

**UNITED STATES OF AMERICA  
BEFORE THE  
FEDERAL ENERGY REGULATORY COMMISSION**

**Midwest Independent Transmission System     )  
Operator, Inc.                                     )     Docket No. EL03-35-002  
   )**

**MARKET MONITORS' ASSESSMENT OF  
RTO SEAMS ISSUES IN THE MIDWEST**

**July 28, 2003**

## **I. Introduction**

We provide this assessment pursuant to FERC's Order On Requests For Rehearing And Directing Compliance Filing, issued May 21, 2003. That Order stated:

We will, however, take this opportunity to direct a joint filing by the market monitors of PJM and the Midwest ISO to address the specific problems raised by the Midwest ISO's IMM, Dr. David Patton, in his April 30, 2003 report to the Commission. The problem raised is that generation located within and dispatched by one RTO will have a substantial effect on flowgates that are located within the other RTO. The potential effects of this include inefficient prices and dispatch decisions, as well as excessive uplift payments. In addition, generators in one RTO could strategically dispatch to cause congestion in the other RTO and then offer transactions to relieve that congestion. These problems can be mitigated by an appropriate amount of coordination between RTOs and more seamless trading methods. The joint filing, to be filed within 60 days of the date of this order, should explain the seams issues, how and when they are expected to be resolved, and who is taking leadership of the seams process.

The Commission also added, in footnote 32 to the Order in Docket EL02-65-009:

We note that in an order issued on May 21, 2003, in Docket No. EL03-35-002, the Commission directed a joint filing by the market monitors of Midwest ISO and PJM to address the potential for inefficient dispatch and gaming opportunities due to the seam between the two RTOs. In that filing, the market monitors are to explain the seams issues, how and when they are expected to be resolved, and who is taking the leadership role in the seams process. When Midwest ISO and PJM file their joint operating agreement, they must explain how their proposal addresses the issues and recommendations contained in the market monitors' report. See Midwest Independent Transmission System Operator, Inc., 103 FERC ¶ 61, 210 (2003).

## **II. Seams Coordination Process**

PJM and MISO staff have been actively pursuing a rigorous technical solution to the seams issues since mid 2002. During this period, multiple meetings to develop the market

to non-market Congestion Management White Paper have been held between MISO and PJM staff in addition to 60 to 70 conference calls. MISO and PJM staff have met with ECAR committees on multiple occasions, with the MAIN Operating Committee at least five times and with various NERC committees in excess of 12 times. As an illustration of the efforts underway, we have attached a timeline of meetings from mid July 2002 and a revised timeline developed at a PJM-MISO technical meeting on July 22<sup>nd</sup> and 23<sup>rd</sup>, 2003. (Attachment 1.)

The PJM-MISO joint effort on the seams coordination process has produced three key documents:

1. The market to non-market Congestion Management White Paper: “Managing Congestion to Address Seams, A Proposal for Congestion Management Coordination.” The current version is dated May 16, 2003 but a revised version is expected out this week (July 30<sup>th</sup> 2003). The Congestion Management White Paper is attached. (Attachment 2.)
2. The market to market White Paper: “MISO and PJM Market to Market Interregional Coordination Proposal.” The current version is dated July 28, 2003. The market to market White Paper is attached. (Attachment 3.)
3. “The Joint Operating Agreement Between the Midwest Independent System Operator, Inc. and PJM Interconnection.” The Joint Operating Agreement (“JOA”) will include both the market to non-market protocols and the market to market protocols from the respective White Papers. A public draft will be distributed by August 1<sup>st</sup> 2003.

The history of the joint effort illustrates the level of effort and the nature of the issues. A final version of the market to non-market White Paper was produced on May 16, 2003. However, subsequent to that date, participants became aware of four additional issues.

The four additional issues are:

1. NNL netting
2. IDC granularity for the integration of Com Ed into the PJM market
3. Dynamic schedule management for the integration of Com Ed into the PJM market
4. Scope of implementation of the market to non-market White Paper.

The NNL netting issue involves the treatment of Network and Native Load (NNL) in determining the Market Flows on coordinated flowgates in each RTO. It became apparent that it was appropriate to use gross directional NNL rather than net NNL in order to accurately capture the flows on the coordinated flowgates associated with Network and Native Load. MISO and PJM have agreed in principle how to address the issue and the resolution will be included in the next version of the market to non-market White Paper.

The IDC granularity issue is associated with the integrated market operation of PJM and Commonwealth Edison. There was a concern that, during times of joint dispatch with the PJM-Com Ed pathway unconstrained, the marginal unit needed to calculate the impacts of transactions on flowgates should be specified as either in PJM or Com Ed. The IDC is the NERC Interchange Distribution Calculator, a tool used by NERC when implementing TLRs to determine the impact of transactions on congested flowgates. PJM and MISO have agreed to a methodology that will better model marginal units when the PJM-Com Ed pathway is unconstrained.

The dynamic schedule management issue is associated with management of the pathway between PJM and Com Ed that arises from the integrated market operation of PJM and Commonwealth Edison. Flows on the pathway will result from the economic dispatch of the PJM and Com Ed control areas and PJM will manage these flows as a dynamic schedule. The flows can be thought of as existing in three components: a flow out of PJM or Com Ed; a flow across AEP; and a flow into Com Ed or PJM. One concern was raised that it would be possible to have two of the three legs of the schedule defined as firm and one as non-firm. PJM has clarified that only PJM will schedule on the pathway and that all three legs will be required to be firm transmission. A second concern was raised that the current NERC tagging rules would allow relatively wide variation in the actual flow under the tag before the tag must be updated. To address this concern, PJM will be updating its schedule amount every 15 minutes and has agreed to hold the schedule amount constant when a related TLR is called to avoid aggravating the constraint.

The scope of implementation of the market to non-market White Paper was raised as an issue. The issue here is that the parties want to be extremely clear about the exact timing of each step of market coordination. In particular, the final version of the White Paper will specify the flowgates that will be jointly monitored when Com Ed joins the PJM market, when AEP joins PJM and when the MISO market becomes operational.

As discussed above, the final resolution of both the market to market and market to non-market interfaces will be contained in a Joint Operating Agreement (JOA). The current draft version is dated July 23. PJM and MISO have continued to meet to update and

complete the JOA, and plan to distribute a final draft to stakeholders over the next two weeks. The RTOs have indicated that they will file the JOA at FERC in early September.

In addition, the IT, Operations, and Market Development officers are working internally and in coordination with their counterparts to develop the necessary resource plans and timetables to implement the two market interfaces. The RTOs are working toward an implementation date of November 1, 2003 for implementation of the market to non-market interface coincident with the integration of ComEd into PJM. Extensive planning has not been completed for the market to market interface, but it must be developed by the time the MISO implements its LMP market (assuming PJM is already operating an LMP market in the ComEd control area). MISO's market start-up is currently planned for March 2004.

### **III. Electrical Interaction Issues**

As noted in the Commission's Order of May 21, 2003, several concerns related to seams issues between PJM and MISO were raised in the 2002 MISO State of the Market Report. This section identifies and expands on these issues, which will be addressed primarily through effective coordination by the RTOs and secondarily by continued market monitoring to detect residual concerns.

#### **A. Nature of the Electrical Interaction**

The Midwest ISO and PJM will be implementing markets over a broad area of the Midwest, including substantial portions of MAPP, MAIN, and ECAR. The RTO membership elections in the Midwest have created an irregular geographical seam

between PJM and the Midwest ISO. The result will be significant electrical interactions, also known as loop flows, between the Midwest ISO and PJM market areas.<sup>1</sup>

Seams arise between RTOs because electrical networks have the inherent property that power injected at one point and withdrawn at another will flow over all interconnected lines and facilities, including those in multiple RTO systems. The flow that occurs on others' facilities is generally referred to as "loop flow". Loop flows are generally lower over longer distance (more circuitous) paths and on lower voltage facilities and higher on more direct paths and higher voltage facilities. Loop flows associated with PJM and MISO operations will occur both within each RTO and also in other control areas. The Congestion Management White Paper includes flowgates in control areas outside both PJM and MISO on which the two RTOs will jointly manage their respective impacts. The White Paper identifies approximately 300 external flowgates that each RTO will monitor and calculate their real-time impacts on. (The list of flowgates is included in the Congestion Management White Paper.)

These electrical interactions raise two significant and related issues if the markets are not well-coordinated: (i) the efficiency of the locational marginal prices and associated dispatch decisions, and (ii) the increased potential for strategic gaming. These configuration issues are exacerbated by the fact that the status and timing of AEP's participation in PJM is unknown.

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<sup>1</sup> Potomac Economics conducted an analysis of the configuration of electrical facilities last summer and the analysis was updated in the 2002 State of the Market Report for the Midwest ISO. PJM filed the affidavit of Andrew Ott in response to the Potomac Economics analysis.

## **B. Efficiency Issues**

As shown in the Potomac Edison analysis and in PJM's response to that analysis, it is clear that there are substantial electrical interactions between the Midwest ISO and PJM. Unless direct coordination is implemented, RTOs with high degrees of electrical interaction are likely to dispatch generation inefficiently by ignoring relevant constraints on each others' systems. The efficiency concerns derive from the fact that the dispatch decisions and locational prices in one RTO area will not be efficient when the RTO is causing (or could alleviate) congestion on the adjacent RTO's system. As a result, the RTO with the binding constraint will take redispatch actions that may be substantially more costly than what the other RTO could take. These actions will be fully reflected in the first RTO's LMP prices, which will exhibit an inefficiently high level of congestion. In the extreme, it is possible that some congestion will not be manageable absent coordination between the two RTOs.

A secondary effect of this efficiency concern relates to uplift costs. One of the principles of the LMP market system is that sufficient congestion revenue will be collected by the RTO to satisfy its financial obligations to the FTR holders as long as the FTRs are physically feasible (i.e., scheduling consistent with the FTRs would not exceed any transmission limits). In the absence of coordinated dispatch, the power flows created by the generation and consumption of electricity on adjacent systems will not be billed for the resultant congestion and the RTOs could incur a revenue shortfall where the congestion revenue collected from the participants is less than its financial obligation to the FTR holders.

When this occurs, the shortfall is generally collected through an uplift charge to the RTO's participants. Given the high degree of electrical interaction between the RTO systems in the Midwest, the customers may be subject to considerable uplift charges if the RTO markets are not well-coordinated.

### **C. Gaming Issues**

In addition to the potential efficiency concerns described above, lack of effective RTO coordination can create gaming opportunities. There are a number of such opportunities that would exist if the RTOs do not coordinate effectively.

The first gaming issue relates to physical scheduling between RTO areas by participants. In general, the physical scheduling of external transactions between RTO areas is generally performed by establishing one or more interface points between the areas (generally referred to as a proxy bus). Scheduling over these interfaces generally assumes that the power will flow over the identified interfaces. In reality, the power will flow over the interconnected network as dictated by the physical properties of the network, and influenced by the actual source and sink for the power (which is not typically identified in the schedule).

When two areas are connected by more than one proxy bus, as will likely be necessary between PJM and the Midwest ISO, participants can schedule transactions over one interface that will largely flow over other interfaces. This can facilitate gaming because the prices at each interface represent that value of power flowing into or out of the RTO system at that point. If scheduled interchange is inconsistent with the actual flow of the power, the settlement for an import or export will be similarly inconsistent. In other

words, the participant may be paid more for an import (or pay less for an export) than true value of the power based on the points where it actually flows into (or out of) the system. This inconsistency between the scheduled and actual flows can create a number of gaming opportunities. One example of this type of gaming issue occurred last year in PJM.<sup>2</sup>

A second gaming issue that could be a concern if the power flows are not well coordinated would be associated with the dispatch of generation. Given two RTOs with a high degree of electrical interaction, a generation owner in one RTO may have the ability to dispatch its units to cause congestion in a neighboring RTO. Having dispatched its units to create this congestion, the supplier could then schedule external transactions across the neighboring system that would apparently relieve the congestion and be compensated accordingly. These issue arises because, absent coordination, the locational prices in the two areas will not be consistent – i.e., the prices in the first RTO will not reflect the congestion occurring on the second RTO.

These concerns indicate the importance of effective coordination between the RTOs. The next section evaluates the progress made to date in developing a process to coordinate power flows in the region.

#### **D. AEP's RTO Status**

An additional seams issue is created by the fact that AEP has not yet joined an RTO. AEP lies between MISO and PJM and will create an ongoing market to non-market seam for

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<sup>2</sup> See the PJM Market Monitoring Unit Report to the Federal Energy Regulatory Commission on Interface Pricing Policy, August 12, 2002.

PJM and for both MISO and PJM after MISO implements markets. These seams will be prone to all the inefficiencies and associated gaming opportunities identified above. The interface pricing issue identified by PJM in July 2002 is one example of the inefficiencies and games that result from this interface.

In addition, the inefficiencies associated with managing congestion at the interface between PJM and AEP continue to require the management of constraints via TLRs rather than redispatch and to create associated issues for PJM. To date, however, the parties have not engaged in developing protocols for managing inefficient dispatch that could begin to address these issues until AEP joins PJM. While it is our understanding that the parties are discussing these issues, we suggest that the parties be required to engage in the market to non-market coordination protocols identified in the White Paper until AEP joins PJM.

#### **E. Data Issues**

In general, we believe we have access to appropriate data and information to effectively monitor the seams issues. We will be seeking one additional category of data needed to address the issues raised in this filing from a market monitoring perspective, which is NERC TAG data collected and managed by OATI. Currently, the RTOs only have access to TAGs that involve a contract path naming an RTO interface or path. Since other TAGs can substantially contribute to a binding constraint on the RTO's system, access to this data is important to be able to fully monitor the market for strategic gaming.

#### **IV. Current Status of the PJM-MISO Market Interfaces**

The PJM-MISO seams-related coordination efforts have taken two paths: (1) the market-to-non-market agreement between the RTOs, and (2) the market-to-market agreement between the RTOs.

The market-to-non-market interface involves developing rules that:

- Allow the use of TLR procedures within MISO
- Allow a combination of internal redispatch by PJM and TLR procedures by PJM at its interfaces
- Allow coordinated actions in the two areas to resolve potential transmission constraints via coordination of reciprocal flowgates.

These procedures will operate during the initial period when PJM is operating an LMP market and MISO is not.

The market-to-market interface procedures address the longer run when PJM and the Midwest ISO are both operating LMP markets in the Midwest. Due to the timing of implementation of the markets in the Midwest, the market-to-non-market interface will be the first interface needed, and the solution to the related issues is therefore more completely developed.

##### **A. Market to Non-Market Interface**

The market to non-market White Paper describes the market to non-market interface proposal in detail. The essential point of the White Paper is to establish protocols that require both RTOs to recognize the impacts of their activity on flowgates in areas outside the electrical boundaries of the RTO. For example, identified PJM flowgates are affected

by schedules within the Midwest RTO. These flowgates will be monitored by the RTOs. If an overload occurs on a monitored flowgate, information will be shared, the Midwest RTO would declare TLRs as appropriate to limit its impact on the flowgates and PJM will implement a mix of internal redispatch and schedule curtailments at interfaces, if necessary, to limit its impact on the flowgate. Similarly, PJM-related flows have an impact on identified MISO flowgates. When such a flowgate is constrained, the information would be shared, PJM would limit its impact on the flowgate by a combination of internal redispatch and schedule curtailments at interfaces, if necessary, and the Midwest RTO would declare TLRs as appropriate to limit its impact on the flowgates.

The market to non-market White Paper has identified the flowgates in MISO and in PJM that are affected by flows in the other RTO and specifies a method for implementing monitored limits and apportioning acceptable levels of usage by each RTO on each such flowgate.

The proposed interface includes procedures to quantify the flow on the flowgate that is associated with native and network load (“NNL”). In the PJM day-ahead market, PJM will honor this amount as a limit on its scheduled use of the flowgate, when congestion is anticipated based on facility outages and prior day operations. In real-time, the RTO will calculate and monitor when the actual and projected flows exceed these NNL limits. The additional flow above the NNL limits is treated as non-firm economic flow. The RTO will post the NNL MW flow and the difference between the NNL limits and actual flow to the IDC.

When there is a TLR3a or higher called on one of these selected external flowgates in the non-market area, and the RTO's actual/projected market flows exceed the NNL limits, the RTO will redispatch its system in order to provide the required flow relief, per the IDC congestion management report. When a TLR 5a or 5b is called, the RTO will curtail or redispatch their respective systems to provide their share of reductions associated with NNL calculated by the IDC. These RTO curtailments are in addition to IDC-related cuts of non-firm transactions.

The RTO will also employ a means to effectively tag its in and out transactions so that the IDC can accurately portray the amount of effect a given transaction has upon an impacted flowgate. Refer to the Congestion Management White Paper for additional detail on the market to non-market coordination.

## **B. The Market to Market Interface**

The Midwest ISO and PJM have also been actively working to develop the Market-to-Market coordination process that will address the efficiency and gaming concerns described in the prior section when both MISO and PJM have operating LMP-based markets. At the time of this filing, PJM and MISO have developed an initial market to market interface plan that would build on certain elements of the market to non-market interface. That plan is presented in the market to market White Paper (Attachment 3).

The fundamental philosophy of the PJM/MISO market to market interface is to establish 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 most efficient and least costly transmission congestion management and will also provide coordinated pricing at the market boundaries.

The market to market coordination plan includes the following elements:<sup>3</sup>

*i. Identification of Constraints to be Jointly Managed*

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 in a manner similar to the method used for the market to non-market interface.

*ii. Real-time Market Coordination*

When any of the identified transmission constraints becomes binding, the monitoring RTO will automatically provide the shadow price and maximum relief amount to the non-monitoring RTO. The non-monitoring RTO will include this information in its security-constrained economic dispatch, resulting in the redispatch of generation to manage the constraint if it is economic. This process occurs iteratively over time in each dispatch interval.

The settlement of the congestion costs would be based on the NNL entitlements for each flowgate. The congestion settlement amount would be equal to the difference between the real-time power flow and the NNL entitlement, multiplied by the constraint shadow price. These payments for congestion management will be added into the congestion charges collected in the RTO that receives the payment in order to fund the FTR credits

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<sup>3</sup> This section draws on the market to market White Paper.

in that RTO for the hour. In addition, the White Paper address how revenue inadequacy caused by facility derations would be shared.

***iii. Optimal Interchange between Markets***

The RTOs are also evaluating the feasibility of coordinating the interchange between the the RTO areas to efficiently manage congestion over facilities that interconnect the areas and optimize the dispatch of generation and load in both areas. Initially, however, it is likely that the RTOs will allow participants to schedule physical transactions between the areas using multiple “proxy buses” to represent the interconnections between the markets. This approach has allowed some instances of gaming in the Northeast when the scheduled interchange across the proxy buses is not consistent with the actual flow between the regions (due to loop flows that occur in reality). The RTOs plan to address this concern through settlement provisions that would settle interregional transactions based on a volume-weighted average of the proxy bus prices.

***iv. Day-Ahead Market Coordination***

Due to time and resource limitations, the Day-Ahead markets will not initially be fully coordinated. Initially, Day-Ahead market protocols will be established to allow the RTOs to request Day-Ahead coordinated congestion relief when congestion is projected to occur that will require scheduled changes to flow entitlements. During this initial period, the markets will rely on day-ahead transactions and virtual purchases and sales to cause the day-ahead results to converge with the real-time. This is consistent with PJM’s historical experience. However, the NNL entitlements will be recognized when the day-ahead commitment and dispatch is performed. In the future, the RTO’s plan to

implement an iterative coordination process to coordinate the day-ahead markets subject to a feasibility assessment and benefits analysis. In addition, each RTO will sell FTRs whose quantities will be limited by the NNL entitlements on the adjacent RTO's flowgates. This will prevent the FTRs being oversold and will be consistent with the real-time settlements described above.

## **V. Conclusions**

We have reviewed the progress of the Midwest ISO and PJM in developing detailed protocols for handling the coordination for both the market to non-market and market to market scenarios, which are summarized in the prior section. If these protocols are fully implemented, we are optimistic that they will minimize the potential for inefficient locational prices and will, therefore, minimize the potential to game the differences between locational prices that do not reflect the underlying electrical reality.

Nonetheless, the challenges are significant. The two RTOs need to commit to establish a process for quickly finalizing the JOA, including developing the market to market protocols to a level of detail comparable to the detail on the market to non-market protocols. This will be necessary to ensure that revisions to the markets software completed to implement the protocols prior to MISO's March 2004 market start up date.

The market to market interface described in the prior section identifies two areas that will not likely be fully addressed in the initial implementation of the interface: (1) optimal interchange between markets, and (2) day-ahead market coordination. These improvements promise additional efficiency improvements when they are implemented.

However, we do not believe these are necessary components for the initial implementation of the market to market interface, which should address the primary efficiency and gaming concerns

We remain concerned that similar coordination is needed with AEP. This concern can only be addressed by development of similar agreements between the RTOs and AEP, or AEP participation in one of the RTOs in the Midwest.

In addition, the market monitors of MISO and PJM need to develop a coordinated approach to monitoring seams issues both in a market to non-market and a market to market setting. We are committed to doing that.

Respectfully submitted,

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