MISO
Second Revised Rate Schedule FERC No. 5
PJM Interconnection, L.L.C.
Second Revised Rate Schedule FERC No. 38

2.2 Definitions

2.2.51.b "Generator Pseudo-Tie Market Flow Adjustment"
Pseudo-Tie Market Flow Adjustment shall mean the amount of calculated energy flows removed from the Attaining Balancing Authority Market Flow for a specified Flowgate representative of the portion of the path from the location of the pseudo-tied generator to the MISO-PJM border.

ATTACHMENT 3

Interregional Coordination Process

Version 3.0

MISO & PJM Market–to–Market
Interregional Coordination Process
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Preface

The purpose of this Interregional Coordination Process ("ICP") is to provide a description of the proposed market-to-market coordination process, including the appropriate use of the market-to-market process that will be implemented concurrently with the implementation of side-by-side LMP-based energy markets in the PJM and MISO regions. Specifically, this ICP presents an overview of the market-to-market coordination process, an explanation of the coordination for market pricing at the regional boundaries, a description of the Real-Time and Day-Ahead coordination methodologies, an example to illustrate the Real-Time coordination, and the associated settlements processes.

1 Overview of the Market-to-Market Coordination Process

The fundamental philosophy of the PJM/MISO interregional transmission congestion coordination process is to set up procedures to allow any transmission constraints that are significantly impacted by generation dispatch changes in both markets to be jointly managed in the security-constrained economic dispatch models of both RTOs. This joint management of transmission constraints near the market borders will provide the more efficient and lower cost transmission congestion management solution, while providing coordinated pricing at the market boundaries.

The market-to-market coordination process builds upon the PJM/MISO market-to-non-market coordination process, as described in the "Congestion Management Process" document ("CMP") filed as part of the MISO – PJM Joint Operating Agreement. That CMP describes the interregional coordination process between a market region that uses an LMP-based congestion management regime and a non-market region that uses a TLR-based congestion management regime (i.e., a market to non-market interface). As described in the CMP, the set of transmission flowgates in each market that can be significantly impacted by the economic dispatch of generation serving load in the adjacent market is identified as the set of Reciprocal Coordinated Flowgates (RCFs). These RCFs are then monitored to measure the impact of Market Flows and loop flows from adjacent regions. The CMP describes how the Market Flow impacts will be managed on an interregional basis within the existing NERC IDC to enhance the effectiveness of the NERC interregional congestion management process. The CMP also describes a process for calculating flow entitlement for network and firm transmission utilization in one region on the RCFs in an adjacent region.

The market-to-market coordination process builds on the work already completed, as described above, by adapting the coordination, as appropriate, to the conditions that will prevail after both the PJM and MISO markets are implemented in the Midwest. In addition, there is a continuing need to define the flow entitlement for network and firm transmission utilization in one region on the subset of RCFs called M2M Flowgates in an adjacent region.

- **Real-Time Energy Market Coordination** -- The market-to-market coordination focuses primarily on Real-Time market coordination to manage transmission limitations that occur on the M2M Flowgates in a more cost effective manner. This Real-Time coordination will result in a more efficient economic dispatch solution across both markets to manage the Real-Time transmission constraints that impact both markets, focusing on the actual flows in Real-Time to manage constraints. Under this approach, the flow entitlements on the M2M Flowgates do not impact the physical dispatch; the flow entitlements are used in market settlements to ensure appropriate compensation based on comparison of the actual Market Flows to the flow entitlements.

- **Day-Ahead Energy Market Coordination** -- The Day-Ahead market coordination focuses primarily on ensuring that the Day-Ahead scheduled flows on all M2M Flowgates are limited to no more than the Firm Flow entitlements for each RTO.

Under certain conditions set forth in this Agreement~~,~~ an RTO may request that the Day-Ahead flow limit be raised above its Firm Flow entitlement ~~but this is expected to happen only by exception under abnormal conditions~~.

- **ARR Allocation & FTR Auction Coordination** -- The Auction Revenue Rights Allocation and Financial Transmission Rights (FTR) auction processes in both RTOs will model the Firm Flow entitlements on all M2M Flowgates.

1.1 Only a subset of all transmission constraints that exist in either market will require coordinated congestion management. This subset of transmission constraints will be identified as M2M Flowgates in a manner similar to the method used in the CMP described above. The list of M2M Flowgates will be limited to only those for which at least one generator in the adjacent market has a significant Generation-to-Load Distribution Factor (GLDF), sometimes called "shift factor," with respect to serving load in that adjacent market. NERC rules currently establish that a significant shift factor is five percent or greater. If NERC adopts a lower shift factor threshold than 5%, the new threshold will be used to determine whether the generator has a significant GLDF for the purpose of this market-to-market ICP. Flowgates eligible for market-to-market coordination are called M2M Flowgates. For the purposes of market-to-market coordination (in addition to the five studies for RCFs described in section 3.2.1 of the CMP) the following will be used in determining M2M Flowgates.

1.1.1 M2M Flowgates include Reciprocal Coordinated Flowgates and any additional Flowgates that meet the criteria in this section (1.1) of the Interregional Coordination Process.

1.1.2 MISO and PJM will only be performing market-to-market coordination on RCFs that are under the operational control of MISO or PJM. MISO and PJM will not be performing market-to-market coordination on Flowgates that are owned and controlled by third party entities or on Flowgates that are only considered to be coordinated Flowgates.

1.1.3 Where the adjacent market does not have a generator with significant impact (either positive impact or negative impact) on a single-monitored element Flowgate at voltages higher than 138 kV (i.e., shift factor is less than 5%) but its Market Flows are a significant portion of the total flow (greater than 25% of the Flowgate rating), these transmission constraints will be included in the list of M2M Flowgates subject to market-to-market coordination. If the Market Flow impacts of the Non-Monitoring RTO exceed 25% of the Flowgate rating during real-time operations, the Flowgate will be added as a M2M Flowgate at the request of the Monitoring RTO.

Where the adjacent market does not have a generator with significant impact (either positive impact or negative impact) on a single-monitored element Flowgate at voltages of 138 kV or lower (i.e., shift factor is less than 5%) but its Market Flows are a significant portion of the total flow (i.e., greater than 35% of the Flowgate rating), these transmission constraints will be included in the list of M2M Flowgates subject to market-to-market coordination. If the Market Flow

impacts of the Non-Monitoring RTO exceed 35% of the Flowgate rating during real-time operations, the Flowgate will be added as a M2M Flowgate at the request of the Monitoring RTO.

1.1.4 The Parties will lower their generator binding threshold to match the lower generator binding threshold utilized by the other Party. The generator binding threshold will not be set below 1.5% except by mutual consent.(This requirement applies to M2M Flowgates. It is not an additional criteria for determination of M2M Flowgates.)

1.1.5 For the purpose of determining whether a multi-monitored element Flowgate is eligible for market-to-market, a progressive threshold based on the number of monitored elements will be used: a single monitored element Flowgate will use a 5% shift factor threshold; double monitored element Flowgate will use a 7.5% shift factor threshold; and a Flowgate with three monitored elements will use a 10% shift factor threshold. Flowgates with more than three monitored elements will be used only by mutual agreement.

1.1.6 The five studies for RCFs described in Section 3.2.1 of the CMP will also be performed using a -5% shift factor threshold to identify Flowgates with a significant negative impact due to market operations. Flowgates where a significant negative impact exists as measured by a -5% shift factor or more negative shift factor will be added as M2M Flowgates.

1.2 M2M Flowgate Studies

During the M2M Flowgate Studies, a M2M Flowgate may be added to the systems for operations control using the actual monitored /contingent element pair. Settlements will be implemented using a hold harmless approach as described in the After the Fact Review process set forth in Section 8.4 below.

1.2.1 MISO and PJM will implement a process whereby either RTO may request the other to enter an anticipated M2M Flowgate into the dispatch tools before the completion of the Flowgate studies when a system event requires prompt attention. Binding on the Flowgate may commence as soon as each entity's operators can make the monitored/contingent element pair available in its system. Firm Flow Entitlements shall be applied and settlements calculated after the M2M Flowgate is approved by both entities.

1.2.2 Use of a M2M Flowgate before Completion of the Studies:
The use of an anticipated Flowgate while the Flowgate is undergoing the M2M Flowgate Studies is described in CMP Section 3.2.5 Dynamic Creation of Coordinated Flowgates. These will typically be limited to forced outages since there should be time to evaluate the potential new M2M Flowgate before the planned outage is taken. However, the need for a new Flowgate is not always identified in advance. The Parties will ensure the time period to run the

coordinated Flowgate test and have these Flowgates ready for the market-to-market process is as short as possible.

1.3 Removal of M2M Flowgates

Removal of M2M Flowgates from the systems may be necessary under certain conditions including the following:

1.3.1 Where Information Technology systems cannot support the operation of a defined M2M Flowgate effectively, the first attempt will be to find a mutually acceptable temporary work-around that will allow the continued use of the market-to-market process. Where a temporary work-around is not available, the market-to-market process will be suspended on that M2M Flowgate until Information Technology system enhancements allow re-establishing the M2M Flowgate. The Party responsible for IT system enhancements will take all practicable steps to minimize the period of the suspension.

1.3.2 A M2M Flowgate is no longer valid when either a temporary M2M Flowgate or a transmission system change is implemented that eliminates significant impacts from either entity's generation such that the Flowgate no longer passes the M2M Flowgate Studies.

a. Once a M2M Flowgate becomes a completely invalid constraint, it will no longer be bound in the monitoring RTO's UDS.
b. A Flowgate that is removed from the M2M Flowgate list but remains a valid constraint may continue to be bound in the Monitoring RTO's UDS, but the market-to-market process will no longer be initiated on it.

1.3.3 The RTOs will collaborate to address specific scenarios where generation is not responding to dispatch signals (e.g., self-scheduled) and the generation does, or could, significantly impact an M2M Flowgate and/or resulting market-to-market settlement.

1.3.4 The Parties can mutually agree to add or remove a Flowgate from the market-to-market process whether or not it passes the coordination tests, or whether or not it is a Reciprocal Coordinated Flowgate. A M2M Flowgate may be removed when the Parties agree that the market-to-market process would not be an effective mechanism to manage congestion on that Flowgate.

2 Interface Bus Price Coordination

Proxy bus prices are calculated by each RTO to reflect the economic value of imports or exports from the neighboring RTO. For example, the proxy bus price for RTO A as calculated by RTO B is driven by the economic dispatch of RTO B, therefore this proxy price will reflect the system marginal price in RTO B, plus any congestion cost adjustment and marginal loss cost adjustment based on the proxy bus location. The coordinated operation of M2M Flowgates will tend to force the pricing at the RTO borders to be consistent with the energy prices at generators and load busses near the RTO border points.

In order to be good functional indicators for the market-to-market coordination, the proxy bus models for PJM and MISO must be coordinated to the same level of granularity. Therefore, the proxy bus modeling approaches must be similar such that the prices are consistent. This does not necessarily mean the proxy bus prices will be the same, particularly in the initial implementation of Market-to-Market coordination. What is important at the outset is that the proxy buses reflect consistent pricing between the RTOs given the constraints for which each RTO is operating. Consistency means that the proxy bus price one RTO calculates for the other RTO reflects the nature of the congestion on both RTOs' systems, such that imports and exports to and from one RTO to the other are provided the correct incentives given their effect on the current binding constraints. A description of the current proxy bus modeling process used by PJM and MISO is posted on each RTO's OASIS.

As the Market-to-Market coordination process continues to evolve, it may be possible to get to the point that each RTO's proxy bus prices for the other is consistently close. This will require coordination beyond merely operating for constraints on each other's systems, to include tightly coordinating the economic dispatches themselves, in an iterative process as described in Section 7.

3 Real-Time Energy Market Coordination

When an M2M Flowgate that is under the operational control of either MISO or PJM become binding in the Monitoring RTOs Real-Time security constrained economic dispatch, the Monitoring RTO will notify the Non-Monitoring RTO of the transmission constraint violation and will identify the appropriate M2M Flowgate that requires mitigation. The Monitoring and Non-Monitoring RTOs will provide the economic value of the constraint (i.e., the shadow price) as calculated by their respective dispatch models. Using this information, the security-constrained economic dispatch of the Non-Monitoring RTO will include the transmission constraint; the Monitoring RTO will evaluate the shadow prices within each RTO and request that the Non-Monitoring RTO reduce its Market Flow if it can do so more efficiently than the Monitoring RTO (i.e., the Non-Monitoring RTO has a lower shadow price than the Monitoring RTO).

An iterative coordination process will be supported by automated data exchanges in order to ensure the process is manageable in a Real-Time environment. The process of evaluating the shadow prices between the RTOs will continue until the shadow prices are sufficiently close that an efficient redispatch solution is achieved. The continual interactive process over the next several dispatch cycles will allow the transmission congestion to be managed in a coordinated, cost-effective manner by the RTOs. A more detailed description of this iterative procedure will be discussed in Section 3.1.

This coordinated dispatch protocol will be performed any time that an M2M Flowgate under the operational control of either MISO or PJM becomes binding. This approach will produce the level of coordination that will be required to ensure efficient congestion management across the market seams. This approach also will provide a much higher level of interregional congestion management coordination than that which currently exists between any existing adjacent markets.

3.1 Real-Time Energy Market Coordination Procedures

The following procedure will apply for managing M2M Flowgates in the real-time energy market:

1. The RTOs will exchange topology information to ensure that their respective market software is consistent.

2. When any of the M2M Flowgates under a Monitoring RTO's control is identified as a transmission constraint violation, the Monitoring RTO will enter the M2M Flowgate into its security-constrained dispatch software, setting the flow limit equal to the appropriate facility rating.

3. The Monitoring RTO will then notify the Non-Monitoring RTO of the transmission constraint violation and will identify the appropriate M2M Flowgate that requires mitigation.

4. When the M2M Flowgate first becomes a binding transmission constraint in the Monitoring RTOs Real-Time security-constrained economic dispatch, the Monitoring RTO will transmit the following information to the Non-Monitoring RTO:

- Constraint Shadow Price ($/MW) - output of the RTOs Real-Time market software.
- Current Market Flow contribution by the Monitoring RTO on M2M Flowgate (MW) - output of the Real-Time market software.
- Amount of MWs requested to be reduced from the current Market Flow of the Non-Monitoring RTO. This number will change throughout the iterative process to efficiently resolve constraints.

5. The Non-Monitoring RTO will enter the M2M Flowgate into its security-constrained dispatch software, setting the flow limit on the M2M Flowgate equal to its current Market Flow minus the relief requested by the Monitoring RTO.

(a) This means the Non-Monitoring RTO will attempt to manage the flow on the M2M Flowgate at its current Market Flow amount or less, such that it will not contribute any additional flow on the limited M2M Flowgate during this time period.

6. If the Non-Monitoring RTO has sufficient generation to be redispatched, it will redispatch its generation to control the M2M Flowgate until one of the following conditions is reached:

(a) The Non-Monitoring RTO has provided the relief requested by the Monitoring RTO.

(b) The Non-Monitoring RTO has provided relief at a cost as high as the current shadow price from the Monitoring RTO.

7. The Non-Monitoring RTO will then transmit the following information to the Monitoring RTO:

- Constraint Shadow Price ($/MW) - Output of the RTOs Real-Time market software. (If the M2M Flowgate does not result in a binding constraint in the Non-Monitoring RTO's security-constrained economic dispatch, then the shadow price is zero and the Flow Relief is zero for the Non-Monitoring RTO.)
- Current Market Flow contribution by the Non-Monitoring RTO on M2M Flowgate (MW) - Output of the RTO's Real-Time market software.

8. Over the next several dispatch cycles the Monitoring RTO may request the Non-Monitoring RTO to adjust its flow limit up or down. The Monitoring RTO will continue to control the M2M Flowgate respecting the appropriate rating of the facility.

9. As the relief provided by the Non-Monitoring RTO is realized in the M2M Flowgate, the Monitoring RTO can control the M2M Flowgate at a lower shadow price since less relief is needed from the Monitoring RTO. The updated shadow price will be sent to the Non-Monitoring RTO. The Non-Monitoring RTO will then control the M2M Flowgate using the latest shadow price from the Monitoring RTO as the shadow price limit.

10. Throughout the period that the transmission constraint violation exists, the RTOs will continue to share the flow and constraint shadow price information that is described above. The shadow prices of the two RTOs will eventually converge towards the most cost-effective redispatch solution provided both RTOs have sufficient redispatch capability. The information transferred via these data exchanges will be retained to provide the pertinent data for Market Settlements.

11. Every 15 to 30 minutes as necessary, the Monitoring RTO will review the constraint shadow price comparison, make required adjustments, and communicate any such adjustments to the Non-Monitoring RTO. This process will continue until the Monitoring RTO determines that the cost of further adjustments to the dispatch of the Non-Monitoring RTO would exceed the cost of relieving the transmission constraint by adjusting the Monitoring RTO's own dispatch.

12. The start and stop times for such Constrained Operation events involving M2M Flowgates will be logged for Market Settlements purposes.

3.2 Real-Time Energy Market Settlements

The Market Settlements under the coordinated congestion management will be performed based on the Real-Time Market Flow contribution on the transmission flowgate from the Non-Monitoring RTO as compared to its flow entitlement.

If the Real-Time Market Flow less the Generator Pseudo-Tie Market Flow Adjustment is greater than the flow entitlement plus the Approved MW adjustment from Day Ahead Coordination, then the Non-Monitoring RTO will pay the Monitoring RTO for congestion relief provided to sustain the higher level of Real-Time Market Flow. This payment will be calculated based on the following equation:

Payment = ((Real-Time Market Flow MW[1] – Generator Pseudo-Tie Market Flow Adjustment[2]) - (Firm Flow Entitlement MW[32] + Approved MW[43])) * Transmission Constraint Shadow Price in Monitoring RTOs Dispatch Solution

If the Real-Time Market Flow less the Generator Pseudo-Tie Market Flow Adjustment is less than the flow entitlement plus the Approved MW adjustment from Day Ahead Coordination, then the Monitoring RTO will pay the Non-Monitoring RTO for congestion relief provided at a level below the flow entitlement. This payment will be calculated based on the following equation:

Payment = ((Firm Flow Entitlement MW[32] + Approved MW[43]) – (Real-Time Market FlowMW[1] - Generator Pseudo-Tie Market Flow Adjustment[2])) * Transmission Constraint Shadow Price in Non-Monitoring RTOs Dispatch Solution

For the purpose of settlements calculations, shadow prices will be calculated by the pricing software in the same manner as the LMP, and will be integrated over each hour during which a transmission constraint is being actively coordinated under the ICP by summing the five-minute shadow prices during the active periods within the hour and dividing by 12 (the number of five minute intervals in the hour).

[1] This value represents the Non-Monitoring RTO's Real Time Market Flow.

[2] This value represents the Generator Pseudo-Tie Market Flow Adjustment as described in Section 11 of this Attachment 3.

[32] This value represents the Non-Monitoring RTO's Firm Flow Entitlement.

[43] This value represents the Approved MW that resulted from the Day Ahead Coordination.

4 Day-Ahead Energy Market Coordination

The Day-Ahead energy market coordination focuses primarily on ensuring that the Day-Ahead scheduled flows on all M2M Flowgates are limited to no more than the Firm Flow Entitlements for each RTO. For the purposes of determining the Firm Flow Entitlement to model in a RTO's Day-Ahead market, either RTO may adjust the Firm Flow Entitlement to align with M2M settlement practices. When system conditions can accommodate the change, either RTO may request that the Day-Ahead flow limit be raised above its Firm Flow Entitlement.

The Day-Ahead energy market redispatch protocol may be implemented in the Day-Ahead energy market upon the request of either RTO if the adjacent RTO verifies that such Day-Ahead redispatch is feasible.

An example of the Day-Ahead energy market protocol is as follows:

1. The Requesting RTO specifies the amount of scheduled flow reduction that it is requesting on a specific M2M Flowgate and communicates the request to the Responding RTO

2. The Responding RTO will then lower the MW limit that it utilizes in its Day-Ahead market on the specified M2M Flowgate by the specified amount. This means that instead of modeling the M2M Flowgate constraint at flow entitlement amount, the Responding RTO will model the constraint as the flow entitlement less the requested MW reduction. Therefore, the Responding RTO will schedule less flow on the specified M2M Flowgate in order to provide Day-Ahead congestion relief for the Requesting RTO. The Requesting RTO may then use the additional MW capability in its own Day-Ahead market.

4.1 Day-Ahead Energy Market Coordination Procedures

The following procedure will apply to the modeling of M2M Flowgates in the Day-Ahead energy markets, unless either the Monitoring RTO or the Non-Monitoring RTO requests specific exceptions.

- Each RTO will model all M2M Flowgates, for which it is the Reliability Coordinator, in its Day-Ahead market and Day-Ahead reliability analyses, with the limit set equal to the applicable facility limit less the Firm Flow Entitlement of the Non-Monitoring RTO.

- Each RTO will model all M2M Flowgates, for which it is NOT the Reliability Coordinator, in its Day-Ahead Market and Day-Ahead reliability analysis with the limit set equal to its Firm Flow Entitlement for that M2M Flowgate.

- The Monitoring RTO will include an appropriate loop flow model in its Day-Ahead process. However, this loop flow model will not account for loop flows contributed by deliveries associated with the Non-Monitoring RTO market since these flows are accounted for by the Firm Flow Entitlement.

An M2M Flowgate limit exception is a request to alter the M2M Flowgate limits, as described above, that will be modeled in the Day-Ahead markets and/or the Day-Ahead reliability analysis. The following procedure will apply for designating M2M Flowgate limit exceptions:

1. If the Requesting RTO identifies a need to utilize more of an M2M Flowgate than it is entitled, it may request the Responding RTO to lower its Day-Ahead Market limit below its Firm Flow Entitlement by a specified amount and range of hours. The Requesting RTO must request the adjustment from the Responding RTO as soon as possible but not later than one hour prior to the Responding RTO's deadline for submitting bids and offers in the day-ahead market.

2. If the Responding RTO agrees to provide the limit reduction, it will communicate the approved amount to the Requesting RTO as soon as possible but not later than to the Requesting RTO's deadline for submitting bids and offers in the day-ahead market.

3. The Requesting RTO may increase its limit on the M2M Flowgate by the agreed upon and specified amount and range of hours.

4. Either Party may rescind the agreement up to one hour after the Responding

   RTO's deadline for submitting bids and offers in the day-ahead market.

For the purpose of modeling generator pseudo-tie impacts in the Day-Ahead market, the RTOs will determine the amount of impact on M2M Flowgates based on Market Participant quantities offered in the Day-Ahead market. The impact for a pseudo-tied generator will be determined appropriately by the RTOs, e.g. from the generator specific location to the MISO-PJM border. Either RTO may adjust and coordinate the M2M Flowgate limit to align with M2M settlement formulas and practices.

4.2 Day-Ahead Energy Market Settlements

The market settlements for Day-Ahead congestion relief will be performed in a similar manner to the Real-Time energy market settlements of the coordinated congestion management protocol. The Day-Ahead payment for the RTO that is requesting congestion relief will be calculated as follows:

Payment = Approved MW *Transmission Constraint Shadow Price in Responding RTOs Dispatch Solution

This payment will be calculated based on the hourly Day-Ahead Market results. If such congestion relief is requested and performed on a Day-Ahead basis, then the Real-Time flow entitlement for the affected hours in the corresponding Real-Time market will be adjusted accordingly.

5 Auction Revenue Rights (ARR) Allocation/Financial Transmission Rights (FTR) Auction Coordination

The allocation of ARR and FTR products in each marketplace must recognize the Firm Flow Entitlement that exists in adjacent markets. The ARR allocation and FTR Auction model will contain the same level of detail for adjacent regions as the Day-Ahead market model and the Real-Time market model. Each RTO will allocate ARRs via Annual ARR Allocation award, and award FTRs via Annual and Monthly FTR Auction to Network and Firm Transmission customers subject to their participation and simultaneous feasibility test that determines the amount of transmission capability that exists to support the ARRs and FTRs.

The simultaneous feasibility analysis for each RTO will model that RTO's Firm Flow Entitlement on the transmission flowgates in the adjacent region as the Market Flow limit that must be respected in the ARR Allocation and FTR Auction processes. For the purposes of determining the Firm Flow Entitlement to model in a RTO's FTR market, either RTO may adjust the Firm Flow Entitlement to align with M2M settlement practices. The transmission flowgates in each RTO will be modeled in the simultaneous feasibility test at a capability value equal to the flowgate rating minus the Firm Flow Entitlement that exists for flows from the adjacent market. In this way, the ARR Allocation and the FTR Auction across both RTOs will recognize the reciprocal transmission utilization that exists for Network and Firm transmission customers in both markets.

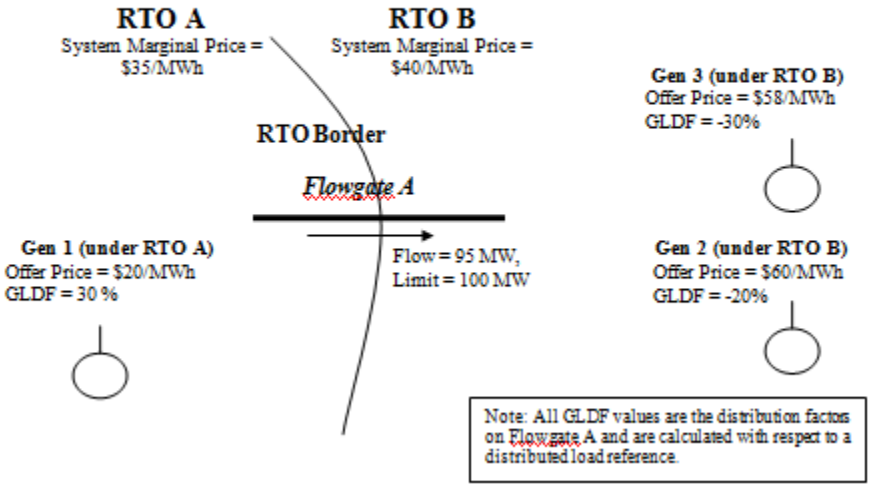
6 Coordination Example

The following example illustrates the Real-Time coordination of an M2M Flowgate, specifically describing the following five stages:

- Stage 1: Initial Conditions & Energy Prices at Border
- Stage 2: Transmission Constraint Initialization & Energy Prices at Border
- Stage 3: First Coordinated Interregional RTO Dispatch Cycle (Constraint Binds in Monitoring RTO) & Energy Prices at Border
- Stage 4: First Coordinated Interregional RTO Dispatch Cycle (Constraint Binds in Non-Monitoring RTO) & Energy Prices at Border
- Stage 5: Ongoing Coordinated Dispatch Cycles

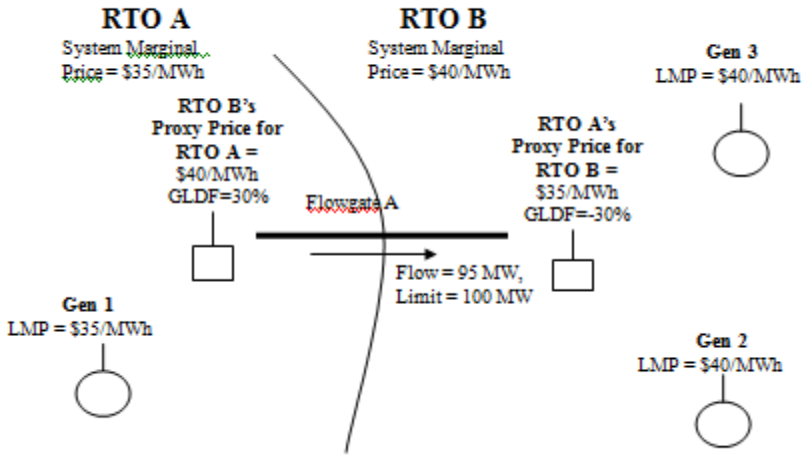
Stage 1 – Initial Conditions

- Marginal Losses are not utilized in this example for ease of understanding
- RTO A is the Non-Monitoring RTO, its system marginal price is $35/MWh
- RTO B is the Monitoring RTO, its system marginal price is $40/MWh
- Generator 1 is on-line and dispatched to full output, its dispatchable range is 100 MW
- Generators 2 and 3 are both off-line; they are both 20 MW quick start CTs
- M2M Flowgate A has a limit of 100 MW with the actual flow at 95 MW



Stage 1 - Energy Prices at the RTO Border (Proxy Bus Prices)

The proxy bus prices will be calculated for each stage of the congestion management example. These examples illustrate that the proxy bus prices will move in the same direction as the constrained bus prices when the M2M Flowgate is binding in both RTO security-constrained economic dispatches. The LMPs throughout both RTOs are equal to their System Marginal Price so long as the RTOs are unconstrained (no binding constraint resulting in redispatch of generation). This example also ignores marginal losses to simplify the illustration.



Stage 2 - Transmission Constraint Initialization

The RTO B (Monitoring RTO) dispatch software is projecting that the flow on Flowgate A is increasing and that ***9 MW of flow relief*** will be required. (Note: The 9 MW is derived from RTO B's look-ahead dispatch software along with a parallel path evaluation). The security-constrained dispatch solution for RTO B results in both Generator 2 and Generator 3 being dispatched; the system marginal price for RTO B remains at $40/MWh. Generator 3 is the most cost effective unit to control the constraint.

The Flowgate A constraint shadow price for RTO B will be equal to:

(Gen 2 Offer Price – System Marginal Price for RTO B)/(Generator 2 GLDF on Constraint)

($60/MWh-$40/MWh) /-0.20 = -$100/MW of Flow Relief.[4]

[4] The transmission constraint shadow price is calculated based on the difference between the constrained on generator offer price and the system marginal price. This difference is then divided by the GLDF of the generator on the binding constraint. In this case, Generator 2 drives the constraint shadow price because it has the highest offer and the lowest GLDF.

The LMP for Gen 2 will be:

System Marginal Price for RTO B + (Gen 2 GLDF)(RTO B Shadow Price)

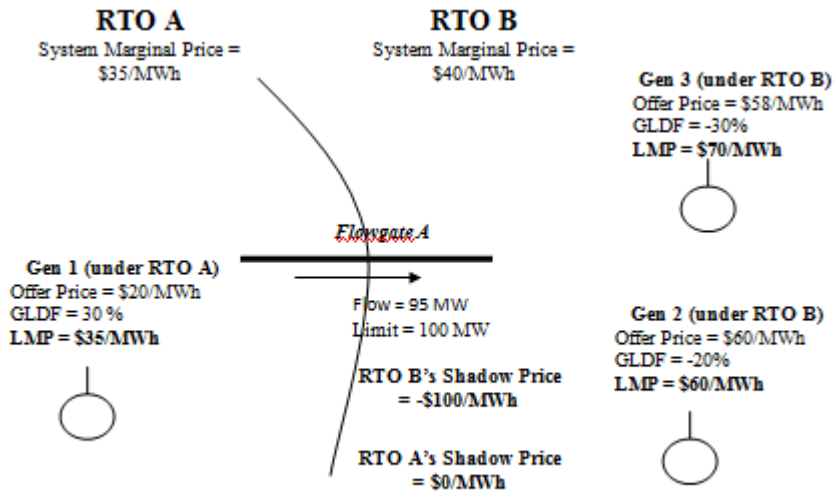
$40/MWh + (-.2)(-$100/MWh flow relief) = $60/MWh

The LMP for Gen 3 will be:

System Marginal Price for RTO B + (Gen 3 GLDF)(RTO B Shadow Price)

$40/MWh + (-.3)(-$100/MWh flow relief) = $70/MWh

The conditions for Stage 2, the initial transmission constrained scenario, are as follows:



Stage 2 - Energy Prices at the RTO Border (Proxy Bus Prices)

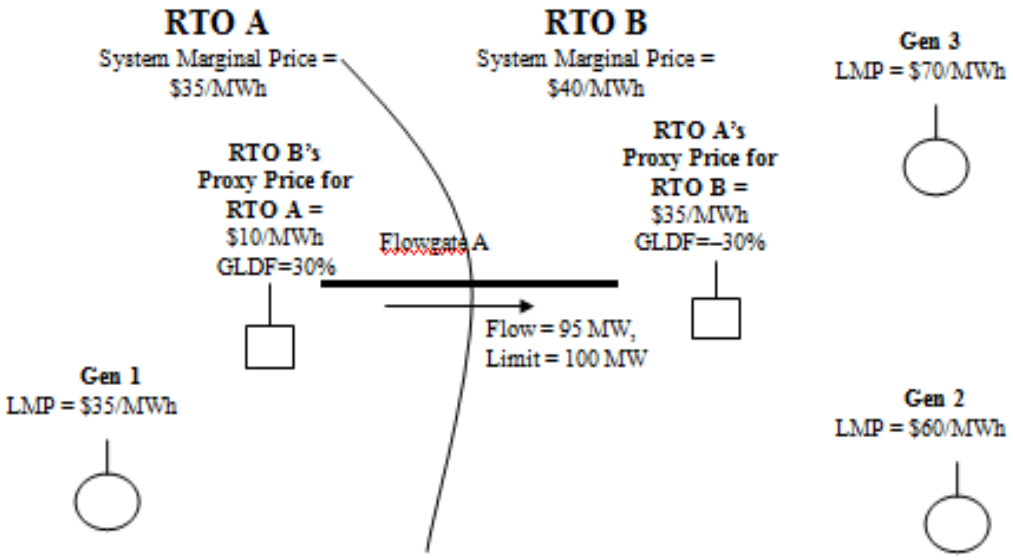
The proxy bus price for RTO A as calculated by RTO B will include the impact of the constraint on Flowgate A.

- Since the constraint is not binding in RTO A in Stage 2, the proxy price for RTO B as calculated by RTO A will remain at the system marginal price of RTO A.
- Since the proxy bus prices for each RTO reflect the value of imports or exports from the neighboring RTO, these proxy prices will be set by the system marginal price in the RTO that is calculating the proxy price.

RTO B's Proxy price for RTO A is as follows:

System Marginal Price for RTO B + (Proxy bus GLDF)(RTO B Shadow Price)

$40/MWh + (.3)(-$100/MWh flow relief) = $10/MWh



Stage 3 – First Coordinated Interregional RTO Dispatch Cycle (Constraint Binds in Monitoring RTO)

- RTO B notifies RTO A of the transmission constraint Condition on Flowgate A. Initially RTO B requests RTO A to maintain its current Market Flow on Flowgate A. RTO B sends its latest shadow price of -$100/MWh to RTO A.
- RTO A enters the constraint into its security-constrained dispatch software with the current flow equal to the limit using -$100/MWh as its shadow price limit. (The current flow equals 35 MW in this case.) Since RTO A's load is growing, the constraint binds with a shadow price less than the -$100/MWh limit. (Assume Firm Flow is 40 MW.).

Flowgate A constraint shadow price for RTO A will be equal to:

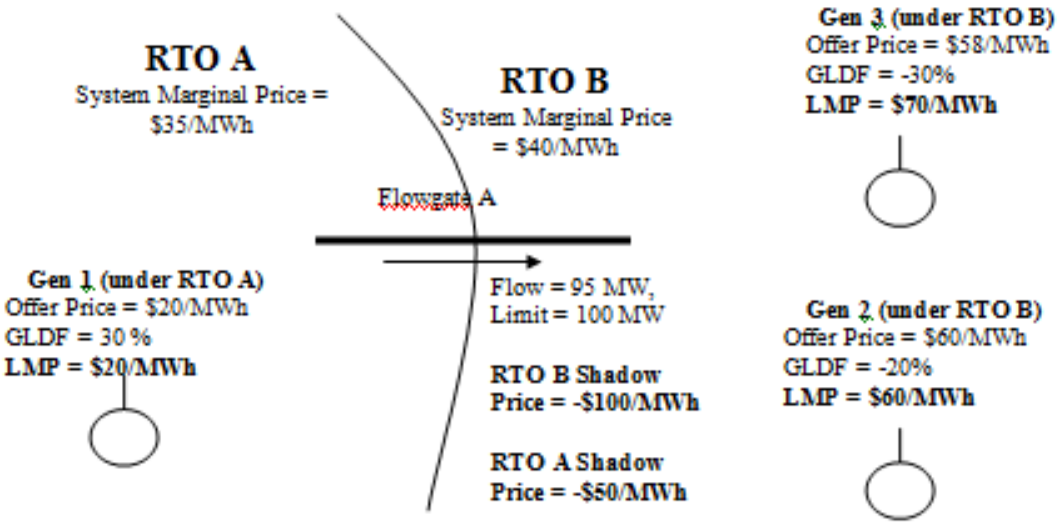
(Gen 1 Offer Price – System Marginal Price for RTO A)/(Gen 1 GLDF on Constraint)

($20/MWh-$35/MWh) /0.30 = -$50/MW of Flow Relief.[5]

The LMP for Gen 1 will be:

System Marginal Price for RTO A + (Gen 1 GLDF)(RTO A Shadow Price)

$35/MWh + (.3)(-$50/MWh flow relief) = $20/MWh



[5]The transmission constraint shadow price is calculated based on the difference between the constrained on generator offer price and the system marginal price. This difference is then divided by the GLDF of the generator on the binding constraint. In this case, Generator 2 drives the constraint shadow price because it has the highest offer and the lowest GLDF. The resulting shadow price of -$50/MWh is less than the limit of -$100/MWh from the Monitoring RTO A.

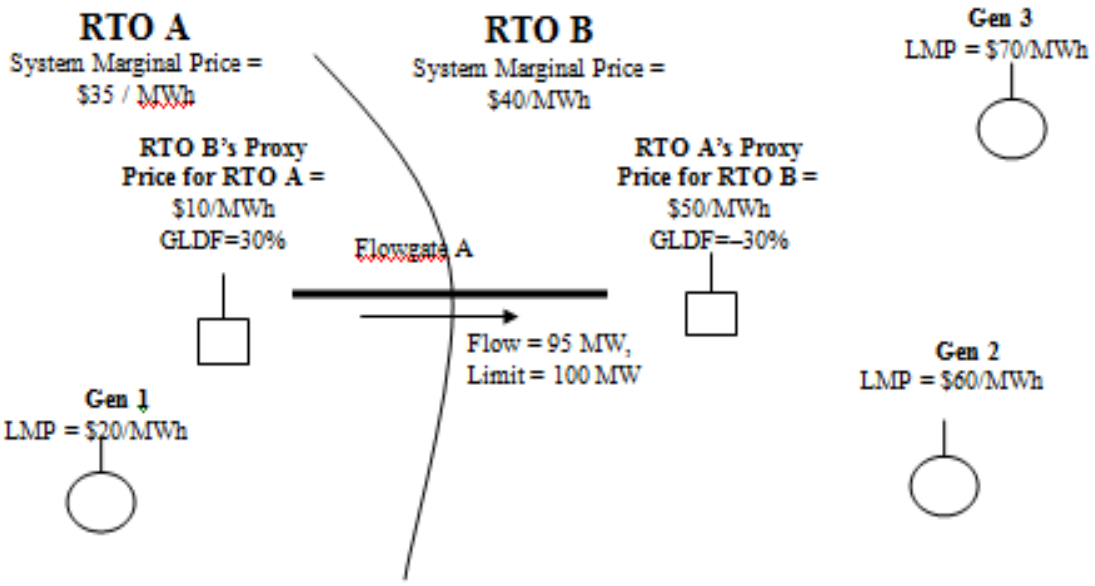
Stage 3 - Energy Prices at the RTO Border (Proxy Bus Prices)

The proxy bus price for RTO A as calculated by RTO B, will include the impact of the constraint on Flowgate A. Since the constraint is now binding in RTO A in stage 3, the proxy price for RTO B as calculated by RTO A will include impact of the constraint on Flowgate A.

RTO A's Proxy price for RTO B is as follows:

System Marginal Price for RTO A + (Proxy bus GLDF)(Shadow Price)

$35/MWh + (-.3)(-$50/MWh flow relief) = $50/MWh



Stage 4 – First Coordinated Interregional RTO Dispatch Cycle (Constraint Binds in Non-Monitoring RTO)

RTO B analyzes the constraint shadow price information and determines that RTO A has a more economical alternative to provide the Flow Relief than is currently being obtained by operating Generator 2 out of merit. The analysis results in RTO B requesting RTO A to provide 4 MW more of Flow Relief to enable Generator 2 to come offline.

RTO A is able to reduce its Market Flow on Flowgate A to the desired 31 MW limit in its dispatch software. RTO A can achieve the requested relief by lowering Gen 1 while observing the shadow price limit from RTO B.

After the flow on Flowgate A is reduced by the redispatch action from RTO A, RTO B requests Generator 2 to come off-line, because it will no longer be required to control the Flowgate A limit.

The Flowgate A constraint shadow price for RTO B will be equal to:

(Gen 3 Offer Price – System Marginal Price for RTO B)/(Generator 3 GLDF on Constraint)
($58/MWh-$40/MWh) /-0.30 = -$60/MW of Flow Relief. [6]

The LMP for Gen 2 will be:

System Marginal Price for RTO B + (Gen 2 GLDF)(RTO B Shadow Price)

$40/MWh + (-.2)(-$60/MWh flow relief) = $52/MWh

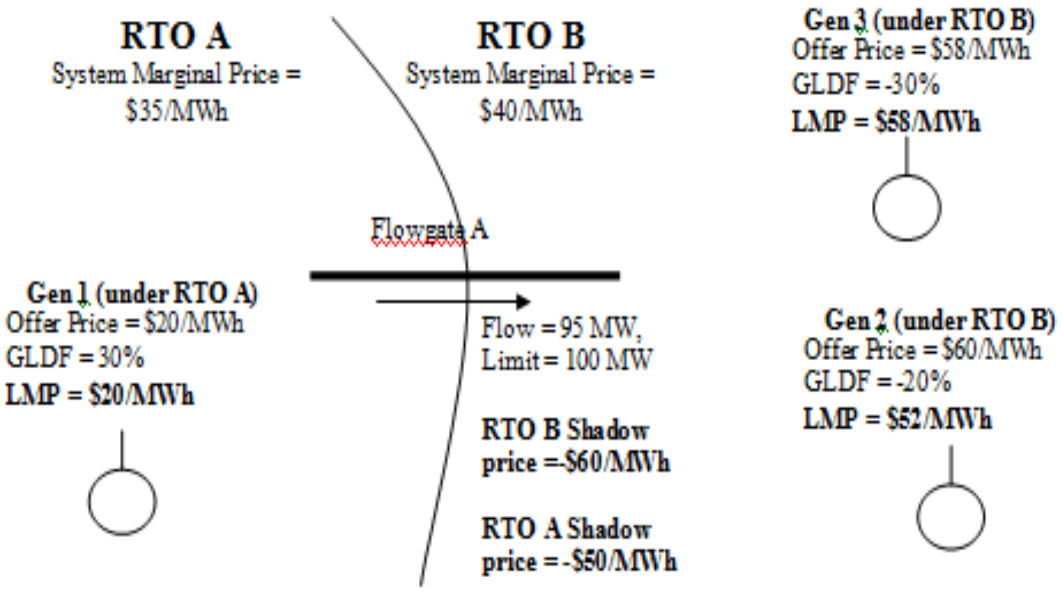
The LMP for Gen 3 will be:

System Marginal Price for RTO B + (Gen 3 GLDF)(RTO B Shadow Price)

$40/MWh + (-.3)(-$60/MWh flow relief) = $58/MWh

[6] The transmission constraint shadow price is calculated based on the difference between the constrained on generator offer price and the system marginal price. This difference is then divided by the GLDF of the generator on the binding constraint. In this case, Generator 3 drives the constraint shadow price because it is the only unit online for the constraint.

The conditions for Stage 4 are as follows:



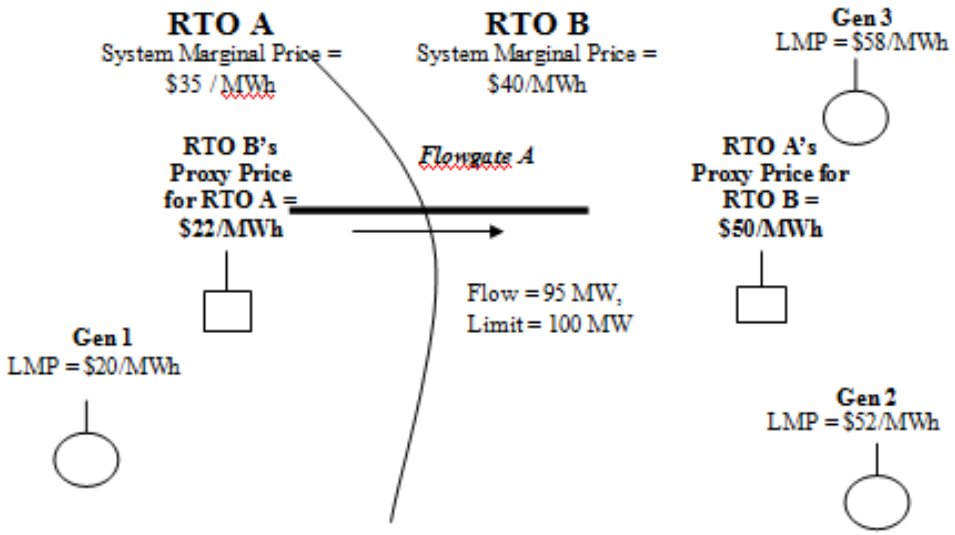
Stage 4 - Energy Prices at the RTO Border (Proxy Bus Prices)

The proxy bus price for RTO A, as calculated by RTO B, will include the impact of the constraint on Flowgate A. Since the constraint remains binding in RTO A in Stage 4, the proxy price for RTO B as calculated by RTO A will include impact of the constraint on Flowgate A.

RTO B's Proxy price for RTO A is as follows:

System Marginal Price for RTO B + (Proxy bus GLDF)(RTO B Shadow Price)

$40/MWh + (.3)(-$60/MWh flow relief) = $22/MWh



Stage 5 – Ongoing Coordinated Dispatch Cycles

As the constrained operations progress, the RTOs will periodically verify that the constrained operations are coordinated by ensuring that the constraint shadow prices are reasonably close for the given constrained scenario.

In this case, the RTO A shadow price is $50/MWh and the RTO B shadow price is $60/MWh, which indicates that the system is optimally coordinated for the given constrained condition.

The RTO B's proxy bus price for RTO A is $22/MWh which is very close to the LMP at Gen 1 bus ($20/MWh) in RTO A. The RTO B's proxy bus for RTO A and the Gen 1 bus both have +30% GLDF on Flowgate A. One of the objectives of the market-to-market coordination is to achieve price convergence for buses with similar GLDFs across the RTO border. Similarly, the RTO A's proxy bus price for RTO B is $50/MWh which is reasonably close to the LMP at Gen 3 bus ($58/MWh) in RTO B. The RTO A's proxy bus for RTO B and the Gen 3 bus both have -30% GLDF on Flowgate A.

Settlement calculations

Stages 4 and 5 are the steady state situation integrated over an hour.

Firm Flow Entitlement for RTO A on Flowgate A per the example = 40MW

Real-Time Market Flow MW by RTO A on Flowgate A = 31MW (requested by RTO B)

RTO A Shadow Price on Flowgate A = -$50/MWh

Payment (RTO B to RTO A) = ((Firm Flow Entitlement MW + Approved MW) – Real-Time Market Flow MW) * Transmission Constraint Shadow Price in Non-Monitoring RTOs Dispatch Solution

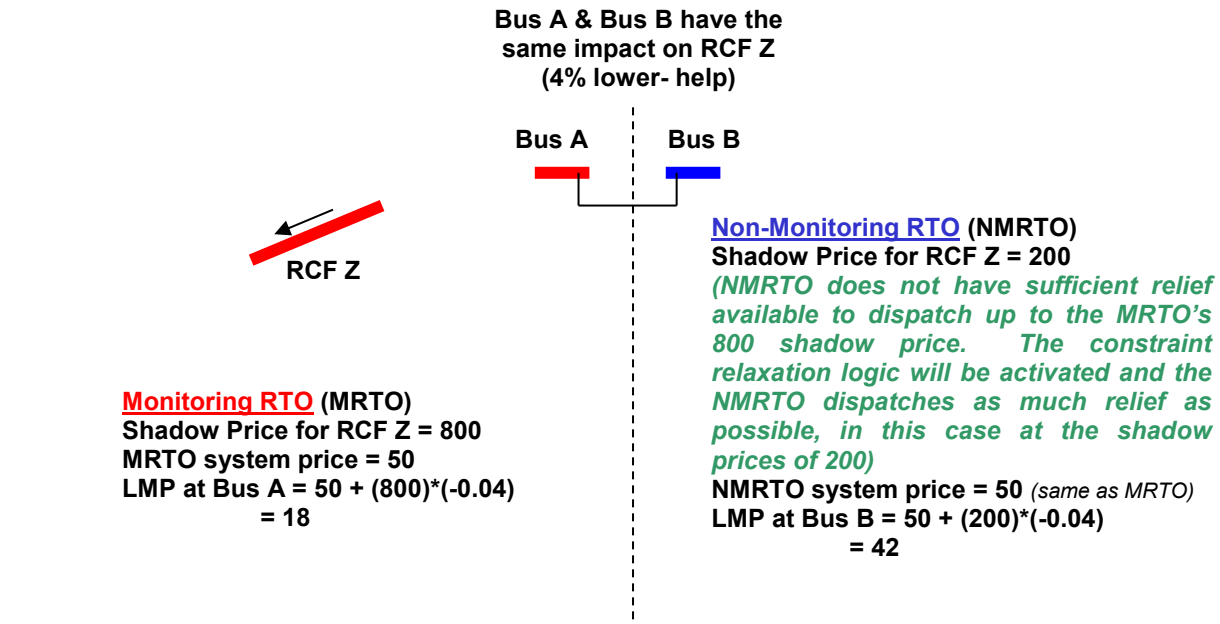
Payment (RTO B to RTO A) = ((40/MWh + 0) -31/MWh)*-$50/MWh

Payment (RTO B to RTO A) = $450

7 When One of the RTOs Does Not Have Sufficient Redispatch

Under the normal market-to-market implementation, sufficient redispatch for a M2M Flowgate may be available in one RTO but not the other. When this condition occurs, in order to ensure a physically feasible dispatch solution is achieved, the RTO without sufficient redispatch will activate logic in its dispatch algorithm which redispatches all available generation in the RTO to control the M2M Flowgate to a "relaxed" limit. Then this RTO calculates the shadow price for the M2M Flowgate using the available redispatch which is limited by the maximum physical control action inside the RTO. Because the magnitude of the shadow price in this RTO cannot reach that of the other RTO with sufficient redispatch, unless further action is taken, there will be a divergence in shadow prices and the LMPs at the RTO border.

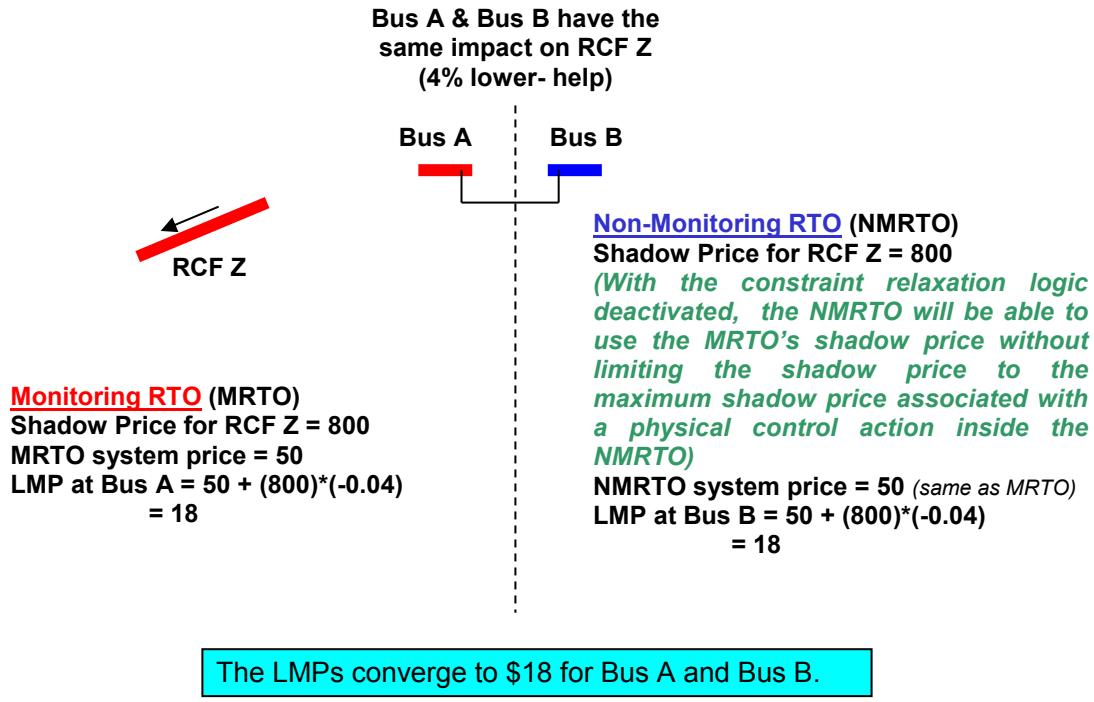
The example below illustrates how the LMPs at the RTO border diverge under this condition:



The LMPs differ by $24 even though Bus A and Bus B are electrically close to each other.

A special process is designed to enhance the price convergence under this condition. If the Non-Monitoring RTO cannot provide sufficient relief to reach the shadow price of the Monitoring RTO, the constraint relaxation logic will be deactivated. The Non-Monitoring RTO will then be able to use the Monitoring RTO's shadow price without limiting the shadow price to the maximum shadow price associated with a physical control action inside the Non-Monitoring RTO. With the M2M Flowgate shadow prices being the same in both RTOs, their resulting bus LMPs will converge in a consistent price profile.

The following example illustrates how the price convergence can occur:



This process also allows price convergence when the Non-Monitoring RTO has a higher shadow price than the Monitoring RTO.

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8 Appropriate Use of the Market-to-Market Process

Under normal operating conditions, the MISO and PJM operators will model all Reciprocal Coordinated Flowgates (RCFs) in their respective EMSs. A subset of these Flowgates, impacted by Market Flows from the two RTOs' energy markets, will be subject to the market-to-market process and called M2M Flowgates. This subset will be controlled using market-to-market tools for coordinated redispatch and additionally will be eligible for market-to-market settlements.

In principle and as much as practicable, Parties agree that the goal is to control to the most limiting Flowgate using the actual Flowgate limit. The RTOs will record and exchange actual M2M Flowgate limits, the limit used to bind, and a reason for significant deviation.

There are times when either Party, acting as the Monitoring RTO, will bind a M2M Flowgate different from its actual limit. The Parties have agreed in subsections 8.1 through 8.4 of this Section 8 to the conditions under which market-to-market settlement will occur even though a limit to which the Monitoring RTO is binding (limit control) is less than its actual limit.

8.1 Qualifying Conditions for M2M Settlement:

8.1.1 Purpose of Market-to-Market. Market-to-market was established to address regional, not local issues. The intent is to implement market-to-market coordination and settle on such coordination where both Parties have significant impact.

8.1.2 Minimizing Less than Optimal Dispatch. The Parties agree that, as a general matter, they should minimize financial harm to one RTO that results from market-to-market coordination initiated by the other RTO that produces less than optimal dispatch, which can lead to revenue inadequacy for FTRs, and impose the burden for such revenue inadequacy on one or both RTOs.

8.1.3 Use Market-to-Market Whenever Binding a M2M Flowgate. The market-to-market process will be initiated by the Monitoring RTO whenever an M2M Flowgate is constrained and therefore binding in its dispatch.

8.1.4 Most Limiting Flowgate. Generally, controlling to the most limiting Flowgate provides the preferable operational and financial outcome. In principle and as much as practicable, market-to-market coordination will take place on the most limiting Flowgate, and to that Flowgate's actual limit (thermal, reactive, stability).

a. Market-to-market events that involve the use of a limit control that is below 95% of the actual limit will be subject to an after-the-fact review, unless the lower limit was agreed to by the RTOs prior to the market-to-market binding event. The review will determine if normal market-to-market settlements are appropriate. If market-to-market settlements are determined by the Parties not to be appropriate, then settlements will not

occur on the M2M Flowgate. Sufficient real-time and after-the-fact data will be exchanged to enable these reviews. The Parties may agree to change the trigger for review to a lower number for specific Flowgates, however, either Party may request review of specific instances that are bound above the established binding percentage

8.1.5 Substitute Flowgates. The Parties agree that, if the use of substitute Flowgates is minimized and the ability to coordinate on the most limiting Flowgate in the very near term is enabled, there should be very few instances where market-to-market coordination occurs without resulting settlement.

a. Generally, market-to-market coordination without the normal market-to-market settlement will be limited to times when: (1) a substitute is used for a period in excess of that defined in Section 8.1.5 (b) (ii) below, or (2) a substitute Flowgate (whether M2M or non-M2M) is used and the most limiting Flowgate is later determined to fail the market-to-market tests.

b. Where the most limiting constraint (monitored/contingent element pair) is not a defined M2M Flowgate:

   i. Parties will add the Flowgate definition and activate market-to-market coordination on that Flowgate (as opposed to a substitute) as soon as reasonably practicable; or
   ii. A substitute Flowgate may be used for a short time (generally less than an hour) until it is possible to coordinate using the most limiting Flowgate. Parties will attempt to use either: (i) the most limiting M2M Flowgate or (ii) the most limiting Flowgate that is modeled by both Parties, in that order of preference. If possible, the Parties should use another Flowgate that is limiting. Optimal choices are Flowgates with the same or very similar Market Flow impacts (sensitivities) resulting in a very similar redispatch and market-to-market settlement.

c. A substitute Flowgate can be used in the market-to-market process pending the outcome of the coordinated Flowgate tests. The substitute Flowgate will be utilized only until the actual constraint can be entered in both the Monitoring and Non-Monitoring RTO systems as an M2M Flowgate. Market-to-market settlement is dependent on the outcome of the coordinated Flowgate tests on the actual constraint and the RTO requesting the use of a substitute Flowgate will do so at its own risk that market-to-market settlement may not occur.

d. A substitute M2M Flowgate will not be used to control for another constrained M2M Flowgate except in very limited circumstances and only where there is prior mutual agreement between MISO and PJM to do so.

Mutual agreement is established only when it has been communicated and logged by the control center operators that the coordinated Flowgate is not the most limiting (i.e., it is a substitute Flowgate).

e. A substitute M2M Flowgate will not be used to control for a non-M2M Flowgate that has failed the Flowgate study or has not been entered into the study process.

f. Any use of substitute Flowgate should be clearly logged by both RTO operators with the actual start time, the actual end time and the reason for using a substitute Flowgate.

g. If the Monitoring RTO requests TLR on an M2M Flowgate but has not initiated the market-to-market process and is not binding its market for that Flowgate, the Non-Monitoring RTO is not required to bind its market for that Flowgate in order to meet the Non-Monitoring RTO's TLR relief obligation. It will be assumed that the Monitoring RTO is binding its market for the actual constraint and that the actual constraint is already active in the market-to-market process (if the actual constraint is an M2M Flowgate).

8.1.6 Operating Guides that refer to market-to-market operation do so under the assumption that the Flowgates for which market-to-market operations take place are, or are expected to be, constrained. Operating Guides are written by operators and are not intended to result in settlement not otherwise contemplated by the JOA or this ICP. Safe Operating Mode (SOM) is reserved for abnormal conditions when existing operating guides and normal tool sets are not sufficient to manage abnormal operating conditions. After declaring SOM, operator actions may include using market-to-market tools in addition to direct dispatch. Operators may choose to use substitute M2M Flowgates with the dispatch tools to maintain reliable operations. Settlement determination will occur during the After-the-Fact Review set forth in Section 8.4 below. Generally, settlement for market-to-market coordination that takes place after SOM is declared will apply if the settlement would apply under normal conditions.

8.2 Specific Conditions Applicable to Section 8.1.4 (Most Limiting Flowgate)

8.2.1 Market-to-Market Events Not Requiring an After-the-Fact Review

The MISO and PJM operators will model all M2M Flowgates facilities with actual limits in their respective EMSs. The MISO EMS model uses design thermal limits of equipment. The MISO limits are updated in UDS following contacts with Transmission Owners prior to binding. The MISO and PJM operators will control the flows on these M2M Flowgates in their respective UDSs at a binding percentage that is 95% or greater of the M2M Flowgate actual limit.

8.2.2 Market-to-Market Events Requiring an After-the-Fact Review

All M2M events that involve the use of a limit control that is below 95% of the actual limit will be subject to an after-the-fact review to determine whether this was an appropriate use of the market-to-market process and is subject to normal market-to-market settlement. The following criteria will be used in making such a determination:

8.2.2.1 Reducing the UDS Binding Percentage to Provide Necessary Constraint Control:

a. A reduced UDS binding percentage below 95% of the actual facility limit can be applied to an M2M Flowgate by the Monitoring RTO provided the monitored element (for the defined contingency condition) of the M2M Flowgate meets the following conditions:

   i. The monitored element is, or is expected to be, over its actual limit (post contingency if applicable) and the UDSs are not providing the desired relief.
   ii. Transient system behavior necessitates controlling the M2M Flowgate to a target between 95% and 100% and providing some margin. To achieve this, in some instances, the UDS percentage may need to be below 95%.
   iii. The limit for the monitored element changes due to equipment switching out of service. For instance the actual limit of a line is reduced when one of the breakers in a breaker-and-half configuration is out of service, or only one parallel transformer remains in service at one of the line end terminals.
   iv. A constraint with a very high loading volatility such that loading is expected to exceed 100% of the actual limit, even when the UDS binding percentage is significantly below that value.

b. The reduced UDS binding percentage should only be applied for the time duration necessary to manage the initiating condition and shall be returned to normal as soon as possible.

c. Each time the Monitoring RTO reduces the binding limit control of an M2M Flowgate below 95% for an actual or relevant post contingency overload, the Monitoring RTO operator will make a best effort to notify the Non-Monitoring RTO operator of the new limit control, the reason for the change, and when the limit control is expected to be returned to normal (if known). Both RTO operators will log the event. This notification only applies to an operating condition causing a limit control change; it does not apply to the use of temperature adjusted limits, voltage limits or stability limits implemented as flow limits.

i. A limit reported by a Transmission Owner on the operating day shall require an accompanying reason. If the limit is set to control for underlying facilities, this shall be called out specifically. Any reason other than those specifically called out herein shall be reported.

d. The Monitoring RTO will operate to the most conservative limit when there are conflicting results between two different EMSs (either another RTO EMS or a Transmission Owner EMS) unless the reason for the difference is known.

8.2.2.2 Reducing the UDS Binding Percentage of a M2M Flowgate for Prepositioning

a. In some conditions system flows are expected to change quickly due to load pick-up, planned, and emergency outages, and the UDS may not be accurately predicting a resulting overload on the M2M Flowgate in the near future. When a reduction in binding percentage is initiated by the operator to mitigate expected impacts on an M2M Flowgate from a planned outage, that action shall be taken to prepare the system consistent with the time submitted on the outage ticket or as revised by the equipment operator. This reduction should be for as short a time as practicable but may be extended if the outage is delayed. If possible, initiating the reduction in binding percentage shall be delayed until the outage begins.

b. M2M Flowgates may be de-rated for a short period of time to pre-position the system for an expected change. These expected changes can include:

i. Change in unit status (anticipated as part of an upcoming outage, reacting to an imminent emergency outage, or change in commitment if the unit for which the commitment was changed cannot be adequately ramped to allow normal redispatch to manage any resulting constraints).
ii. Transmission system topology change (either anticipated event or as part of an upcoming planned outage). In this case, every effort shall be made to add the expected constraint to the systems and bind on the expected constraint instead of using a substitute Flowgate.
iii. Increase or decrease in wind generation output.

c. Reducing the limit to pre-position the system will be considered an appropriate use of market-to-market tools but subject to settlement adjustment for substitute M2M Flowgates applying a hold harmless approach discussed in the After the Fact Review process set forth in Section 8.4 below. The time duration of such events shall be limited to that necessary to pre-position to avoid excessive impacts on market prices.

8.3 Specific Conditions Applicable to Section 8.1.6 (Operating Guides)

8.3.1 All op guides are subject to review by MISO and PJM through which either RTO can request removal of a reference to the market-to-market process. Where reference to the market-to-market process has been removed and not replaced by alternate congestion management actions, the use of SOM will be added to the op guide if it is not already included in the op guide. Before modifying existing op guides, one of the following conditions must be met:

a. One or more constraints are made available to assist in managing West-to-East flows across NIPS to avoid the conditions that prompted SOM; or

b. MISO and PJM will agree to a mechanism to manage congestion that will avoid the need for repeated SOM declarations on the same constraint.

8.3.2 In the event of severe abnormal system conditions, such as storm damage to critical facilities, the Inter-RTO Steering Committee shall meet as soon as practicable to agree upon the response, which shall be incorporated into a temporary operating guide.

8.4 After-the-Fact Review to Determine Market-to-Market Settlement

8.4.1 Based on the communication and data exchange that has occurred in real-time between the Monitoring RTO operator and the Non-Monitoring RTO operator, there will be an opportunity to review the limit change and the use of the market-to-market process to verify it was an appropriate use of the market-to-market process and subject to market-to-market settlement. The Monitoring RTO will initiate the review as necessary to apply these conditions and settlements adjustments.

a. A review will verify that the limit used in the market-to-market coordination represented the actual limit of the monitored element of the original Flowgate that has passed one of the M2M Flowgate Studies. The Monitoring RTO will archive and make available data (including all UDS solutions) that supports the decision to change the M2M Flowgate limit. The Parties will mutually agree upon, and document in writing and post on the Parties' websites, the data that should be exchanged and/or archived to meet this requirement, and shall retain the data for the period applicable to other data used to audit settlements inputs and Market Flow calculations under this agreement.

b. A review will verify the outcome of the M2M Flowgate Studies and whether the potential Flowgate passed one of the M2M Flowgate Studies by both the Monitoring RTO and the Non-Monitoring RTO. The Monitoring RTO uses market-to-market tools before a M2M Flowgate is approved at its own risk regarding market-to-market settlement. After the M2M Flowgate Studies are

complete, if the Flowgate did not pass at least one of the studies conducted by the Monitoring RTO and at least one of the studies conducted by the Non-Monitoring RTO, then settlements will be adjusted as follows.

i. If the Non-Monitoring RTO's integrated Market Flows are below its Firm Flow Entitlement for the hour, there will be a normal market-to-market settlement with a payment from the Monitoring RTO to the Non-Monitoring RTO for the hour.

ii. If the Non-Monitoring RTO's integrated Market Flows exceed its Firm Flow Entitlement for the hour, there will be no market-to-market settlement for the hour.

iii. If the Monitoring RTO was requested to initiate the market-to-market process on the Monitoring RTO's Flowgate to assist the Non-Monitoring RTO, the Monitoring RTO will be held harmless as follows.

a. If the Non-Monitoring RTO's integrated Market Flows are below its Firm Flow Entitlement for the hour, there will be no market-to-market settlement for the hour.

b. If the Non-Monitoring RTO's integrated Market Flows exceed its Firm Flow Entitlement for the hour, there will be a normal market-to-market settlement with a payment from the Non-Monitoring RTO to the Monitoring RTO for the hour.

8.4.2 The Non-Monitoring RTO may request the Monitoring RTO to implement the market-to-market process on its behalf. There will be an after the fact review performed to determine whether this market-to-market event should be subject to settlement. If the review finds it is subject to settlement, the usual criteria will be applied. If the review finds it is not subject to settlement, the usual criteria will be applied except that the Monitoring RTO shall be held harmless.

a. If the Non-Monitoring RTO's integrated Market Flows are below its Firm Flow Entitlement for the hour, there will be no market-to-market settlement for the hour.

b. If the Non-Monitoring RTO's integrated Market Flows exceed its Firm Flow Entitlement for the hour, there will be a normal market-to-market settlement with a payment from the Non-Monitoring RTO to the Monitoring RTO for the hour.

8.5 M2M Data Exchange

8.5.1 A data exchange will be established. Parties shall mutually agree upon data, format and frequency of exchanges. The data exchange must be updated to include the following data as soon as practicable if requested by either Party.

a. actual Flowgate SE/SA flow from the approved case,
b. UDS solution %,
c. operator entered binding %,
d. actual Flowgate limit, and
e. shadow price.

9 Coordinated Transaction Scheduling

Coordinated transaction scheduling or “CTS” are real-time transactions implemented by MISO and PJM that allow transactions to be scheduled based on a market participant’s willingness to purchase energy at a source (in MISO Balancing Authority Area or the PJM Balancing Authority Area) and sell it at a sink (in the other Balancing Authority Area) if the forecasted price at the sink minus the forecasted price at the corresponding source is greater or equal to the dollar value specified in the bid.

CTS transactions are ordinarily evaluated on a 15-minute basis consistent with forecasted real-time prices from MISO’s Coordinated Transaction Scheduling Dispatch run and the forecasted price information from PJM’s Intermediate Term Security Constrained Economic Dispatch solution. Coordinated optimization with CTS improves interregional scheduling efficiency by (i) better ensuring that scheduling decisions take into account relative price differences between the regions, and (ii) moving the evaluation of bids and offers closer to the time scheduling decisions are implemented.

MISO and PJM may suspend the scheduling of CTS transactions when MISO or PJM are not able to adequately implement schedules as expected due to: (1) a failure or outages of the data link between MISO and PJM prevents the exchange of accurate or timely data necessary to implement the CTS transactions; (2) a failure or outage of any computational or data systems preventing the actual or accurate calculation of data necessary to implement the CTS transactions; or (3) when necessary to ensure or preserve system reliability.

10 Market-to-Market Settlement Calculations for the Michigan-Ontario Phase Angle Regulators Interface

10.1 Qualification Test for MOPI M2M Flowgates

Unless both PJM and MISO agree otherwise, the Parties shall study each M2M Flowgate to determine whether the M2M Flowgate qualifies as a MOPI M2M Flowgate. A M2M Flowgate shall be considered a MOPI M2M Flowgate where the average MI-ONT PAR shift factor value is: (1) greater than or equal to 5 percent for a single-monitored element; (2) greater than or equal to 7.5 percent for a double-monitored element; or (3) greater than or equal to 10 percent for a triple-monitored element. A M2M Flowgate with more than three monitored elements may be added as a MOPI M2M Flowgate only upon mutual agreement by the Parties.

10.2 Market Flow and Firm Flow Entitlements Calculations on MOPI M2M Flowgates

In addition to the Market Flow and Firm Flow Entitlements calculated pursuant to Attachment 2 and the sections of Attachment 3 other than this Section 10, the Parties shall calculate separate MOPI Market Flows and MOPI Firm Flow Entitlements in accordance with Section 10.2.1 and 10.2.2, respectively, for each MOPI M2M Flowgate when the MI-ONT PARs are regulating (i.e., controlling loop flows with PAR tap changes) for Lake Erie circulation. The MOPI Market Flows and MOPI Firm Flow Entitlements calculated pursuant to Section 9.2.1 and 9.2.2 shall only be used only for the purpose of calculating market-to-market settlements on MOPI M2M Flowgates for periods when the MI-ONT PARs are regulating for Lake Erie circulation.

PJM and MISO shall use the Market Flow and Firm Flow Entitlements calculated pursuant to Attachment 2 to calculate market-to-market settlements when the MI-ONT PARs are not regulating for Lake Erie circulation.

10.2.1 MOPI Market Flow Calculations for MOPI Flowgates When MI-ONT PARs are Regulating

$$MOPI\ Market\ Flow_{MOPI\ M2M\ Flowgate\ X} = Market\ Flow_{MOPI\ M2M\ Flowgate\ X} + MI\text{-}ONT\ PARs\ Market\ Flow_{MOPI\ M2M\ Flowgate\ X} - LEC\ Adjustment_{MOPI\ M2M\ Flowgate\ X}$$

Where:

$Market\ Flow_{MOPI\ M2M\ Flowgate\ X}$= the Market Flow for the relevant MOPI M2M Flowgate calculated in the same manner as M2M Flowgates, as described in Attachment 2 of this Agreement;

MI-ONT PARs Market Flow$_{MOPI\ M2M\ Flowgate\ X}$ = *PAR Shift Factor*$_{MOPI\ M2M\ Flowgate\ X}$ × the RTO's Market Flow for the four MI-ONT PAR paths, calculated in the same manner as the Market Flow is computed for M2M Flowgates, as described in Attachment 2 of this Agreement;

PAR Shift Factor$_{MOPI\ M2M\ Flowgate\ X}$ = the MI-ONT PAR interface shift factor on M2M Flowgate X;

LEC Flow = The difference between the actual and scheduled flow on the MI-ONT PAR interface, with the clockwise flow around Lake Erie considered as the positive direction;

LEC Bandwidth = a megawatt range agreed upon by the Parties that represents the maximum directional LEC Flow on the MI-ONT PAR interface, with the clockwise flow around Lake Erie considered as the positive direction; and

LEC Adjustment$_{MOPI\ M2M\ Flowgate\ X}$ = one of the following values:

(1) where the LEC Flow is outside the LEC Bandwidth on the MI-ONT PAR interface, *LEC Adjustment*$_{MOPI\ M2M\ Flowgate\ X}$ = *PAR Shift Factor*$_{MOPI\ M2M\ Flowgate\ X}$ × *(LEC Flow – LEC Bandwidth)*; or

(2) where the actual circulation on the MI-ONT PAR interface is equal to or between the directional limits of the *LEC Bandwidth*, *LEC Adjustment*$_{MOPI\ M2M\ Flowgate\ X}$ shall equal zero.

10.2.2 MOPI Firm Flow Entitlement Calculations for MOPI Flowgates When MI-ONT PARs are Regulating

Firm Flow Entitlement for MOPI M2M Flowgates are calculated by: (1) revising the Flowgate contingency definition of the MOPI M2M Flowgate to include the MI-ONT PAR interface; and (2) calculating MOPI Firm Flow Entitlements for this MOPI M2M Flowgate in the same manner as all other M2M Flowgates with the following exception: impacts from historical reservations that cross the MI-ONT PAR interface shall be excluded from the process of calculating allocations described in Attachment 2 of this Agreement.

11 Market Flow Adjustment for Generator Pseudo-Ties

Pursuant to the calculations in this Section 11, the Parties shall adjust the Market Flow on M2M Flowgates for market-to-market settlement calculations to account for each generator pseudo-tied from PJM into MISO or pseudo-tied from MISO into PJM.

11.1 The Transfer Distribution Factor Calculation for each Generator Pseudo-Tie and Flowgate

The Parties shall use the equations in Section 11.1 to calculate the transfer distribution factor for each generator pseudo-tie and M2M flowgate pairing. The weighted shift factor for the MISO-PJM common interface definition will be determined based on a mutually agreed upon method and represents the portion of the path from the location of the pseudo-tied generator to the MISO-PJM border.

The Parties shall calculate a transfer distribution factor for each generator pseudo-tie and M2M Flowgate pairing. The calculation is as follows:

$$TDF_{PT,FG} = SF_{PT,FG} - WSF_{Interface,FG}$$

Where:

$SF_{PT,FG}$ = shift factor for each generator pseudo-tie and M2M Flowgate pairing

$WSF_{Interface,FG}$ = weighted shift factor for the MISO-PJM common interface and each M2M Flowgate pairing

11.2 The Generator Pseudo-Tie Market Flow Adjustment Calculation

The calculation for the Pseudo-Tie Market Flow Adjustment is the transfer distribution factor for each generator pseudo-tie and M2M Flowgate pairing multiplied by the output of the pseudo-tie and is described as follows:

$$PseudoTieMarketFlowAdj_{PT,FG} = TDF_{PT,FG} * GEN\_MW_{PT}$$

Where:

$TDF_{PT,FG}$ = transfer distribution factor for each generator pseudo-tie per flowgate

GEN_MW_{PT} = output per generator pseudo-tie based on net Market Flows serving Attaining BA load

The Parties shall sum each Pseudo-Tie Market Flow Adjustment for each generator pseudo-tie and M2M Flowgate pairing as follows:

$$PseudoTieMarketFlowAdj_{FG} = \sum_{FG} PseudoTieMarketFlowAdj_{PT,FG}$$

Appendix A: Definitions

Any undefined, capitalized terms used in this ICP shall have the meaning: (i) provided in the Joint Operating Agreement between PJM and MISO, or in the CMP, or (ii) given under industry custom and, where applicable, in accordance with good utility practices.

Monitoring RTO	The RTO that has the primary responsibility for monitoring and control of a specified M2M Flowgate
Non-Monitoring RTO	The RTO that does not have the primary responsibility for monitoring and control of a specified M2M Flowgate, but does have generation that impacts that Flowgate
Firm Flow	The estimated impacts of firm Network and Point-to-Point service on a particular M2M Flowgate.
Firm Flow Entitlement	The firm flow entitlement (FFE) represents the net allocation on M2M Flowgates used in the market-to-market settlement process. The FFE is determined by taking the forward allocation (using 0% allocations) and reducing it by the lesser of the two day-ahead allocation in the reverse direction (using 0% allocations) or the generation-to-load impacts in the reverse direction (down to 0%). The generation-to-load impacts in the reverse direction come from the day-ahead allocation run. The forward allocation comes from the day-ahead network and native load (DA NNL) calculation. The FFE may be positive, negative or zero.
Flow Relief	The reduction in the MW flow on an M2M Flowgate that is caused by the generation redispatch as a result of the binding transmission constraint
Market Flow	The flow in MW on an M2M Flowgate that is caused by all generation deliveries to load in the RTO footprint.
Reciprocal Coordinated Flowgate (RCF)	A Coordinated Flowgate for which Reciprocal Entities have generation that has a GLDF on the flowgate at or above the NERC approved threshold (currently, 5% or greater)
Requesting RTO	RTO that is requesting an increase in their Firm Flow Entitlement in the Day-Ahead energy market coordination procedures. A Requesting RTO may be a Monitoring RTO or a Non-Monitoring RTO with respect to a given RCF in Real Time.
Responding RTO	RTO that is responding to a request to reduce their Firm Flow Entitlement in the Day-Ahead energy market coordination

	procedures. A Responding RTO may be a Monitoring RTO or a Non-Monitoring RTO with respect to a given RCF in Real Time.
UDS	Security constrained, economic dispatch software used to determine dispatch instructions to resources in a Party's market area.
M2M Flowgate	Has the definition as defined in Section 1 of this Attachment 3.
M2M Flowgate Studies	M2M Flowgate Studies consist of the coordinated flowgate tests defined in Section 3.2.1 of the Congestion Management Process and the significantly impacted flowgate tests defined in Section 1.1.3 of this Attachment 3.