Capacity Deliverability

June 2012

MISO

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1. Preface

MISO has identified Capacity Deliverability as an important issue across the MISO and PJM seam. Removing barriers to efficient interregional capacity transfers is a necessary step toward realization of the significant benefits available to consumers across the MISO and PJM footprint. MISO has developed this whitepaper to provide a detailed description of barriers to capacity deliverability and proposed steps to unlock the value of increased capacity deliverability.

On June 11, 2012, FERC formally requested comments on the issue of capacity deliverability between MISO and PJM (Docket AD12-16-000). It is MISO's hope that this whitepaper will increase understanding of the problem and assist parties interested in filing comments by providing a description of the issue and MISO's proposed solution.

In addition, MISO and PJM are reinitiating the Joint and Common Market ("JCM") effort in order to pursue opportunities to enhance seams operations. These discussions are expected to include enhanced seams capacity deliverability. MISO is concerned that previously expressed differences in perspectives of MISO and PJM and their respective stakeholders on this important issue suggest that this problem may not be resolved absent FERC direction. MISO encourages parties interested in this important issue to participate in the MISO and PJM Joint and Common Market process and to provide comments to FERC in the above referenced docket.

2. Abstract

MISO and PJM both operate capacity markets that serve important roles in providing transparent locational capacity pricing signals for market participants to make investment decisions. These capacity markets have fallen short of selecting the most efficient resources to meet resource adequacy requirements particularly when evaluating eligibility for external resources to supply capacity.

The MISO and PJM Joint and Common Market Initiative was developed to achieve all the benefits of a combined market across the broad footprint including both PJM and MISO and that meets the needs of all customers and stakeholders using the electric power grid in the two RTOs' regions. Additionally, FERC Order 2000 requires RTOs to "coordinate their practices with neighboring regions to ensure that market activity is not limited because of different regional practices". Both MISO and PJM treat internal and external resources differently when evaluating a resource's deliverability to load for capacity market purposes. This practice results in a barrier to participation by external resources limiting the market activity across the seam. This is inconsistent with the FERC's requirements under the JCM initiative and with FERC's requirements under Order 2000. Efficiencies related to use of the transmission system have been realized internal to RTOs. This paper introduces a proposal that will effectively extend these efficiencies across RTO boundaries while maintaining reliable operations. Further, Potomac Economics, MISO's Independent Market Monitor, has identified that "substantial barriers at the seam between the two RTO's are preventing efficient capacity trading."[1] MISO has developed this proposal as a starting point to launch a joint effort to fully develop and implement a solution to this issue utilizing the existing Joint and Common Market Initiative.

[1] MISO Independent Market Monitor Answer to comment submitted by PJM in FERC docket ER11-4081-000

[2] http://www.miso-pjm.com/~/media/pjm-jointcommon/downloads/20050715-pjm-miso-jointandcommon-white-

3. Background

3.1 Interactions between Capacity and Transmission Service

Maintaining a sufficient quantity of generation resources and demand resources above the peak demand is required due to uncertainties in load forecasts and generation resource availability. The amount of generation capacity required beyond expected peak load is commonly referred to as a planning reserve margin. To achieve the most efficient use of the finite capacity resources, loads must have access to all generation supplies that are not prevented from delivering power by real, physical transmission constraints.

Historically, control areas generally maintained this margin through building the additional generation capacity within their service territories. Interconnections between control areas expanded with transmission facilities built to increase system reliability and to take advantage of more efficient sources of energy and capacity. Resource deliverability to load and access to the transmission system became important factors in enabling these more efficient sources of capacity and energy, particularly when they are outside of a control area boundary. As a result, Open Access Transmission Tariffs (OATTs) were required by FERC to facilitate open access for all transmission customers to the transmission system. These tariffs introduced two types of important services: (1) Transmission Service for determining if transmission capacity is available to support incremental energy transactions between load and generation; and (2) Interconnection Service for determining if the existing transmission system can support the addition of new capacity.

Transmission Service was further broken down into "Network Service" and "Point-to-Point" Service. Network Transmission Service is used for the transmission of capacity and energy from network generating resources to network loads within a single Balancing Authority Area. Network customers also can use the service to deliver economic energy purchases to their network loads. Point-to-Point Transmission Service uses the system for the transmission of a fixed MW capacity and energy between a point of receipt and a point of delivery, which can be into, out of or through the footprint.

While these transmission products represented significant improvements in fair access to the transmission system, it was quickly realized that efficiency gains were limited under this new paradigm because even though the transmission system may have been able to physically support energy or capacity transactions over broader geographical regions, the existence of multiple transmission tariffs between generation resources and loads rendered transactions over multiple transmission boundaries more difficult and less inefficient.

Regional Transmission Organizations (RTOs) were created to eliminate the inefficiencies in transmission utilization caused by the existence of multiple transmission tariffs. RTOs eliminated these inefficiencies within their own footprint through extending Network Resource Interconnection Service (NRIS) and Network Integration Transmission Service (NITS) to member Load Serving Entities instead of continuing to use Point-to-Point or Network transmission service reservations. The consolidation of NRIS and NITS service within RTOs created efficiencies by expanding the pool of generation resources available to load for capacity and energy under a single transmission tariff. This same opportunity to increase the efficient use of the transmission system exists between RTOs.

RTOs with LMP-based markets use network service study methodologies to determine which resource qualify to provide capacity and energy. These methodologies employ a combination of generator deliverability studies, load deliverability studies, and baseline planning studies to establish NRIS and NITS which more fully utilize the transmission system. Comparatively, the incremental, Point-to-Point methodology is less efficient because it assumes a static generation dispatch with a discrete, incremental transfer from one generation source to another specific sink point. The efficiencies gained through network service with joint optimization of generation and transmission schedules by extending the NITS option to regional members are observed in both MISO and PJM Tariffs as the majority of transmission customers choose to utilize NITS over point to point transmission service.

3.2 RTO Seam Coordination

MISO and PJM previously identified that Stakeholders in both RTOs would benefit by aligning processes as if both RTO footprints were combined. This effort, established in 2005, was called the Joint and Common Market (JCM) initiative. The JCM initiative started with a whitepaper that identified the goals and values as well as a separate Stakeholder process consisting of customers and Stakeholders from MISO and PJM. The whitepaper specified that these benefits would be gained by examining the different rules by which the two RTOs operate as individual entities and evolving over time to coordinate market operations and ensure there are no impediments to trade in either, both, or between the markets. The JCM whitepaper[2] established that well-functioning, efficient, and competitive markets benefit customers because they:

- Provide information about the value of energy to buyers and sellers active in the markets who, through their market actions, produce competitive prices.
- Create incentives for efficient production.

[2] http://www.miso-pjm.com/~/media/pjm-jointcommon/downloads/20050715-pjm-miso-jointandcommon-white-paper.ashx
http://www.miso-pjm.com/~/media/pjm-jointcommon/downloads/20050715-pjm-miso-jointandcommon-whie-paper.ashx

- Allocate scarce resources efficiently.
- Create incentives for efficient investment where and when needed by highlighting scarcity through price signals.
- Provide customers with new options and flexibility for meeting demand.
- Allow many buyers and sellers to participate.
- Minimize barriers to entry or to efficient utilization of the regional transmission system.
- Enable effective mitigation of market power and/or manipulation.

Since the creation of the JCM, MISO and PJM have successfully implemented new processes and modified business practices to increase efficiency to the benefit of customers in both RTO footprints. These successes include the implementation of Market-to-Market redispatch, methodology for market flow calculations, loop flow modeling, energy price transparency, and progress made to date on the Interchange Optimization proposal.

As part of this JCM initiative, MISO and PJM conducted a joint deliverability study in 2006 to "evaluate the potential for combined deliverability of Network Resources within both RTOs to a combined RTO footprint."[3] The methodology, described in Section 1.2 of the Coordinated System Plan, used the standard deliverability method employed by both RTOs at the time and applied it to the combined footprint as if it were one large market. This joint analysis concluded that over 95% of the generation in the combined footprint was deliverable to load within the combined footprint. While this study presented a significant opportunity to enhance the seam, no further action was pursued at that time to allow focus on other JCM initiatives.

MISO PJM Joint Operating Agreement has been successful in delivering benefits of the JCM initiative over the past seven years. MISO proposes reinstating the formal JCM process to evaluate and develop solutions to this and other issues that may prevent MISO and PJM from achieving the benefits anticipated in the JCM initiative. In particular, we recommend pursuing the significant opportunity available to increase consumer benefits presented by the 2006 joint deliverability study.

4. Capacity Deliverability Problem Definition

Customers are best served when existing transmission assets are fully available to meet capacity and energy requirements allowing the most efficient use of existing supply, deferral of new supply investments, and efficient supply additions, when needed. Currently, customers have restricted access to economic capacity resources due to the seam created by the boundaries of MISO and PJM. Cross-border transactions are limited not only because of physical transmission

[3] Coordinated System Plan Section 1.1. Available at https://www.midwestiso.org/Library/Repository/Report/Resource%20Adequacy/20061207-2011%20CSP%20Report.pdf

limitations, but also because of institutional barriers. In particular, access is restricted by the requirement to procure cross-border Point-to-Point transmission service to enable capacity transactions. Further, the RTOs evaluate the request for transmission with similar, but not identical, processes. Capacity Deliverability refers to enabling efficient capacity transactions across the seam through extension of network service, or a similarly efficient transmission service, across the seam.

As described previously, RTOs maximize transmission utilization within their own systems by using Network Resource Interconnection Service (NRIS). The benefits of NRIS are further demonstrated as utilities join or change their RTO membership. New utilities are integrated into RTO markets by determining which generation resources are eligible to serve network load in the RTO footprint. This determination is different from the studies performed to grant Point-to-Point transmission service, thus creating differential treatment for generation resources internal and external to an RTO.

This differential treatment creates restricted access to potentially economical capacity resources in the neighboring RTO footprint.

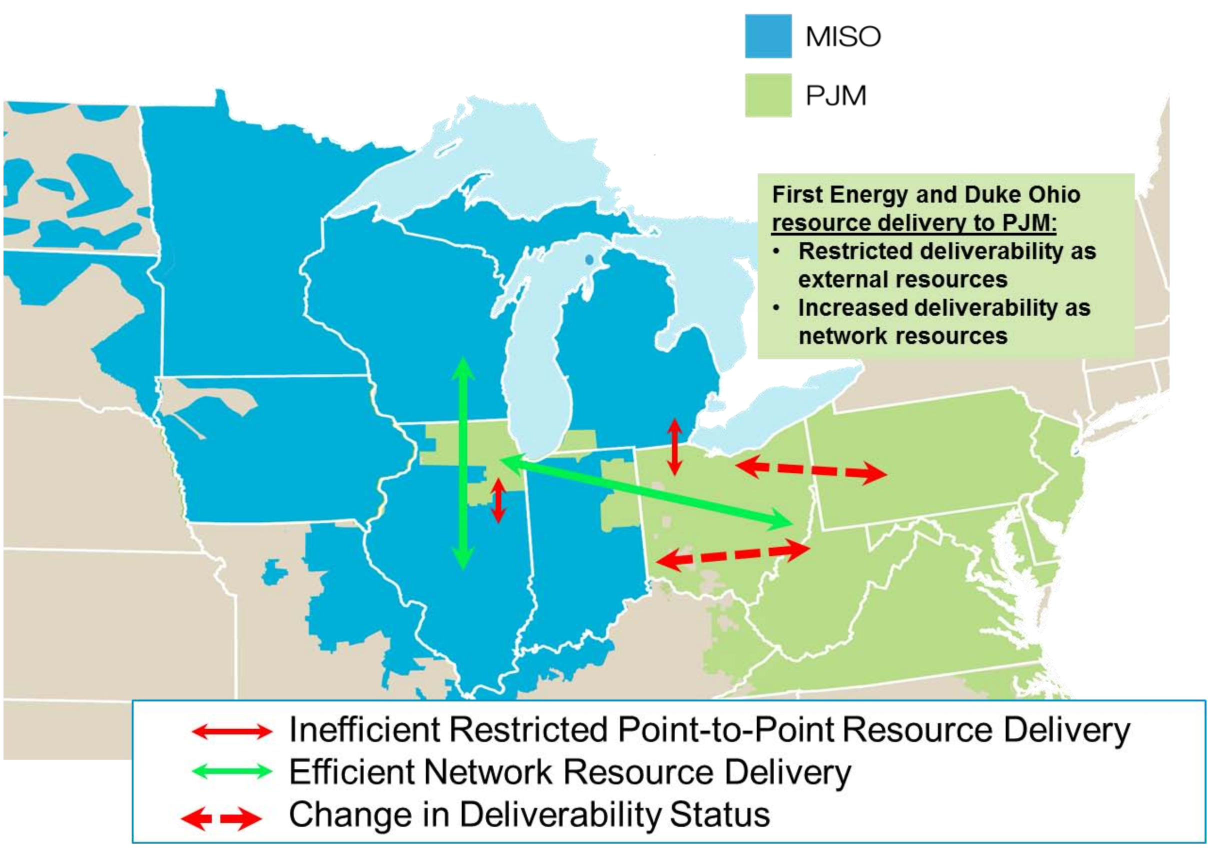

Figure 1

It is important to recognize that membership in RTOs is voluntary and that utilities have choices in determining RTO membership. A look at the resource deliverability aspects of the First Energy and Duke Ohio transitions from MISO to PJM in 2011, exemplifies the limitations of point-to-point transmission service. As part of this transition, PJM evaluated their generators' deliverability to PJM load[4]. Prior to joining PJM, First Energy and Duke Ohio generation resources were not deliverable to PJM load because of the Point-to-Point transmission service inefficiencies. However, once First Energy and Duke Ohio joined PJM, the same resources were determined to be deliverable to PJM load using network service[5]. This situation indicates that, while the transmission system was capable of supporting capacity transactions from these generators to PJM load, the difference in treatment restricted the capacity transaction.

In 2011, MISO sponsored a preliminary analysis performed jointly with The Brattle Group that evaluated the efficiency of the seam in relation to capacity transfers. The preliminary analysis compared historical volumes of capacity commitments across the border between MISO and PJM and the physical capability of the transmission system between the two RTOs. The study indicated that significant volumes of capacity transfer capability between the two RTOs may be underutilized, although the study did not evaluate: (1) any potential differences between MISO's estimates of transfer capability and PJM's estimates which have not yet been developed; or (2) the implications of capacity benefit margin (CBM), which uses some of the transfer capability and lowers the required reserve margin in PJM. The most important outcome of the study was to identify the possible range of benefits that could be achieved by eliminating barriers to cross-border capacity sales. The preliminary report found that benefits may be billions of dollars per year. This suggests that MISO and PJM should further evaluate this barrier and identify potential solutions.

Customers in both MISO and PJM benefit by eliminating artificial barriers to capacity transactions thereby increasing efficiency and decreasing consumer costs. More efficient capacity transfers enabled by fluid responses to changing supply, demand, and price conditions in both markets will ultimately reduce the total combined system costs.

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[4] First Energy to PJM:
http://oasis.midwestiso.org/documents/Miso/A366_Final_Report.pdf, (MISO Impact Study)
http://www.pjm.com/pub/planning/project-queues/ltf-phase-1/853531_ltf1.pdf (PJM Initial Study)
http://www.pjm.com/pub/planning/project-queues/ltf-phase-2/853531_ltf2.pdf (PJM Impact Study)

Duke to PJM
http://oasis.midwestiso.org/documents/Miso/A279%20Final%20Report_rev2.pdf (MISO Impact Study)

[5] All identified required upgrades had already been identified by MISO through its planning process and would have been required if First Energy and Duke OH would have stayed in MISO.

5. Proposed Guiding Principles

MISO offers the following guiding principles for developing a solution to this issue:

- Maintain or improve the level of reliability resulting from existing resource adequacy processes of MISO and PJM;
- Minimize impacts to existing market rules while improving the efficiency of cross-border capacity transactions;
- Respect the jurisdictional authority of each State within MISO and PJM regarding resource adequacy; and
- Ensure proposal would not lead to higher total capacity costs in MISO and PJM.

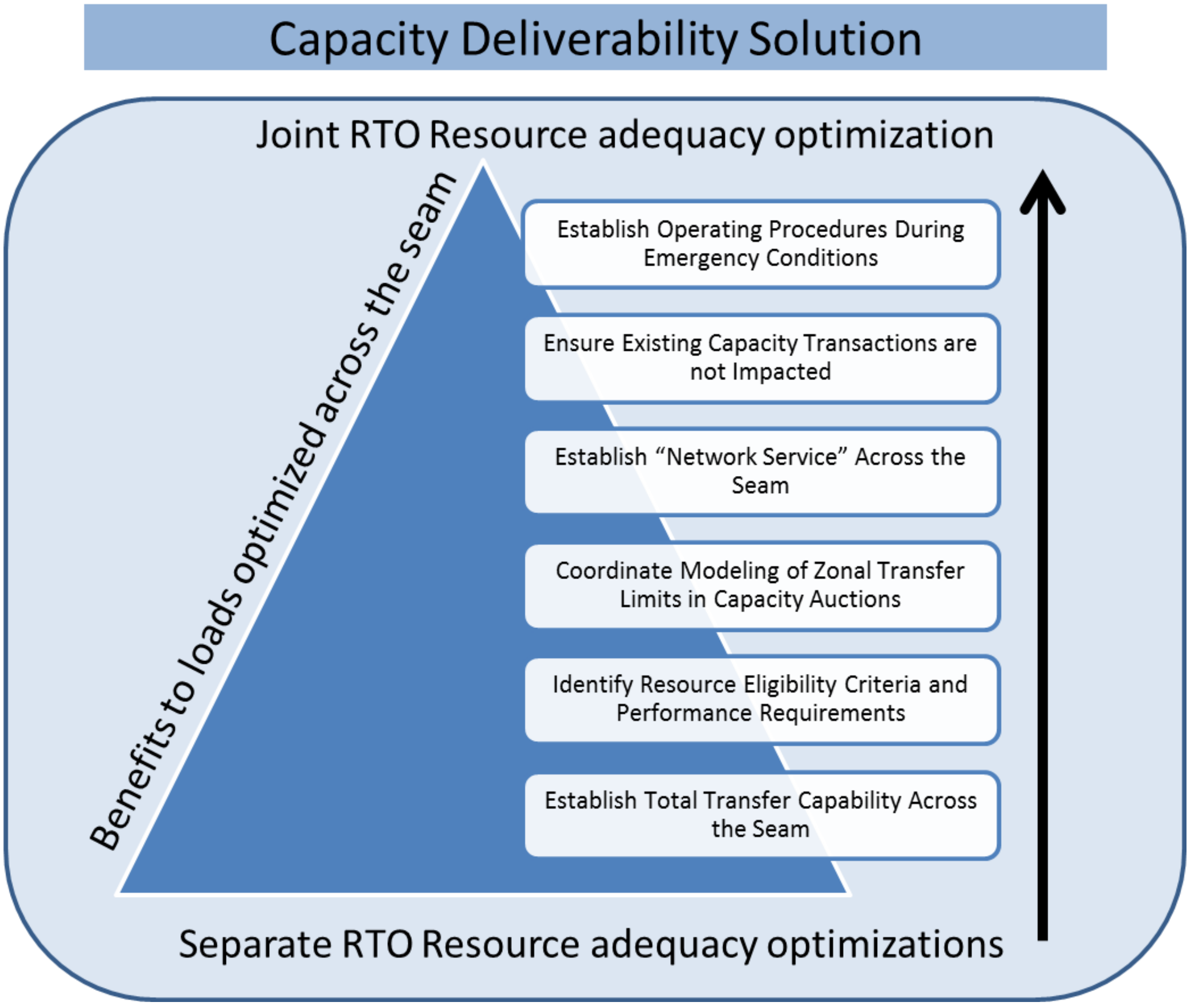
6. Solution Proposal

To enable loads in both RTOs to obtain efficient external capacity resources, the differential treatment in transmission service requirements for internal and external resources must be eliminated. This proposed solution will explore a methodology to evaluate transmission capability consistently across the MISO PJM seam and identifies the key design elements to be developed by MISO, PJM and stakeholders. This solution does not attempt to modify the existing processes for establishing Planning Reserve Margin or the Capacity Benefit Margin (transmission capacity reserved for short-term energy transactions and for achieving diversity benefits between systems).

The key issues and market design elements included in the proposal:

- Establish Total Transfer Capability Across the Seam
- Identify Resource Eligibility Criteria and Performance Requirements
- Establish "Network Service" like Transmission Product Across the Seam[6]
- Coordinate Modeling of Zonal Transfer Limits in Capacity Auctions
- Ensure Existing Capacity Transactions are not Impacted
- Establish Operating Procedures During Emergency Conditions

[6] This type of transmission service could be awarded up to the capacity transfer constraints modeled in the capacity auctions.



6.1 Establish Transfer Capability across the Seam

Establishing the transfer limit between the RTOs is a key foundational element to aligning capacity resource market participation and will be utilized as a constraint in the capacity market processes of both RTOs. This limit represents the maximum number of MW that one RTO could import from the other. To do so, both RTOs will work together through a joint study process to develop the transfer limits. The proposed joint study process would ensure both RTOs use the same assumptions about transfer capability between both RTOs.

While determining transfer limits two approaches are typically used – Simultaneous and Non-Simultaneous. Both of these approaches are described below.

Non-Simultaneous and Simultaneous Transfers[7]

Transfer capability can be determined by simulating transfers from one area to another independently and non-concurrently with other area transfers. These capabilities are referred to as "non-simultaneous" transfers. Another type of transfer capability reflects simultaneous or multiple transfers concurrently. These capabilities are developed in a manner similar to that used for non-simultaneous capability, except that the interdependency of transfers among the other areas is taken into account. These interdependent capabilities are referred to as "simultaneous" transfers. No simple relationship exists between non-simultaneous and simultaneous transfer capabilities. The simultaneous transfer capability may be lower than the sum of the individual non-simultaneous transfer capabilities.

MISO performed a preliminary study to determine simultaneous and non–simultaneous transfer limits. The analysis showed that up to 6,000 MW of simultaneous transfer capability exists between the RTOs[8]. Appendix A contains additional details regarding the study. When implementing any cross-border capacity market design enhancements, PJM and MISO would need to create mechanisms to ensure that simultaneous transfer capability is never violated.

6.2 Identify Resource Eligibility Criteria and Performance Requirements

With the transfer limit established, criteria must be established to identify performance requirements for each resource to ensure that it can continue to provide capacity after it was initially approved as an eligible resource. MISO proposes resource participation and qualification to be at individual generating unit level. Additionally the resource must be subject to the qualification and performance requirements of the RTO in which it has sold capacity, because it ultimately commits to providing capacity to that RTO.

6.2.1 Qualification of Resources

Generation resources offering capacity into either RTO would be subject to the qualification, measurement, and verification procedures of the RTO into which the offer is to be submitted, regardless of where the unit is physically located. The Independent Market Monitors for each RTO would be responsible for monitoring and mitigation activities for any resources offering into the respective capacity auctions.

6.2.2 Meeting Energy Market Must Offer Obligations

In both RTOs, a capacity resource has the obligation to make energy available to the energy market through a "Must Offer" requirement. To satisfy that obligation, market participants with capacity resources will make the required energy offers into the RTO where their capacity is

[7] From NERC ATC paper (http://www.westgov.org/wieb/wind/06-96NERCatc.pdf)
[8] MISO sponsored preliminary report by The Brattle Report.

committed. This can be accomplished by pseudo-tying the resource into the RTO where the capacity is committed or by offering energy schedules from the committed resources. This is consistent with the current must offer requirements in place. Market participants with external resource capacity commitments must manage additional risks related to congestion and clearing in two different energy markets. Future energy market coordination enhancements should be explored to reduce risk and provide additional hedging mechanisms.

6.3 Establish "Network Service" Across the Seam

A resource must have firm transmission service in order to qualify as a capacity resource. As described previously in Section 2.1, the use of NRIS and NITS within a RTO ensures full economic utilization of the transmission system. In addition to generators that have already made cross-border capacity commitments, generators with Network Resource Interconnection Service must be eligible to serve as a capacity resource for loads in both RTOs. This can be accomplished because both RTOs have LMP based markets and an established JOA that allows for cross border re-dispatch to solve transmission constraints in the operating horizon. As described in Section 6.2.2, a generator committed as a capacity resource has a "must offer" requirement to offer their generation into the market of the RTO where its capacity is committed, which will ensure that the generator is available to provide energy if needed. Section 5.1 described the joint process to establish the transfer capability limit between RTOs to be modeled as a constraint in their respective capacity auctions. Physical transmission constraints across the border would then be modeled in the auctions similarly to how each RTO already models its internal transmission constraints in the capacity markets. Together, these elements ensure that generation designated as capacity will be available to produce energy and that sufficient transfer capability exists on the system to deliver energy across the seam.

6.4 Auction Timing and Modeling of Locational Constraints

Currently, the RTOs have different processes and timelines for their capacity markets. The exchange of information related to transfer limits and resource qualification must be coordinated well so that the executions of both RTO's processes are not impacted. This information exchange will also ensure that resources are not double-counted for capacity credit in both RTOs.

6.4.1 Coordinating Capacity Auction Timing

PJM conducts four capacity market auctions for each planning year whereas MISO conducts one market auction as described in Table 1 below for the 2014-2015 planning year. A Base Residual Auction (BRA) is conducted three years prior to the planning year with subsequent Incremental Auctions (IA) conducted two years to three months prior to the planning year. MISO's one auction occurs two months prior to the planning year. The timing of the auctions requires that PJM's initial capacity auctions for a planning year include accurate Transfer Capability between the RTOs and the MW amount of capacity available from eligible resources. Likewise, MISO's capacity auction will need to reflect the Transfer Capability between the RTOs and the results of PJM's initial capacity auctions.

Additionally, PJM's capacity auctions recognize three different capacity resource types(1) Annual Capacity Resources which are comprised of generation resources, Energy Efficiency, and Annual Demand Response resources; (2) Extended Summer Demand Response resources; and (3) Limited Summer Demand Response resources. MISO's capacity auctions recognize only the equivalent to an Annual capacity product running from June-May through the delivery year. The only common, consistent product type is an Annual generation resource. Therefore, MISO proposes that only capacity resources that are available for an entire planning year be eligible for cross-border capacity commitments.

Table 1
Timing of PJM and MISO Capacity Auctions for Delivery Year 2014/15

Auction	PJM Auction Date	MISO Auction Date
Base Residual Auction	May 2011	--
1st Incremental Auction	Sep 2012	--
2nd Incremental Auction	Jul 2013	--
3rd Incremental Auction	Feb-Mar 2014	--
Planning Resource Auction	--	April 2014

6.4.2 Modelling of Locational Constraints

Section 5.1 above describes the joint study process to determine the transfer capability between the RTOs that should be modeled as zonal constraints. As recognized in Appendix A, MISO and PJM have additional sub zones that are modelled with Locational constraints. The transfer capability described in Section 5.1 refers only to the ability of a capacity resource in one RTO to deliver energy to the other, but does not address the constraint modeling practice for the sub-zones. For instance, should MISO model Locational constraints of PJM Local Deliverability Areas (LDA) if a resource within a constrained LDA offers into MISO's capacity auction? Two approaches have been identified.

The first approach would utilize only the Transfer capability between the RTOs as the only constraint to be considered of the external RTO. This is modeled in Figure 2 below wherein the external RTO would be modeled as a pool of generation resources with one constraint.

An alternative approach would require a RTO to consider constraints relative to sub zones inside an external RTO in addition to the transfer capability limit between the RTOs. This could be accomplished by discrete modeling of constraints consistent with each RTO's internal capacity market zones or LDAs. This is modeled in Figure 3 below.

Both of these proposed approaches have issues that should be considered related to allocation of transfer capability between the MISO and PJM capacity auctions. Due to the timing of the auction, PJM load would effectively have preference in use of the transfer capability between MISO generators and PJM load. The requirement for MISO load to meet resource adequacy requirements coupled with the ratio of total transfer limits compared to the total MISO capacity requirements limit this concern. However this dynamic should be considered when determining which external zones to model and the transfer limits enforced for such zones.

Appendix B contains additional, detailed discussion regarding the specific modeling of Locational constraints within a RTO.

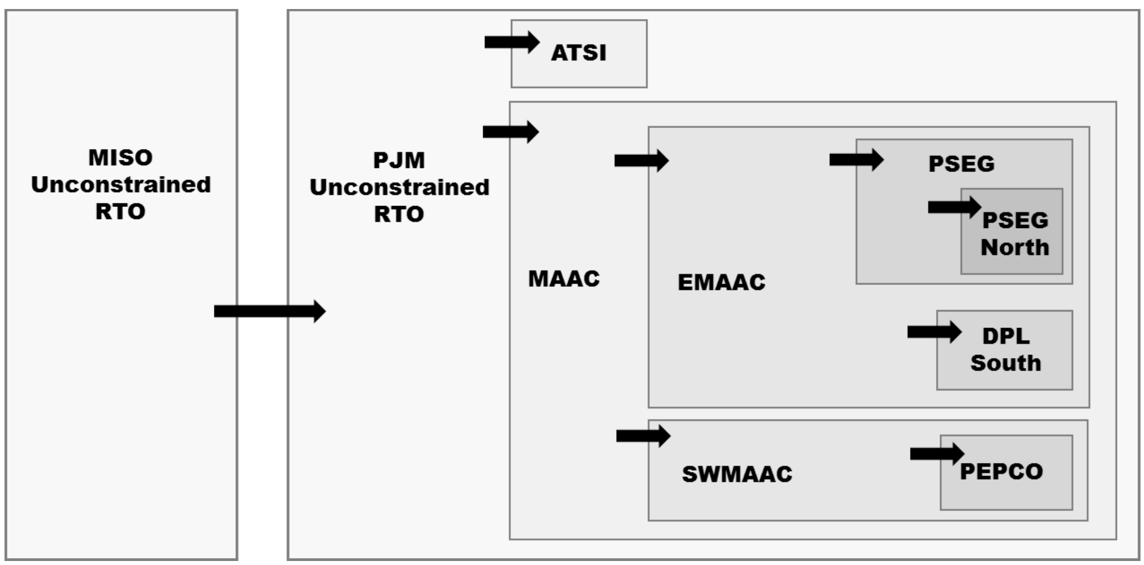


Figure 2: External RTO generation pooled together with one constraint

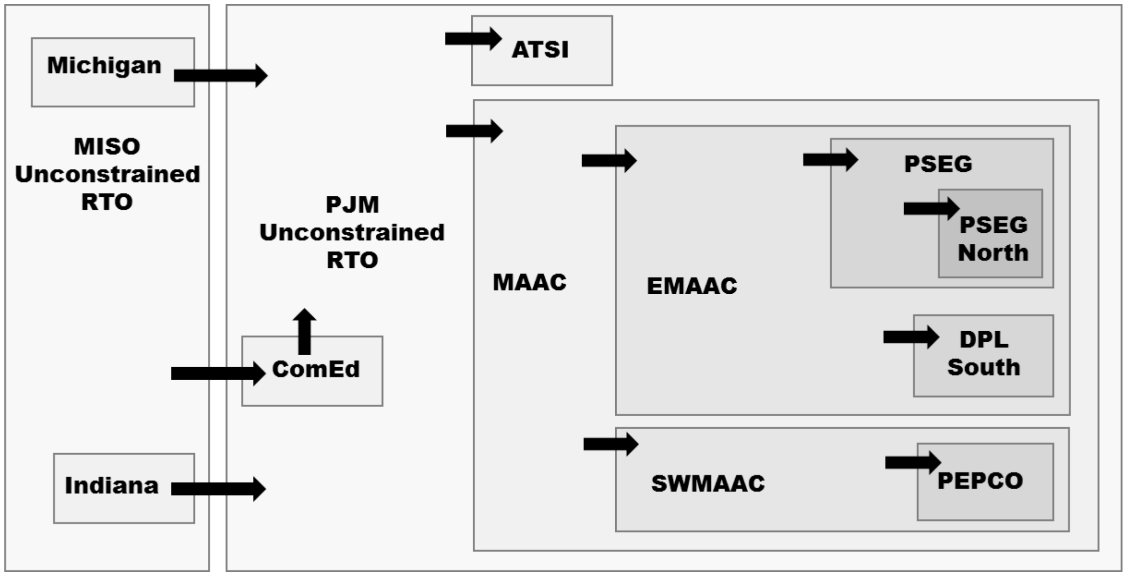


Figure 3: External RTO generation recognizing sub zone constraints

6.4.3 Treatment of Bilateral Capacity Transactions

The goal of this proposal is to not impact or restrict a market participant's ability to utilize bilateral transactions for capacity. These transactions would continue to be allowed by both markets through approaches similar or identical to those currently in place.

Bilateral capacity transactions between load and generation entities that occur across the PJM-MISO border prior to completion of the capacity auctions would be accounted for similarly to those transactions that occur internally in each system. Such bilateral transactions may occur in any direction and between any two LDAs or capacity zones, but would have to be executed as contracts for the difference between the contract price and the capacity clearing price at either the generator's host market clearing price or the LSE's host market clearing price. The overall import transactions would have to be scheduled through the PJM and MISO auctions as described above, with one of the two counterparties taking on the risk of price separation between the capacity zones.

6.4.4 Replacement Transactions for Committed Resources

Some capacity resources may wish to buy out of their capacity obligation after clearing in a PJM or MISO capacity auction. For example, this situation might arise if the supplier has an unexpected costly maintenance problem that would make it economic to retire a unit rather than reinvest in the unit to continue operating. Consistent with current practices, if a generator has made a cross-border capacity commitment to the other RTO, it is obligated to procure an alternative resource to fulfill its capacity obligation. If a generator opts to utilize a bilateral agreement instead of using the capacity auction, the alternative agreement should be made with another generator resource within the same zone (LDA in PJM or capacity zone in MISO) to maintain the integrity of the transfer limits modeled between the RTOs and/or zones.

6.5 Treatment of Existing Capacity Transactions

With the extension of Network Resource Integration Service across the seam, firm point-to-point transmission service reservations will no longer be required to procure capacity from either RTO. Holders of existing point-to-point transmission service for capacity transactions must not be materially harmed by this proposal. MISO proposes that these reservations, if used to support cross-border capacity sales, should be grandfathered and be compensated to be held harmless. This can be accomplished by utilizing financial Capacity Transfer Rights (CTR), a concept that is familiar to market participants in both RTOs. These CTRs would be awarded from the source zone of the generation asset that has previously made capacity commitments to the sink zone at which the unit would have realized its capacity payment. CTRs would be funded through the congestion rents generated in the relevant capacity auction. For example, a MISO capacity resource that had previously sold capacity into PJM's auctions using firm transmission rights would be awarded a CTR from its capacity zone to the load zone within the PJM capacity auction. This mechanism would make the entity financially whole. These CTRs could be allowed to roll over to subsequent years similarly to how long term firm transmission rights can be rolled over, but would be non-transferable and would expire if the unit retired or network service not maintained.

6.6 Operating Procedures during Emergency Conditions

As described above in Section 5.2.2, capacity resources have a "must offer" requirement because loads require the ability to call on those capacity resources during capacity emergencies. Both RTOs have emergency procedures for real time operations that describe how capacity resources will be called upon during a capacity event, including generators that are located in either RTO. MISO and PJM will work together to develop procedures for when and how each RTO can call upon capacity resources located inside the other RTO. These procedures should include a provision whereby both RTOs exchange information regarding the cross-border capacity commitments and have a mutual understanding of the net Unforced Capacity (UCAP) commitment between both RTOs. In the case of a simultaneous emergency in both RTOs, the RTO with a net UCAP commitment would be required to fulfill that commitment as if it had been exporting power under firm transmission rights as under current mechanisms.

7. Next Steps

MISO offers this whitepaper as a straw proposal to work with PJM and all stakeholders in the future to draft a final proposal that addresses the issues described herein. The JCM process provides a collaborative framework where Stakeholders of both RTOs can work together to resolve this issue. This proposal should be developed and implemented in time to bring increased efficiency for the annual capacity auctions conducted by MISO and PJM respectively in the spring of 2013.

MISO envisions that concepts described herein could be extended toward the modeling and evaluation of energy transactions between both RTOs.

Below are specific action items that will assist in moving this issue forward:

- Establish the framework for the JCM process
- Agree upon the specific planning year to target implementation
- Establish work product timeline, including any necessary filing dates with FERC

Appendix A: Preliminary Study for Transfer Capability between MISO and PJM

During the scope identification phase of this work effort, MISO staff analyzed transfer capability limits between MISO and PJM on both a simultaneous and a non-simultaneous basis. The simultaneous results produced a range of values between 5300 and 6300 MW. The non-simultaneous values are shown in Tables 2 and 3 below.

While the non-simultaneous values are not directly additive, reviewing the directional components and specific constraints led MISO staff to believe these are not contradictory with the simultaneous values. Actual numbers and methodologies will be discussed with PJM.

Table 2: MISO to PJM Non-Simultaneous Transfer Limits. Values in parentheses indicate new value if flowgate CBM is removed.

	PJM Locational Deliverability Areas			
MISO Capacity Zones	Unconstrained RTO	MAAC	MAAC, EMAAC, SWMAAC	EMAAC
1 - DPC, GRE, MDU, MP, NSP, OTP, SMP	3,028	2,516	2,546	2,385
2 - ALTE, MGE, UPPC, WE, WPS	284	286	286	286
3 - ALTW, MEC, MPW	2,579	2,338	2,344	2,344
4 - AMIL, CWLP, SIPC	39.2 (302)	42.3 (325)	42.5 (327)	42.5 (327)
5 - AMMO, CWLD	56 (431)	62 (481)	63 (486)	63 (486)
6 - BREC, DUK, HE, IPL, NIPSCO, SIGE	1,118	1,025	1,030	1,029
7 - CONS, DECO	3,147	683	718	724

Table 2 PJM to MISO Non-Simultaneous Transfer Limits. Values in parentheses indicate new value if CBM removed.

	PJM Locational Deliverability and Utility Service Areas			
MISO Capacity Zones	Unconstrained RTO	MAAC	MAAC, EMAAC, SWMAAC	EMAAC
1 - DPC, GRE, MDU, MP, NSP, OTP, SMP	0	0	0	0
2 - ALTE, MGE, UPPC, WE, WPS	0	0	0	0
3 - ALTW, MEC, MPW	0	0	0	0
4 - AMIL, CWLP, SIPC	6,709	0	0	0
5 - AMMO, CWLD	3,619	266	3,626	0
6 - BREC, DUK, HE, IPL, NIPSCO, SIGE	4,348 (4,622)	266	4,757	0
7 - CONS, DECO	4,756 (7,516)	266	4,403 (6,958)	0

Appendix B: Discrete Modeling of Locational Constraints within a RTO

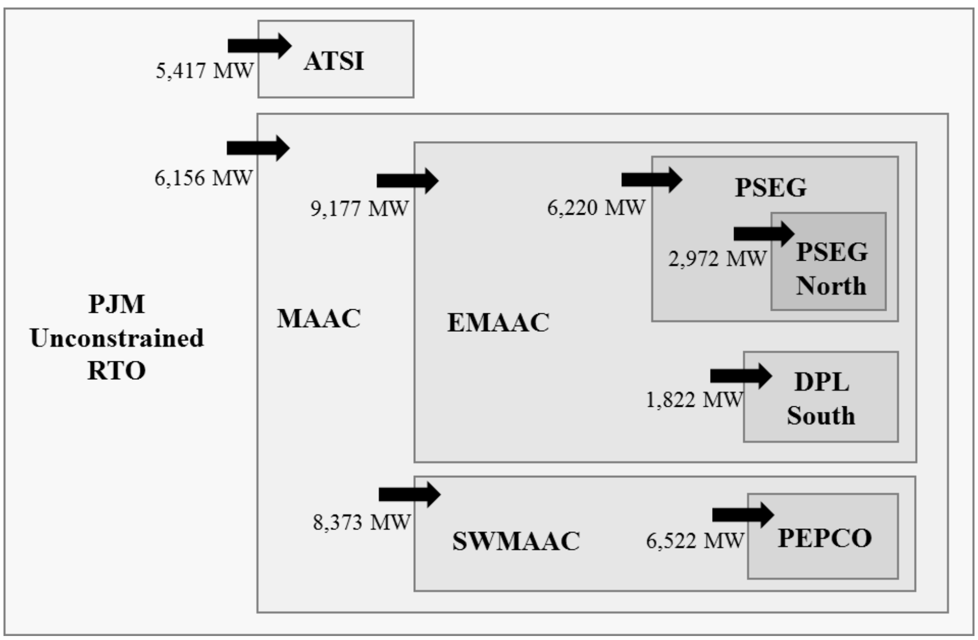
Incorporating MISO in PJM's Locational Deliverability Area Modeling

PJM's locational capacity market construct currently models 9 different Locational Deliverability Areas (LDAs). PJM imposes multiple constraints to ensure locational and system-wide resource adequacy as schematically as shown Figure 4. PJM procures sufficient capacity in each zone to meet the Variable Resource Requirement (VRR) curve from resources internal to that LDA or imported to that LDA. However, imports can only be accepted up to CETL, which is the maximum import limit for that LDA.

Figure 4

Schematic of Nested Locational Deliverability Areas and Transmission Zones in PJM

(Excluding MISO)

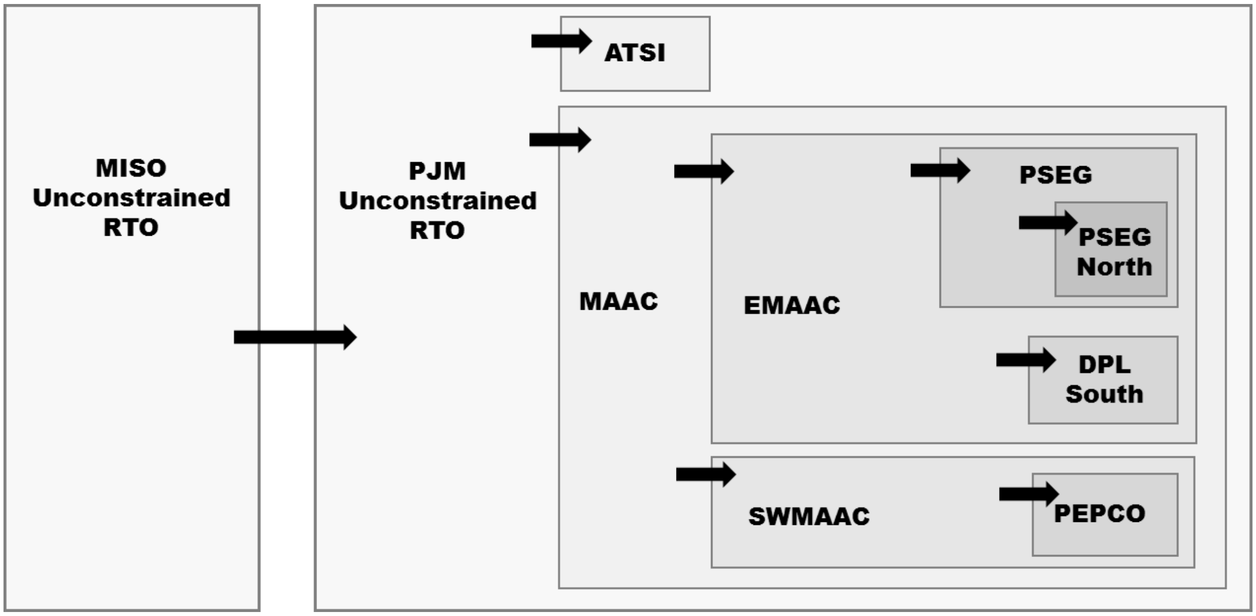


In order to model MISO supply in PJM's locational capacity construct, PJM would revise the LDA modeling approach to include MISO as an external capacity zone. Figure 5 shows one schematic approach for how these import constraints could be modeled with minimal changes to the current PJM construct for modeling nested LDAs.

Figure 5

Schematic of Nested Locational Deliverability Areas and Transmission Zones in PJM

(Modeling MISO in a Simple Structure)

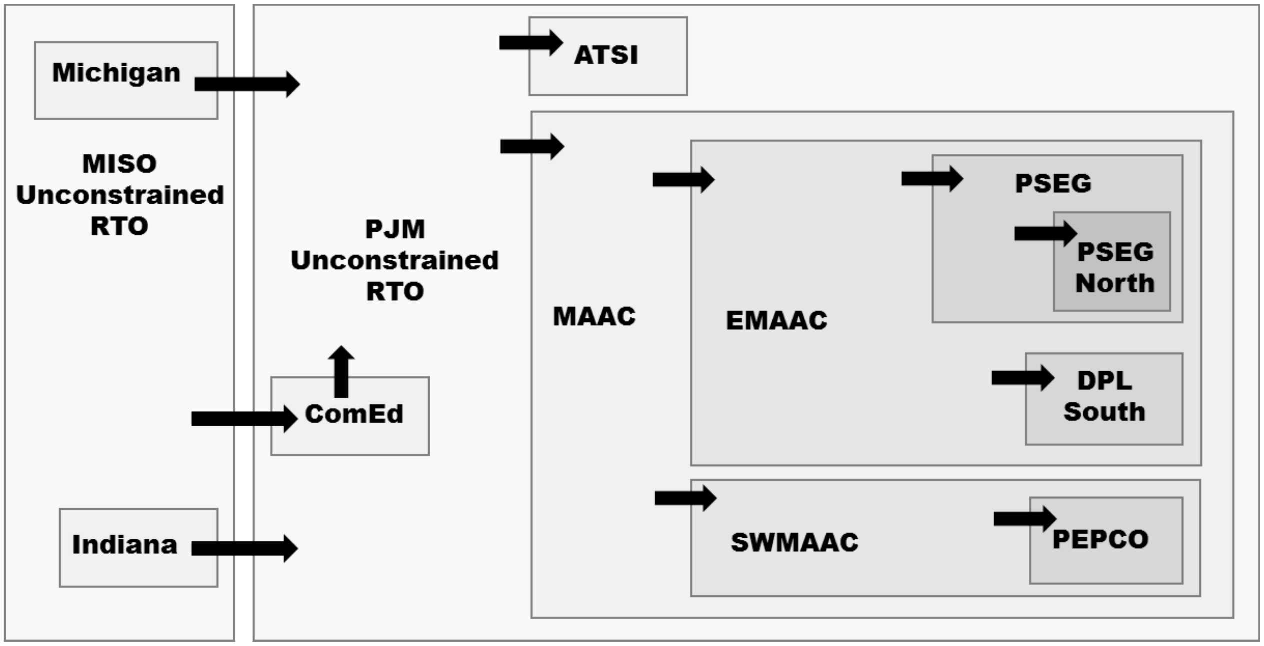


The figure above shows the inter-RTO transmission constraint as a single constraint between the "unconstrained RTO" portions of both RTOs, although the engineering staffs in each RTO may determine that it would be better to model the import constraint at a more granular level. For example, one RTO may wish to model the transfers as importing from a specific zone rather than from the unconstrained RTO. Overall, as long as both RTOs agree on the total capacity transfer capability at each interface, the specifics of how the RTO-internal zones are modeled could be determined independently by each system operator. An example of a slightly more complex modeling structure is found in Figure 6.

Figure 6

Schematic of Nested Locational Deliverability Areas and Transmission Zones in PJM

(Modeling MISO in a More Complex Structure)



Market clearing in PJM's capacity auctions would allow supply offers bids in the MISO capacity zones as follows:

Supply Offers in MISO Zones – Any generation resource physically located in MISO could submit a capacity supply offer in the MISO zone where it is physically located. Any supply offer cleared in the MISO zone in a PJM capacity auction will be obligated to fulfill a capacity commitment under PJM enforcement rules.

All capacity counter-flows would be netted in the auction clearing process between MISO and PJM. This would be accomplished in a manner identical to how PJM clears its own internal resources. The net capacity flows cleared in each previous auction, or self-committed through capacity export obligations to MISO, would be accounted for in each subsequent auction.

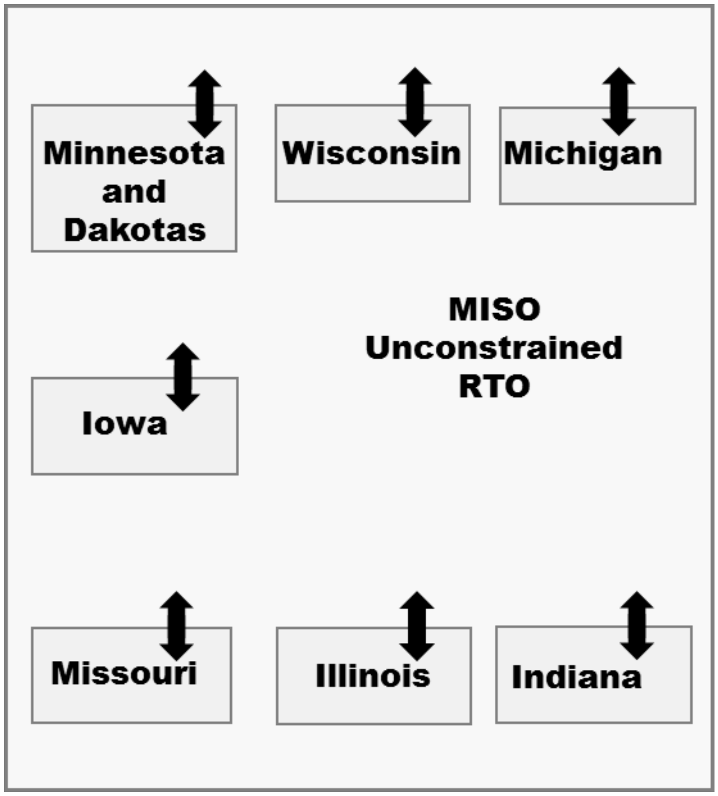
Incorporating PJM in MISO's Zonal Capacity Construct

The MISO locational construct will model 7 different capacity zones as shown schematically in Figure 7. MISO auctions impose multiple constraints to ensure locational and system-wide resource adequacy. The imposed constraints will include:

1. A System Reliability Requirement for the entire RTO,
2. A Locational Reliability Requirement in each Capacity Zone,

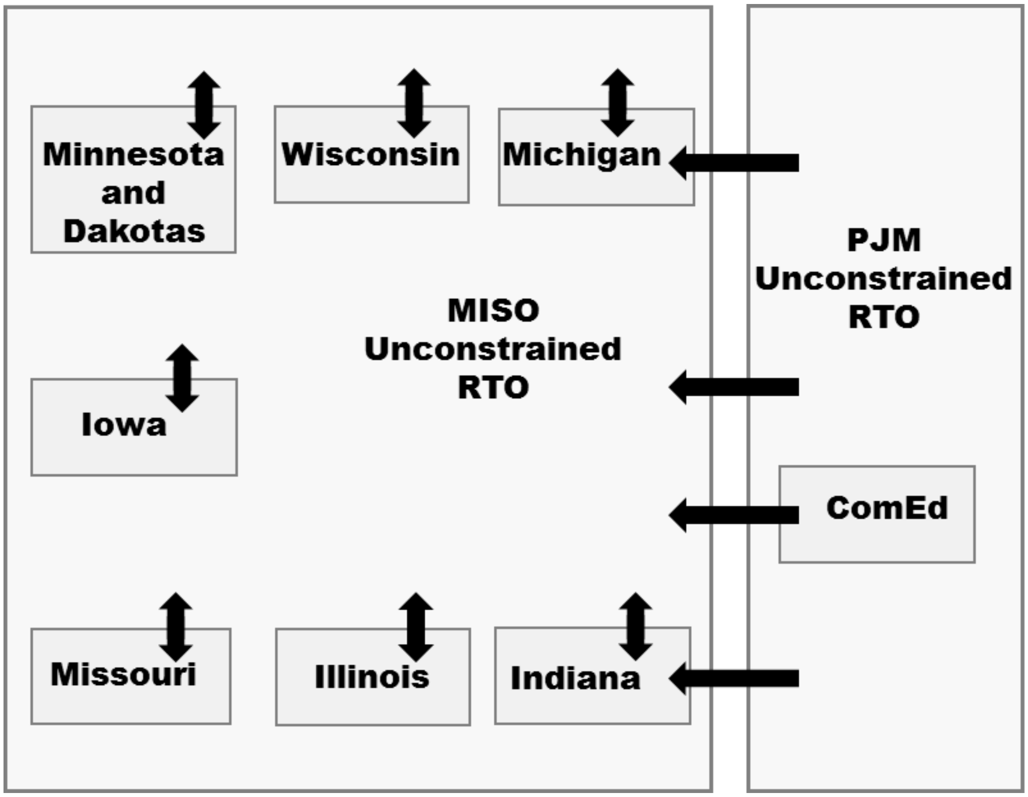
3. Capacity Import Limits for each Zone (modeled as all-to-one imports), and
4. Capacity Export Limits for each Zone (modeled as one-to-all exports).

Figure 7
MISO Proposed Capacity Zones
(Excluding PJM)



In order to model PJM supply in MISO's zonal capacity construct, MISO could revise the locational model to include PJM as an external capacity zone or zones. As discussed above, the interface between the two RTOs could be modeled simply as a single transmission constraint. Alternatively, the two RTOs could be modeled according to a more granular structure with multiple interface points as shown schematically in Figure 8. Note that the MISO modeling schematic presented below is also consistent with the PJM modeling schematic shown in 6 above. In both cases, as long as both RTOs respect the total capacity transfer capability at each interface point, the determination of how to model internal capacity zones could be independently decided by the two system operators.

Figure 8
Schematic of How MISO Capacity Zones Could Be Modeled
(Modeling PJM Consistent with Figure 6 Above)



Market clearing would allow supply offers and demand bids in the PJM capacity zones as follows:

Supply Offers in PJM Zones – Any generation resource physically located in PJM may submit a capacity supply offer in the PJM zone where it is physically located, which in the above schematic may be either: (1) ComEd, or (2) Rest of PJM. Any supply offer cleared in a MISO capacity auction would be obligated to fulfill a capacity commitment under MISO enforcement rules.

All capacity counterflows would be netted in the auction clearing process. Because all PJM capacity auctions would be conducted prior to the MISO PRA, the data necessary to fully account for capacity counterflows would be provided by PJM to MISO prior to the auction. These data would be used by MISO as follows:

Data Provided by PJM to MISO – PJM would provide data on all supply physically located in MISO that has been committed to supply capacity through a PJM-conduction auction or through a bilateral generator replacement transaction. PJM would also provide MISO with the net UCAP capacity flow obligation that has cleared across each market interface over the course of all PJM auctions. This number would represent net imports to PJM.

MISO Supply Cleared in PJM Auctions Treated as a Self-Schedule – All MISO generator offers that have cleared in a PJM auction would be pre-scheduled in the MISO PRA as a fixed self-schedule. This treatment would be similar to all other self-schedules submitted into the MISO PRA.[9]

Net UCAP Capacity Flow Obligation **–** MISO will begin the PRA by scheduling a fixed UCAP capacity flow over each MISO-PJM interface, consistent with PJM auction clearing results. This fixed flow obligation will be maintained as MISO clears its PRA and may preclude some additional sales in the prevailing-flow direction.

Examples of Generator Export Transactions

The following examples of export transactions across the seam illustrate how cross-border transactions would be implemented and accounted for in PJM and MISO auctions.

1. ***MISO Generator Exporting to PJM*** **–** The generator would submit a supply offer into the MISO zone in one of PJM's forward auctions. If the offer is accepted, the generator would be paid the PJM auction clearing price for the MISO capacity zone. The generator would have a capacity commitment to PJM and would be assessed performance credits or penalties according to PJM's rules.

   In the MISO PRA, the generator's supply commitment would be a self-scheduled supply bid that could affect MISO's PRA clearing results. If the generator happens to be in an export-constrained or import-constrained zone within the MISO PRA, then it will be subject to zonal deliverability charges (or credits) based on the price differential between its MISO capacity zone and the MISO system capacity price.

2. ***PJM Generator Exporting to MISO*** **–** The generator with available capacity (not committed to PJM load through any previous PJM auction) would submit a supply offer into the PJM zone in MISO's PRA. If the offer is accepted, the generator would be paid the MISO auction clearing price for the PJM capacity zone. The generator would have a capacity commitment to MISO and would be assessed performance credits or penalties according to MISO's rules.

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9 As with other self-schedules, these self-schedules may be subject to Zonal Deliverability Charges in the case that individual capacity zones price-separate.