusion has at least a five percent PTDF or OTDF impact as the result of a Flowgate Coordination test. These criteria are provided in additional detail in the Transmission Provider's ATCID.

6. MATHEMATICAL ALGORITHM FOR FIRM AND NON-FIRM AFC CALCULATION

The mathematical formulas used by the Transmission Provider to calculate AFC are included in this section and are also posted on the ATC Information Link page on the MISO OASIS webpage.

6.1. FIRM AFC

MISO uses the following formula to determine firm AFC in the operating horizon, planning horizon and study horizon:

$$\textbf{Firm AFC} = \textbf{TFC} - \textbf{ETC}_{Fi} - \textbf{CBM}_{i} - \textbf{TRM}_{i} + \textbf{Postbacks}_{Fi} + \textbf{counterflows}_{Fi}$$

where,

TFC is the Total Flowgate Capability, also known as the Flowgate rating.

TRM is calculated as described in Section 3 of this document and the Transmission Provider's TRMID.

CBM calculated as described in Section 4 of this document and the Transmission Provider's CBMID.

$\boldsymbol{ETC_{FI}}$ is the sum of Impacts from Firm TSRs and Reservations as defined in Section 6.2.1. Please reference the additional details regarding ETC provided below and in the ATCID.

$\boldsymbol{Postbacks_{Fi}}$ are changes to firm AFC due to a change in the use of transmission service. Additional details regarding the Transmission Provider's usage of Postbacks is described in its Postback Methodology available on the ATC Information Link page on the Transmission Provider's OASIS.

$\boldsymbol{counterflows_{Fi}}$ are adjustments to firm AFC. This component of firm AFC is normally zero since the Transmission Provider calculates the impact of TSRs on the Flowgate in the ETC component.

6.2. NON-FIRM AFC

MISO uses the following formula to determine non-firm AFC in the operating horizon, planning horizon, and study horizon:

$$\textbf{Non-Firm AFC} = \textbf{TFC} - \textbf{ETC}_{\textbf{Fi}} - \textbf{ETC}_{\textbf{NFi}} - \textbf{CBM}_{\textbf{Si}} - \textbf{TRM}_{\textbf{Ui}} + \textbf{Postbacks}_{\textbf{NFi}} + \text{counterflows}$$

where,

TFC is the Flowgate rating.

$\boldsymbol{ETC_{FI}}$ is the sum of Impacts from Firm TSRs and Reservations as defined in Section 6.2.1.

***ETC**$_{NFI}$* is the sum of Impacts from Non-Firm TSRs and Reservations as defined in Section 6.2.1.

***CBM**$_{Si}$* is the impact of any schedules during that period using CBM.

TRM as calculated for a Flowgate. Additional details are in the Transmission Provider's ATCID.

***Postback**$_{SNFi}$* are changes to Non-Firm AFC due to a change in the use of transmission service. Additional details regarding the Transmission Provider's usage of Postbacks is described in its Postback Methodology available on the ATC Information Link page on the Transmission Provider's OASIS.

counterflows are adjustments to Non-Firm AFC. This component of AFC is normally zero since the Transmission Provider calculates the impact of TSRs on the Flowgate in the ETC component.

Non-firm AFC for the operating horizon is calculated differently than non-firm AFC in the planning or study horizon. More specifically, before 5:00 pm (EST) during the current operating day, the operating horizon uses schedules for the current day and uses reservations for the next day in AFC calculations. After 5:00 pm (EST), the operating horizon exclusively uses schedules for the calculation of AFC for the remainder of the current day and entire next day for AFC calculations. While using schedules in the operating horizon, the ETC_{Fi} and ETC_{NFi} components are derived from the flow expectations associated with schedules.

6.2.1. EXISTING TRANSMISSION COMMITMENT

ETC represents the sum of the impacts from the power flow model building described in Section 2.1 above and the webTrans process described in Section 2.2 above. ETC is calculated in the Planning and Study Horizons by utilizing Reservations impacting those horizons. The Reservations and TSRs utilized in MISO's AFC process are filtered as necessary to reduce or eliminate duplicate impacts from transactions using Transmission service from multiple Transmission Service Providers.

After 5:00pm (EST), MISO utilizes schedules expected to flow (in place of reservations) to calculate net interchange for the remainder of the current day and the next day in the operating horizon. Accordingly, when schedules are utilized, the power flow model building incorporates impacts from schedules expected to flow into the calculated net interchange input into the power flow model. The other inputs to the model remain the same. The resulting flows represent the ETCs calculated during the power flow model building for the specified time period.

The impacts of TSRs that are received by the Transmission Provider and have a status of Confirmed, Accepted, Counter-Offered and, in some cases, Study will also be incorporated into the webTrans process to calculate firm and non-firm AFC for the operating, planning, and study horizons.

Finally, rollover rights are modeled as corresponding Reservations unless the renewal deadline has passed. The transmission usage of native load and non-OATT customers are calculated in the same manner. The Transmission Provider ensures that non-firm capacity is released appropriately by replacing the TSRs with the corresponding schedules for AFC calculations in the scheduling horizon as described in the previous section.

6.3. CONVERSION OF AFC TO ATC CALCULATION

6.3.1. FIRM AND NON-FIRM ATC

The Transmission Provider uses the following algorithm to convert Flowgate AFCs to ATCs for its paths:

$$ATC = min(P)$$

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

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

Where:

ATC is the Available Transfer Capability.

P is the set of partial Available Transfer Capabilities for "impacted" Flowgates honored by the Transmission Provider.

$\boldsymbol{PATC_n}$ is the partial Available Transfer Capability for a path relative to a Flowgate *n.*

$\boldsymbol{AFC_n}$ is the Available Flowgate Capability of a Flowgate *n*.

$\boldsymbol{DF_{np}}$ is the distribution factor for Flowgate *n* relative to path *p*.