

MISO-PJM Interface Pricing Post Implementation Metrics and Criteria

Contents

1	Introduction	2
2	Real-Time Market Interchange Price Signal Effectiveness Metrics	2
2.1	Post Implementation Pricing Monitoring Analysis.....	4
2.2	Price Efficiency Metrics	4
2.3	Constraint Shadow Price Convergence and Volatility.....	4
3	Market Congestion Revenue Metrics	5
4	Revision History.....	5

1 Introduction

As discussed during MISO-PJM Joint and Common Market (JCM) stakeholder meetings, there are two focus areas to monitor after implementation of the MISO-PJM Common Interface definition on June 1, 2017.

Focus Area	Monitored Parameters	Potential Mitigation Options/ Enhancement Opportunities
i) Price Signal	<ul style="list-style-type: none"> Congestion transaction incentives for M2M constraints Price signal for Non M2M constraints 	<ul style="list-style-type: none"> More granular common interface definition Additional M2M FG coordination effort Through other M2M efforts that improves shadow price convergence for M2M constraints in general
ii) Revenue Imbalance	<ul style="list-style-type: none"> Uplift or FTR imbalance 	<ul style="list-style-type: none"> Day Ahead M2M coordination Monitor the impact of commercial flow

The price incentives have been the subject of stakeholder discussions with the selected approach being the “common interface” approach in which MISO’s interface for PJM and PJM’s interface for MISO are modeled as the same weighting of the same electrical locations.

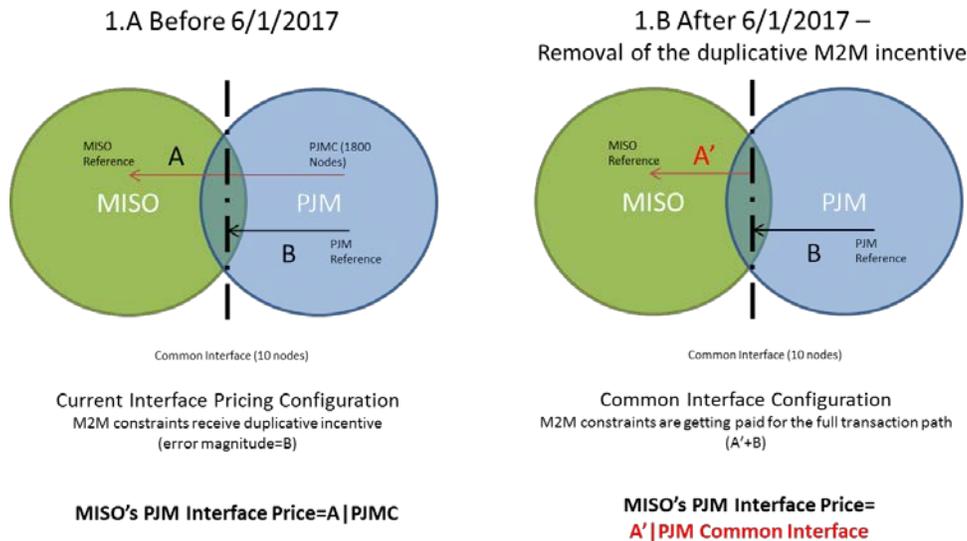


Figure 1: Illustrations of Interface Definition Pre (1A) and Post (1B) June 1 2017

- The common approach removes overlaps as seen in figure 1A in modeling the congestion impact between MISO and PJM and thus no overlap as illustrated in figure 1B in congestion pricing which would produce distorted (too high or too low) congestion pricing incentives.

The common interface approach will be monitored to provide measure of its effectiveness in meeting key objectives:

- Incremental congestion pricing improvement from status quo (Diagram 1A)
- Balanced congestion revenue

2 Real-Time Market Interchange Price Signal Effectiveness Metrics

One of the key goals of implementing the common interface approach is to provide combined MISO and PJM transmission congestion price incentives to interchange transactions between MISO and PJM which reflect the impact (and thus value) of the interchange on transmission constraints. These accurate price incentives will help incent efficient market results.

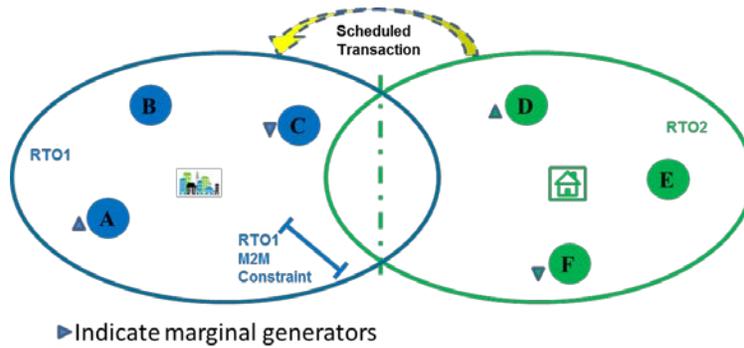


Figure 2: Transaction from RTO2 to RTO1

Consider a transaction from RTO 2 to RTO 1. The ideal per MW settlement is the incremental charge in production cost across both RTOs for an incremental transaction amount.

Transaction (from RTO 2 to RTO 1) net price per MWh:

- RTO1 pays injection – RTO2 charges withdrawal
- LMP_{RTO1} interface for RTO2 – LMP_{RTO2} interface for RTO1
- $(MEC1 + MLC@RTO2 + MCC@RTO2) - (MEC2 + MLC@RTO1 + MCC@RTO1)$

Ignoring losses for this discussion, net transaction price per MWh is reduced to

- $MEC1 - MEC2 + (MCC@RTO2 - MCC@RTO1)$

The energy components contain congestion between marginal generators to each RTO's reference and independent from the MISO-PJM interface definition. The change to the interface definition directly impacts the congestion components.

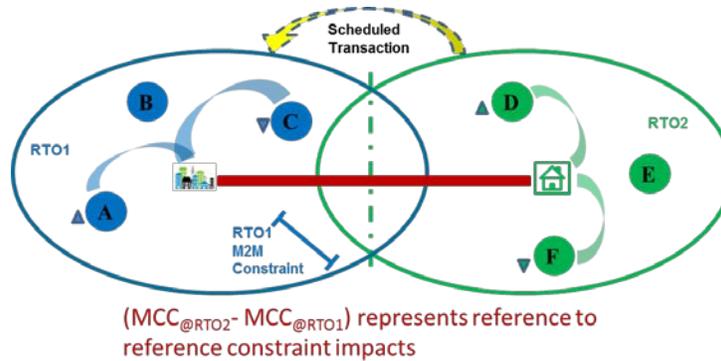


Figure 3: Illustration of $MCC@RTO2 - MCC@RTO1$

Measurements monitored as indicators of the effectiveness of the current pricing approach in the Real-Time Market include the following direct measures of the current incentives versus established ideal values and measures impacting the overall quality of the incentives:

- M2M constraint MISO and PJM combined congestion pricing incentives
- Non-M2M constraint MISO congestion price incentives

Additionally, the following measures have been identified as being important attributes of the implemented solution:

- M2M constraint shadow price convergence
- Interface price volatility

The following sections describe these metrics in additional detail.

2.1 Post Implementation Pricing Monitoring Analysis

MISO will preserve the traditional PJM interface definition which uses all generators inside of PJM to be used for post implantation monitoring purpose. MISO market engine will simultaneously calculate price signals with respect to the traditional PJM interface definition and the new Common Interface definition.

The purposes of this analysis are: 1) identify magnitude and frequency of the price incentive change due to interface definition change; and 2) to evaluate the appropriateness of the change in price.

For intervals that produce large price differential comparing the Common Interface definition to the traditional interface definition, additional shift factor analysis will be performed to evaluate the dominating constraints that drove the interface price differences.

For M2M constraints, price differences are expected. As illustrated in figure 2, reference to reference is the appropriate metric to measure price efficiency against. As seen in figure 1, the common interface approach removes overlaps in modeling the congestion impact between MISO and PJM and thus no overlap in congestion pricing which would produce distorted (too high or too low) congestion pricing incentives.

Large shift factor difference due to interface definition change is not expected for Non M2M constraints. The additional shift factor analysis mentioned before will verify this assumption. In case when Non M2M constraint shown a shift factor difference, MISO and PJM will investigate coordinated M2M Flowgate test.

2.2 Price Efficiency Metrics

Metrics and Key Performance Indicators (KPI):

Metrics for Price Efficiency	KPI #1 Price Differential	KPI # 2 Shift Factor Differential for Non M2M Constraints	KPI #3 Overall Performance
What is being measured	LMP and MCC differential between the 2 interface definitions	Shift factor differential between the 2 interface definitions	Combination of KPI 1 and KPI2
Reporting Periodicity	Bi-Monthly	Bi-Monthly	Bi-Monthly
What is the mitigation if outside of threshold	Additional joint investigation	Investigate M2M Flowgate coordination test	Re-evaluate the common interface definition

2.3 Constraint Shadow Price Convergence and Volatility

Market-to-market coordination is an iterative construct that leverages each RTOs Security Constrained Economic Dispatch engines by exchanging the shadow prices developed in these applications. In an attempt to converge on the most efficient cross-border congestion price for each M2M flowgate, each SCED solution will receive the partners pricing of the constraint and evaluate whether its re-dispatch solution can be cheaper. Occasionally, there are situations that occur that inhibit the construct defined above, and convergence can be challenging or unachievable.

Additionally, the converging construct is initiated by the Monitoring RTO, who is controlling to total flow. The Non-Monitoring RTO will consequently price the constraint after receiving the Monitoring RTO shadow price. It is not uncommon for the Non-Monitoring entity to have more effective or flexible relief that causes some shadow price volatility. By definition, this volatility will then be present in LMP solutions, including interface pricing. While this is not the only cause, PJM and MISO believe that it is a major and identifiable source of volatility and both are working to address this situation in the construct itself.

In the spirit and purpose of identifying the correct interface pricing definition, PJM and MISO will exclude the situations named above from its analysis and focus on situations where the defined constructs are working as designed. PJM and MISO see these situations defined above as opportunities to enhance the market to market coordination construct itself, and address issues at the point of inception.

3 Market Congestion Revenue Metrics

A detailed background on this issue can be found in the material posted for the [May, July and September 2014 JCM meetings](#). At this time, PJM and MISO do not plan to calculate explicit metrics associated with the impact of interface pricing on revenue adequacy, as the metrics defined above capture the heart of the issue.

4 Revision History

Date	Author	Comment
10/17/2016	Beibei Li (MISO)	Initial Draft
2/9/2017	Beibei Li (MISO) Joseph Rushing (PJM)	Expanded the draft based on RTOs post implementation analysis capability