

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

Potomac Economics, Ltd.

Complainant

v.

PJM Interconnection, LLC

Respondent

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Docket No. EL17-____-000

COMPLAINT OF POTOMAC ECONOMICS, LTD.

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Attachment I: Affidavit of Dr. Patton

Attachment II: MISO Pseudo-Tie Issue Paper

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COMPLAINT OF POTOMAC ECONOMICS, LTD.

Pursuant to Rule 206¹ of the Commission's Rules of Practice and Procedure and Sections 206 and 306 of the Federal Power Act ("FPA"),² Potomac Economics, Ltd. ("Potomac Economics") submits this Complaint against the PJM Interconnection, LLC ("PJM"). This Complaint asks that the Commission direct PJM to revise its Open Access Transmission Tariff ("OATT") and Reliability Assurance Agreement Among Load-Serving Entities in the PJM Region ("RAA") to eliminate the existing requirement that resources located external to PJM seeking to offer as Capacity Performance Resources in PJM be pseudo-tied into PJM.

For the reasons set forth in more detail below, and attested to in the attached affidavit of Dr. David B. Patton, Ph.D, PJM's pseudo-tie requirement has proven to be unjust, unreasonable, and unduly discriminatory. The pseudo-tie requirement has already imposed substantial economic and reliability costs on the Midcontinent Independent System Operator, Inc. ("MISO") that will only grow as pseudo-ties proliferate. The requirement threatens to impose even greater costs on the New York Independent System Operator, Inc. ("NYISO") if it is applied to New York generation. It has even caused difficulties within PJM that PJM itself has effectively acknowledged are unjust and unreasonable.

The Commission should therefore eliminate the pseudo-tie requirement and direct PJM to establish an alternative mechanism for addressing its underlying operational and reliability concerns. Potomac Economics presents an example of a viable alternative model for delivering external capacity to PJM, which would eliminate the need for external resource to pseudo-tie to PJM to meet PJM's capacity performance objectives.

¹ 18 C. F. R. § 385.206 (2016).

² 16 U.S.C. §824e and 825e

I. BACKGROUND

A. Origin of PJM's Pseudo-Tie Requirement for External Capacity Resources

Potomac Economics serves as the market monitor for MISO, NYISO and ISO New England. All of these RTOs operate capacity markets and accept imports from external capacity resources, and none of them require external resources to be pseudo-tied to their system. We are not aware of any concerns in any of these markets that external resources will not perform reliably and be delivered when the RTO needs the capacity. This is notable particularly for ISO New England, who employs capacity performance rules comparable to PJM's rules.

PJM stands alone in promoting the pseudo-tying of external capacity resources over the past few years in an attempt to ensure that it will receive the full value of the external capacity that it purchases through its Reliability Pricing Model ("RPM"). Before pseudo-ties were required, external capacity was delivered via standard import and export scheduling processes between PJM and its neighbors. To ensure that the external capacity, in aggregate, could be delivered to PJM when it needed it, PJM established Capacity Import Limits ("CILs") that capped the total quantity of external capacity that could be procured over each interface. However, PJM proposed pseudo-tying as one of three requirements necessary for a resource to be exempted from the CIL.³ Some of the intervenors in that proceeding, including PJM's Market Monitor argued that all external capacity resources should be required to pseudo-tie to PJM. In that proceeding, PJM disagreed with the intervenors and answered:

PJM states that, assuming acceptance of PJM's proposal, there are no adverse reliability impacts from not mandating that all external capacity resources seeking to offer into a capacity market auction must first obtain firm transmission, commit to a pseudo-tie, and agree to a must offer obligation. However, requiring these three conditions of all external resources could limit competition from external resources without providing any

³ See *PJM Interconnection, L.L.C.*, 147 FERC ¶ 61,060 (2014) ("CIL Order").

offsetting benefits, since the conditions are not needed to assure reliability, and they are not comparable to the treatment of internal resources.⁴

The Commission ultimately agreed with PJM, approving pseudo-tying as a means to be exempt from the CIL, but not requiring that all external capacity resources be pseudo-tied:

We reject the PJM Utilities Coalition and the PJM Market Monitor’s argument that the required three conditions to receive an exception (i.e., firm service, pseudo-tie, and must-offer) must be made mandatory for all resources. . . . In addition, we find reasonable PJM’s position that making these three conditions mandatory for all external resources would limit competition from external resources (by making it more difficult for them to qualify as capacity resources) without providing any offsetting benefits.⁵

Subsequently, in its 2015 filing proposing the current “capacity performance” construct, PJM asserted that external capacity resources needed to be pseudo-tied to the PJM system to allow PJM to enforce its capacity performance obligations. Therefore, PJM sought approval to add a requirement that all external capacity resources selling the capacity performance product be pseudo-tied to PJM.⁶ In its capacity performance filing, PJM argued that pseudo-tying was needed to:

- “...accurately determine whether an external capacity resource owner met its commitment to deliver energy to PJM from the specific resource committed as a Capacity Performance Resource.”⁷

⁴ CIL Order at P 46 (citing Response of PJM Interconnection, L.L.C. to Deficiency Letter, Docket No. ER14-503-000, filed February 20, 2014 (“Deficiency Letter Response”) at p. 4-5).

⁵ CIL Order at P 49.

⁶ In fact, the PJM tariff proposal approved in the CIL Order does not use the term “pseudo-tie.” Rather, it requires, in Section 5.14D.3 of Attachment DD of the PJM OATT, that any “external Generation Capacity Resource be “reasonably expected, by the relevant Delivery Year, to meet all applicable requirements to be treated as equivalent to PJM Region internal generation that is not subject to NERC tagging as an interchange transaction.”. Since the Commission’s approval of that language, this has been interpreted as a mandate that external Generating Capacity Resources be pseudo-tied to PJM because pseudo-tying is the only means currently available to satisfy these requirements. Additionally, the PJM Filing proposed revisions to the RAA to clarify that pseudo-tying is required. Therefore, our references in this complaint to the “Pseudo-Tie Requirement” refers to the requirements in Section 5.14D.3 of Attachment DD of the PJM OATT.

⁷ Response of PJM Interconnection, L.L.C. to Commission’s March 31, 2015 Information Request, Docket No. ER15-623-000, filed April 10, 2015 (“Deficiency Letter Response”), at 25.

- “...ensure that the performance assessment evaluations are completed accurately and that any Non- Performance Charges are applied correctly.”⁸ and
- ensure “that external resources are on equal footing with internal resources”⁹

In its Deficiency Letter Response in the capacity performance proceeding, PJM extended these arguments by asserting that absent a pseudo-tie arrangement, “PJM will not have the unit-specific visibility of external resource performance necessary to accurately apply Non-Performance Charges to external resources.”¹⁰ As we demonstrate later in this Complaint, PJM’s capacity performance obligations can be fully and comparably applied to external capacity resources with appropriate cooperative procedures in place between PJM and its neighbors.

Although there was very little evidence on the record in the capacity performance proceeding to support PJM’s assertions that pseudo-ties were necessary, there was also only limited evidence presented that pseudo-ties were harmful to the day-ahead and real-time markets of PJM and the other affected Regional Transmission Organizations (“RTOs”).¹¹ The Illinois Commerce Commission argued that the pseudo-tie requirement would exacerbate seams issues between PJM and adjacent regions, but the Commission rejected this concern on the ground that it had not been adequately supported:

...the Illinois Commission fails to specify what seams issues would be exacerbated or how such result would occur.¹²

⁸ *Id.*

⁹ Answer of PJM Interconnection, L.L.C., Docket No. ER15-623-000, filed February 13, 2015 at pg. 34.

¹⁰ *PJM Interconnection, L.L.C.*, 151 FERC ¶ 61,208 at P 97 (2015) (“CP Order”) (citing Deficiency Letter Response at 24-25).

¹¹ For convenience, this Complaint uses the term “RTO” to refer to both Regional Transmission Organizations, such as the MISO and PJM, and Independent System Operators, such as the NYISO.

¹² 151 FERC ¶ 61,208 at P 96.

However, the Commission did acknowledge that pseudo-ties could create or exacerbate seams issues between the markets, requiring that PJM work to develop agreements with external Balancing Authority Areas regarding:

...all implementation issues associated with a pseudo-tied resource, including reliability and commercial obligations, and that this process should minimize any resulting seams issues.¹³

Therefore, based on the record then existing in the capacity performance docket and its expectation that the neighboring systems could work together to address any potential concerns or seams issues, FERC ultimately found that pseudo-tie requirement in the capacity performance design to be just and reasonable.

Unfortunately, the record in the capacity performance proceeding did not reveal the substantial harm caused by pseudo-ties in regions where pseudo-tied resources are located, or include alternative means for PJM to enforce its capacity performance obligations without resorting to pseudo-ties. This Complaint remedies those shortcomings. It provides extensive evidence and analyses demonstrating the growing economic and operational concerns caused by the increasing numbers of pseudo-ties to PJM.

B. Even PJM Now Concedes that Widespread Pseudo-Tying Creates Problems

PJM's recent Section 205 filing in Docket No. ER17-1138 -000 ("PJM Filing") identifies a number of operational and efficiency concerns associated with the widespread use of pseudo-ties to facilitate the delivery of increasing quantities of external capacity resources. PJM argues that the changes proposed by the PJM Filing:

...provide reasonable solutions to several challenges that can arise (and have arisen) when loads in one Balancing Authority Area¹ rely for capacity on generation physically located in other Balancing Authority Areas that have different planning, operating, and market rules and practices...PJM has

¹³ *Id.*

identified specific modeling, congestion management, planning, and operational concerns with the current Pseudo-Tie rules...¹⁴

In fact, PJM concedes that these problems are so significant that they are leading (or will lead) to outcomes that are unjust and unreasonable:

Delaying a resolution of those concerns would not be just and reasonable; to the contrary, delay would simply perpetuate those concerns.¹⁵

This is tantamount to an admission that PJM's current rules, if not modified, are not just and reasonable because of the adverse effects of the pseudo-ties on PJM alone (which are the only problems described by the PJM Filing). As one should expect, however, the negative effects of pseudo-ties on PJM's neighbors are much greater because the neighboring RTOs lose dispatch control of resources whose power flows primarily occur over their transmission systems. Based on our analyses of the numerous pseudo-ties that have been implemented in MISO to date, we have identified substantial dispatch inefficiencies and operational concerns. These concerns and inefficiencies are discussed in detail in this Complaint. The identified concerns have the potential to be even larger in the NYISO area, which experiences more severe congestion, is subject to more local reliability issues than MISO, and where pseudo-tie implementation would be even more difficult due to the operation of a number of phase-angle regulators on the PJM/NYISO border.

The PJM Filing attempts to address the problems that pseudo-ties have caused in PJM by proposing to impose substantial new restrictions on pseudo tying, which effectively limit the ability of external suppliers to sell capacity in PJM.¹⁶ In fact, PJM has proposed at least six new

¹⁴ Tariff Filing of PJM Interconnection, L.L.C., Docket No. ER17-1138-000, filed March 9, 2017 ("2017 PJM Pseudo-Tie Filing"), at 1.

¹⁵ *Id.* at . 2.

¹⁶ *Id.* at . 12-21.

tests that would restrict the ability of external resources to pseudo-tie to PJM. Taken together, these restrictions would make it nearly impossible to secure approval from PJM to be pseudo-tied and, therefore, nearly impossible to export capacity to PJM. All the problems identified by Potomac Economics (and by PJM itself) associated with pseudo-ties, relate solely and specifically to pseudo-tying as the means to deliver external capacity. Importantly, none of these problems would exist under reasonable alternative approaches for delivering external capacity. Therefore, the restrictions proposed in the PJM Filing would not be necessary absent the growth in pseudo-ties caused by PJM's Capacity Performance rules that require external resources to be pseudo-tied.

We filed a protest in response to the PJM's Filing and made two primary points. First, the proposed restrictions are unjust and unreasonable because they will interfere with efficient capacity trading. Additionally, they are unduly discriminatory because they will erect uneconomic barriers that prevent external suppliers from selling into PJM. Second, because the true source of all the problems caused by pseudo-ties is the pseudo tying requirement in PJM's Tariff, we recommended that the Commission reject the proposed restrictions and, instead grant the relief sought by this Complaint.

II. ARGUMENT

A. PJM's Existing Pseudo-Tie Requirement Is Not Just and Reasonable

1. PJM's Pseudo-Tie Requirement Creates Substantial Inefficiencies in Neighboring RTO Regions that Cannot Possibly Be Justified Based on Benefits to PJM

PJM's pseudo-tie requirement is unjust and unreasonable, and should be eliminated by the Commission. PJM has asserted that it has a very broad right to impose requirements on external generators to ensure that their capacity can be delivered reliably and efficiently,¹⁷ but the PJM

¹⁷ See, e.g., *Protest of PJM Interconnection, L.L.C.*, Docket No. ER17-1061-000 at 2 (March 21, 2017) (Asserting that RTOs have "the right to make unilateral determinations and take action without the consent of a neighboring Balancing Authority with respect to pseudo-tied resources for

pseudo-tie practices exceed all reasonable bounds. The standard for evaluating the justness and reasonableness of a practice must consider the relative benefits and burdens that it imposes.¹⁸ A tariff proposal that imposes substantial burdens on one or more entities that are not clearly outweighed by offsetting benefits to others cannot be just and reasonable.¹⁹

In the context of RTO practices, particularly those involving PJM and MISO, this evaluation of benefits and burdens must be further assessed in the context of the significant impacts that they can have on one another. Indeed, the Commission has consistently recognized that PJM and MISO do not operate in isolation and that the justness and reasonableness of their practices must be evaluated based, in large measure, on the impacts that those practices have on each other.²⁰ Indeed, MISO's and PJM's compliance with the RTO requirements of Order No. 2000 was expressly conditioned upon them working together to eliminate seams and administer well-functioning markets.^{21,22} Thus, the fact that many of the entities that bear the negative

any number of matters, including but not limited to data requirements, transmission service requirements, market participation, settlement data specifications, notifications, and penalties.”) In that same filing, however, PJM also asserted that MISO was obligated to coordinate with it on various matters where interregional coordination was necessary to compliance with NERC Reliability Standards.

¹⁸ See, e.g., *Illinois Commerce Commission v. FERC*, 576 F.3d 470, 476 (7th Cir. 2009) (“we evaluate compliance with this unremarkable [just and reasonable] principle by comparing the costs assessed against a party to the burdens imposed or benefits drawn by that party.”).

¹⁹ *Id.* (In a circumstance in which the costs imposed by a practice substantially exceed its benefits, “the disparity between benefits and cost would be unreasonable.”)

²⁰ See *Northern Indiana Public Service Company v. Midcontinent Independent System Operator, Inc., et al.*, 155 FERC ¶ 61,058 at PP 141-43 (2016) (finding existing planning practices by PJM and MISO to be unjust and unreasonable, and ordering those practices to be modified to require closer coordination between the two RTOs).

²¹ *Regional Transmission Organizations*, Order No. 2000, FERC Stats. & Regs. ¶ 31,089 (1999), *order on reh’g*, Order No. 2000-A, FERC Stats. & Regs. ¶ 31,092 (2000), *aff’d sub nom. Pub. Util. Dist. No. 1 of Snohomish County, Washington v. FERC*, 272 F.3d 607 (D.C. Cir. 2001).

²² See, e.g., *Midwest Independent Transmission System Operator, Inc.*, 152 FERC ¶ 61,213 at 3 (2015) (“[T]he Commission found that those Regional Transmission Organization (RTO) choices would result in an elongated and highly irregular seam between MISO and PJM that would

consequences of PJM's requirements are located outside of its geographic footprint in no way diminishes the unjustness and unreasonableness of either the consequences or the requirements.

The CIL Order implicitly applied a balancing test that was interregional in scope to determine the justness and reasonableness of PJM's proposal in that proceeding when FERC concluded, based on the evidence then before it, that requiring all external resources to be pseudo-tied would make "it more difficult for them to qualify as capacity resources . . . without providing any offsetting benefits."²³ The CP Order in 2015 did the same.²⁴ There was scant evidence in the record in that proceeding of the harm that pseudo-ties would cause to PJM and neighboring markets or that they would exacerbate interregional seams. Accordingly, the Commission accepted the imposition of the pseudo-tie requirement in the belief that any potential harms would be ameliorated by collaborative efforts between PJM and its neighbors.²⁵

By contrast, this Complaint demonstrates, based on the body of evidence that has accumulated since the CP Order including new analyses by Potomac Economics, that PJM's pseudo-tie requirement is unjust and unreasonable. The requirement imposes costs, in both economic and reliability terms, that far exceed its benefits. As discussed in Sections II.B and C, pseudo-ties are proliferating in number due to the requirement that external generators pseudo-tie

"island" portions of MISO (Wisconsin and Michigan) from the remainder of MISO and would divide highly interconnected transmission systems across which substantial trade takes place. The Commission found that, without mitigation, the seam would subject a large number of transactions in the region to continued rate pancaking, impeding the goals of Order No. 2000. Therefore, as a condition of accepting those RTO choices, the Commission required parties in the region to address the problem of rate pancaking across the MISO-PJM seam.")

²³ CIL Order at P 49.

²⁴ *See supra* n .12.

²⁵ *See* 151 FERC ¶ 61,208 at P 96 ("We note that PJM is required to reach agreement with external Balancing Authorities regarding all implementation issues associated with a pseudo-tied resource, including reliability and commercial obligations, and that this process should minimize any resulting seams issues.").

if they wish to become eligible to be Capacity Performance Resources in PJM. This rapid proliferation is decreasing efficiency, raising costs, and degrading reliability. Sections II.B.1 and 2 explain how pseudo-ties are implemented and their potential to create harmful impacts. Sections II.C.1 and 2 establish that pseudo-ties are already causing serious harm within MISO, which MISO itself has warned of, and that this harm will grow worse as the number of pseudo-ties increases. Section II.C.3 highlights the even greater harm that pseudo-ties threaten to impose on NYISO, noting the serious concerns that the NYISO itself raised about them in a recent filing. Section II.C.4 describes the harm that pseudo-ties have caused within PJM which, although less than the harm caused in MISO (and potentially to be caused in NYISO) is nonetheless substantial. Taken together, the costs far exceed the benefits that pseudo-tie arrangements confer upon PJM.

Finally, Section II.D explains that there is no reason for the Commission to accept the cost-benefit imbalances associated with PJM's pseudo-tie requirements because alternative mechanisms exist that would satisfy PJM's legitimate needs, and treat both external and internal resources comparably, without imposing unjustifiable hardships on neighboring systems. Potomac Economics is not proposing that the Commission compel PJM to adopt any specific alternative mechanism at this time. However, Section II.D of this Complaint describes a potential alternative both to demonstrate that viable alternatives exist and as a potential starting point for future PJM stakeholder discussions to develop an alternative.²⁶ This alternative was developed in collaboration with MISO staff and discussed with PJM and the stakeholders of both RTOs.

²⁶ Courts have clearly held that complainants in Commission proceedings are obligated to demonstrate that existing tariff requirements are unjust and unreasonable but do not bear the "dual burden" of establishing replacement tariff provisions that are just and reasonable. *See. e.g., FirstEnergy Servs. Co. v. FERC*, 758 F.3d 346, 353 (D.C. Cir. 2014) ("[I]t is only FERC who is required to shoulder the 'dual burden' [of showing the existing tariff to be unjust and unreasonable and demonstrating a just and reasonable replacement] when it institutes a section 206 proceeding.") *Md. Pub. Serv. Comm'n v. FERC*, 632 F.3d 1283, 1285 n.1 (D.C. Cir. 2011) ("It is the Commission's job—not the petitioner's—to find a just and reasonable rate.").

2. PJM's Proposed Solution to Impose Additional Economic Barriers to Capacity Imports is also Unjust and Unreasonable

As described below, the PJM Filing identified many operational and efficiency concerns associated with the widespread use of pseudo-ties to facilitate the delivery of increasing quantities of external capacity resources. To address the problems that are caused by pseudo-ties, PJM has proposed a number of new restrictions on external resources wishing to pseudo-tie to PJM. The following are a list of the six new restrictions on pseudo-tying:

1. *Electrical Distance Requirement.* A Pseudo-Tie can be established for any external resource that either: a) has a minimum Electrical Distance impedance equal to or less than 0.065; or b) is within one station of a transmission bus that has a minimum Electrical Distance impedance equal to or less than 0.065.
2. *M2M Flowgate Test.* If a proposed Pseudo-Tie would require PJM to add a coordinated flowgate, at least one PJM internal generator must have a flow impact of 1.5 percent on that flowgate, or the external resource will be excluded from the RPM Auction.
3. *Model Consistency Requirement.* PJM proposes that PJM and MISO must maintain network models that produce results for such flowgates that are within two percent of one another.
4. *Tagging Assurances.* A Capacity Market Seller seeking a Pseudo- Tie must secure written acknowledgement from the external Balancing Authority Areas that the Pseudo-Tie does not require tagging.
5. *Firm Flow Allocation.* The seller also must obtain acknowledgement that firm allocations associated with any coordinated flowgates applicable to the external generator under an agreed congestion management process will be allocated to PJM.
6. *Transmission Service Requirement.* PJM also proposes to require a seller of capacity to arrange for long-term firm point-to-point transmission service that must be evaluated for deliverability from the unit-specific physical location of the resource to PJM load, and be evaluated in accordance with PJM deliverability criteria. The study must also be reviewed and approved by PJM.

In proposing these restrictions, PJM provides no evidence or explanation that would justify most of its proposed restrictions including its array of arbitrary parameters included in these restrictions. Our protest of the PJM Filing discussed the key proposed restrictions that we anticipate would make it impossible for any supplier in MISO that does not currently have a unit pseudo-tied to PJM to meet these requirements to offer capacity in the RPM forward auctions.

Further, PJM simply asserts that these tests and the parameters it will use are just and reasonable. PJM provided scant support for any of the proposed tests and specific parameters that would be applied to pseudo-ties to restrict inter-RTO capacity trading. Additionally, our evaluation of these proposals demonstrated affirmatively that they would lead to unjust and unreasonable capacity market outcomes. To understand why the restrictions will lead to unjust and unreasonable capacity market outcomes, one must first understand that interregional capacity transactions are necessary to achieve efficient capacity market outcomes.

When surplus capacity exists in a neighboring RTO region or entry costs (*i.e.*, costs of building a new resource) are substantially lower, it is efficient to import capacity from the adjacent region. Absent interregional capacity transactions, an RTO can set inflated capacity prices to motivate investment in new resources. Such prices would not be based on the interplay of competitive market forces and thus would be unjust and unreasonable, if the RTO could satisfy its planning requirements by importing capacity at a much lower cost. Excluding even a share of the external capacity that is currently import into PJM could result in sizable and uncertain capacity price increases.

In recent years, PJM has cleared between 3900 and 4700 MW of external capacity resources. In his affidavit, attached to this Complaint as Attachment I, Dr. Patton estimates the potential price effects and resulting capacity cost increase that would result if the supply of

external capacity to the PJM capacity market were reduced by 3000 MW.²⁷ Dr. Patton shows that the price effects and costs increases are likely to be highly variable, with the price effects ranging from \$10 per MW-day and the capacity cost increases to PJM's customers ranging from \$0.5 to \$4 billion annually. Further, Dr. Patton explains why, in the longer-run, the inflation in capacity costs are likely to be at the higher end of this range.

An evaluation of the PJM Filing's proposals clearly indicates that they would severely limit new and existing pseudo-ties and, in doing so, would effectively eliminate capacity imports. While this may address some of the substantial problems caused by the pseudo-ties, it would lead to inefficient inflation of prices and costs in the PJM capacity market that are not just and reasonable. In addition, these proposed restrictions unduly discriminate against external resources. In essence, PJM proposes restrictions that would lead to unjust and unreasonable capacity market outcomes in order to address unjust and unreasonable outcomes in the RTOs' energy markets caused by pseudo-ties (by undermining optimal dispatch). Unfortunately, good competitive electricity market design is not an area where two wrongs make a right. Therefore, the Commission should not look to PJM's proposals in Docket No. ER17-1138-000 as a potential remedy to the issues presented by this Complaint.

B. The Rapid Growth in Pseudo-ties is Decreasing Efficiency, Raising Costs, and Degrading Reliability

One of the primary benefits of locational marginal pricing ("LMP") in energy markets is the ability to efficiently and reliably manage network congestion through the commitment and dispatch processes. This is achieved because the RTO can optimize the output of each resource that affects the flow over a transmission constraint positively or negatively. Not only does this

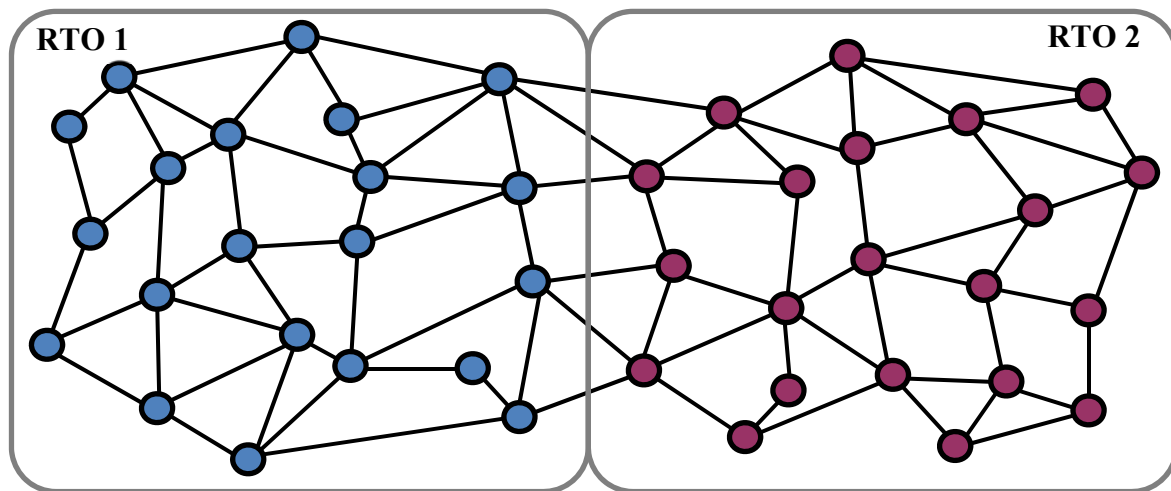
²⁷ See Patton Affidavit at 11-13.

reduce costs for an RTO's customers, it also ensures system reliability. Pseudo-ties are fundamentally inconsistent with this foundational principle underlying competitive electricity markets, which we describe in detail in this section.

1. Dispatch and Market-to-Market Coordination with no Pseudo-Ties

To understand why pseudo-ties are so damaging economically and operationally, it is instructive to first describe the interaction between two RTOs without any pseudo-ties. Figure 1 shows two RTO systems with a well-defined seam in which the blue generators located to the left are interconnected to the transmission system operated by RTO 1 and are committed and dispatched through RTO 1's markets. Likewise, the maroon generators located to the right in the figure are committed and dispatched by RTO 2.

Figure 1: Typical RTO Configuration Without Pseudo-Ties



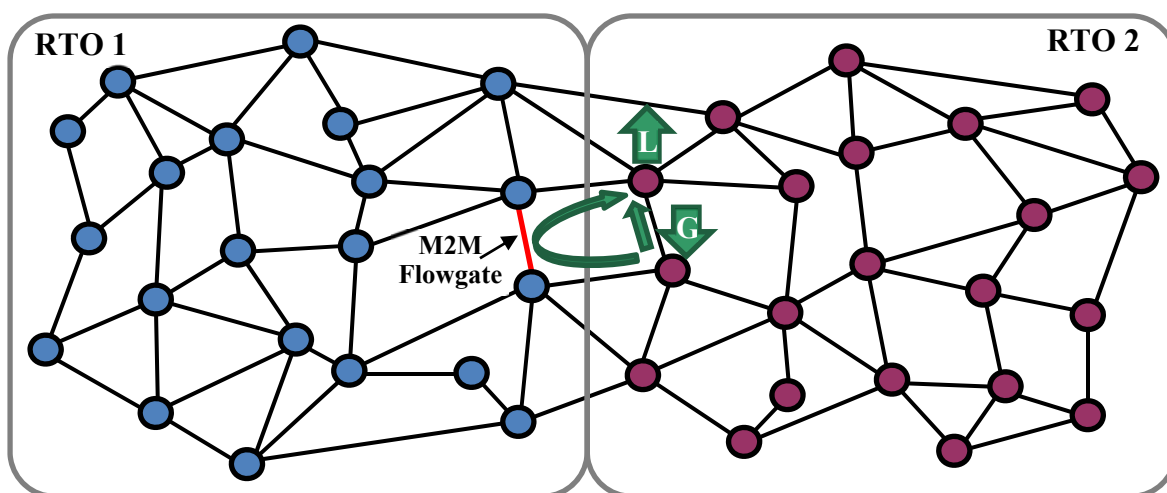
Each of these RTOs has the dispatch control of virtually all the generators that affect the power flows over the transmission facilities on its own network. Therefore, the RTOs are able to optimize the commitment and dispatch of their resources through their day-ahead and real-time markets. Through this market optimization, they produced energy LMPs at each location used to pay generators to produce electricity and charge load for consuming it. These LMPs represent the

true marginal cost of producing and consuming electricity at each location and are, therefore, just and reasonable provided the markets are competitive (not subject to the exercise of market power or manipulation).

Even though this configuration is well-defined and the “seams” issues may appear to be minimal, because these RTOs operate on the same interconnected network, their generation and load will still produce flows on each other’s system. These “loop flows” caused by the RTO dispatch are the reason why market-to-market coordination is essential. Market-to-market coordination, although far from perfect, allows the two RTO’s to coordinate their energy market dispatch to jointly manage constraints that both substantially affect.

Figure 2 shows how the dispatch of generation by RTO 2 to serve its load can result in power flowing over a constraint on the RTO 1 system that causes the constraint to be coordinated as a market to market constraint. The commitment and dispatch of generation is only slightly modified in Figure 2 because RTO 2’s markets will now recognize the effects of its dispatch on the market to market flowgate and these effects will, therefore, be included in RTO 2’s LMPs.

Figure 2: Market to Market Coordination Without Pseudo-Ties



Unfortunately, the configuration of MISO and PJM are not as neat and logical as depicted in these figures. If it were, a relatively small number of constraints would need to be coordinated under the market to market processes. Nonetheless, these figures provide a good starting point to understand the damaging effects of pseudo-ties.

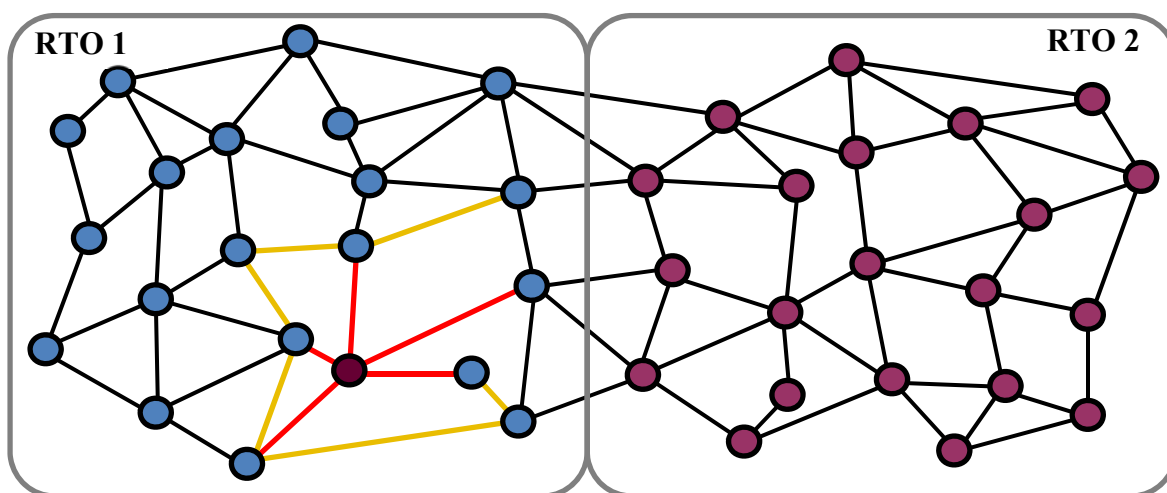
2. Description of the Effects of Pseudo-Tie Arrangements

Pseudo-tying transfers the dispatch control from the host RTO (MISO in this case) to the attaining RTO (PJM).²⁸ Historically pseudo-tying was used predominately to serve load located in a neighboring control area and essentially served to simplify the real-time accounting of load-serving obligations. Pseudo-tying of generating resources was relatively rare and generally limited to the dispatch of jointly-owned units with owners in different control areas. In contrast, the rapid increase in pseudo-tying of generating resources that has resulted from PJM's capacity performance rules is a new phenomenon in the Eastern Interconnect. Of the more than 2 GW of resources in MISO that are pseudo-tied to PJM, nearly all of it began after PJM required it.

Figure 3 illustrates the effects of pseudo-ties by showing two adjacent RTOs where one unit in RTO 1's control area is dispatched by RTO 2. This figure illustrates why just one unit pseudo-tied from RTO 1 to RTO 2, can create a host of new market-to-market constraints, which are depicted by the red lines in Figure 3. These red transmission constraints are those that are substantially affected by this unit and that must now be coordinated between the RTOs as market-to-market constraints.

²⁸ The PJM Filing stated at 9 that pseudo-tying “electrically moves a generator from its Native Balancing Authority Area to PJM’s Balancing Authority moving them electrically from one area to another” but this is substantively not true. Pseudo-tying does not change the physical system or the flow impacts of the unit on transmission system, or deliverability of a unit.

Figure 3: Market to Market Coordination with One Pseudo-Tied Unit



The congestion management of these new market-to-market constraints will be less efficient than if RTO 1 could optimally dispatch this unit. Under market-to-market coordination, PJM's dispatch of the unit will be reactive based on constraint information from MISO and neither RTO can optimize the commitment and dispatch of their units prospectively. MISO will not know the output of the unit in advance (or even whether it will be online when MISO runs its day-ahead market). Likewise, PJM will always be responding to the MISO's congestion on these constraints with a lag of up to 20 to 25 minutes from when the congestion first occurs to when the unit finishes moving in response to PJM's dispatch signals.²⁹

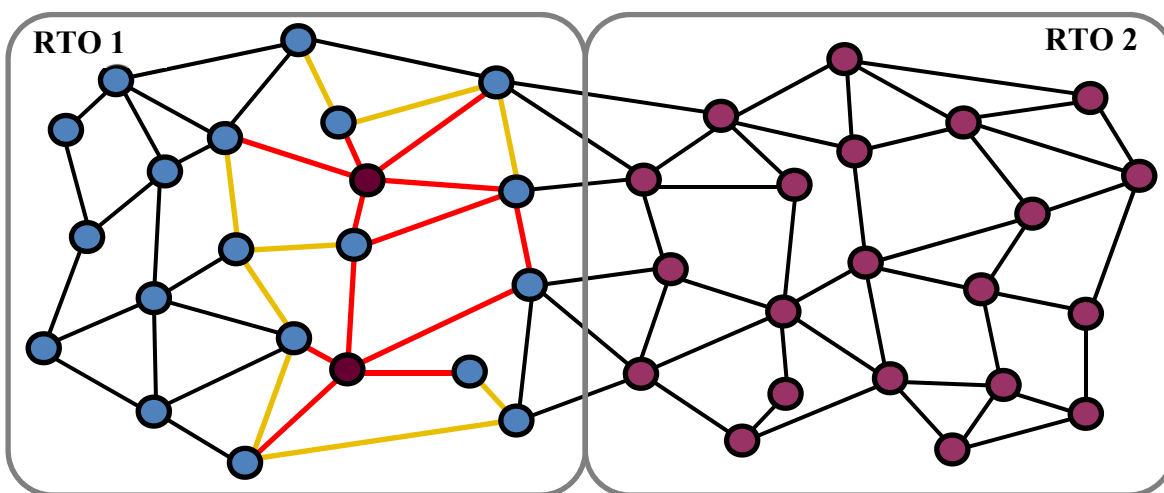
It is important to recognize that the pseudo-tied unit's effects on RTO 1's constraints are not limited to these new market-to-market constraints. It will also affect many other constraints that do not pass the tests to be coordinated under the market-to-market procedures. These other constraints that are adversely affected by the pseudo-tied resource are depicted in yellow in the

²⁹ This lag causes substantial inefficiencies, but can also raise reliability concerns for constraints that will remain in violation until the pseudo-tied unit moves to provide relief.

figure. Because they are not coordinated, these constraints can result in even larger inefficiencies even though the pseudo-tied unit's flow impacts on them are smaller.

These dispatch inefficiencies and reliability concerns grow dramatically as the number of pseudo-tied units increase. Figure 4 shows how the network illustration changes as more than one unit is pseudo-tied from RTO 1's system to RTO 2.

Figure 4: Market to Market Coordination with Multiple Pseudo-Tied Units



This figure illustrates how a relatively small number of pseudo-ties can lead to severe coordination problems. The PJM Filing indicated the twelve units that pseudo-tied to PJM in 2016 have resulted in 114 new market-to-market constraints on the MISO system. As of June 1, 2017 when an additional tranche of resources will be exporting capacity to PJM. By applying the market-to-market tests to the constraints that were binding in 2016, we estimate that the additional units will prompt the definition of another 100 new market-to-market constraints of all these capacity resources are pseudo-tied to PJM. This will bring the total number of new market-to-market constraint caused by the new pseudo-ties to more than 200. This is roughly double the number of market-to-market constraints that would need to be coordinated absent the pseudo-ties.

3. Market-to-Market Coordination Does Not Remedy the Pseudo-Tie Concerns

There is a limit to the number of constraints that market-to-market coordination mechanisms can efficiently handle. Large numbers of such constraints create process and modelling issues that are difficult to manage. For example, we believe that it would not be possible for PJM to model the current market-to-market constraints in its day-ahead market and to have the day-ahead model solve in a reasonable amount of time. This problem likely exists today even before the June 2017 pseudo-ties begin that could add more than 100 additional new market-to-market constraints. An excessive number of market-to-market constraints binding in the real-time market can also make it extremely difficult to manage congestion efficiently, particularly if the constraints are interrelated.

However, even if the RTOs could handle this quantity of market-to-market constraints, it is important to recognize that while market-to-market coordination may ameliorate it cannot remedy the problems created by pseudo-tying external resources. Delays and gaps in market-to-market procedures unavoidably limit their ability to resolve the efficiency and reliability concerns created by pseudo-tying. Market-to-market coordination was conceived as a workable way of managing the seam where resources in one RTO area can affect flows on the neighboring RTO's transmission system. The market-to-market process allows an RTO to obtain cost-effective relief when available and feasible from the neighboring RTO. However, this is not a substitute for dispatch control. Normally, an RTO uses the most current data on generation levels and system flows to optimize the dispatch of all its resources over the next 5 to 10 minutes.

However, under the market-to-market process, the host RTO's partially optimized dispatch solution (the pseudo-tied units are not optimized) results in congestion, which is conveyed to the neighboring RTO that is responsible for dispatching the pseudo-tied unit. The neighboring RTO

then uses this information to produce a dispatch solution that includes dispatch instructions for the pseudo-tied unit over the following 5 to 10 minutes. Hence, this process results in the pseudo-tied unit actually moving to relieve the constraint more than 20 minutes after the host RTO measures the flows on the constraint. This timeframe does not include the time required to activate the coordination process, which can add an additional 10 minutes or more. By the time the pseudo-tied unit moves, its relief may no longer be required or substantially more relief from the unit may be economic. As the IMM for MISO, we have observed that such outcomes are common. Hence, these lags in the market-to-market process make it impossible for the RTOs to achieve truly efficient and optimal real-time market outcomes.

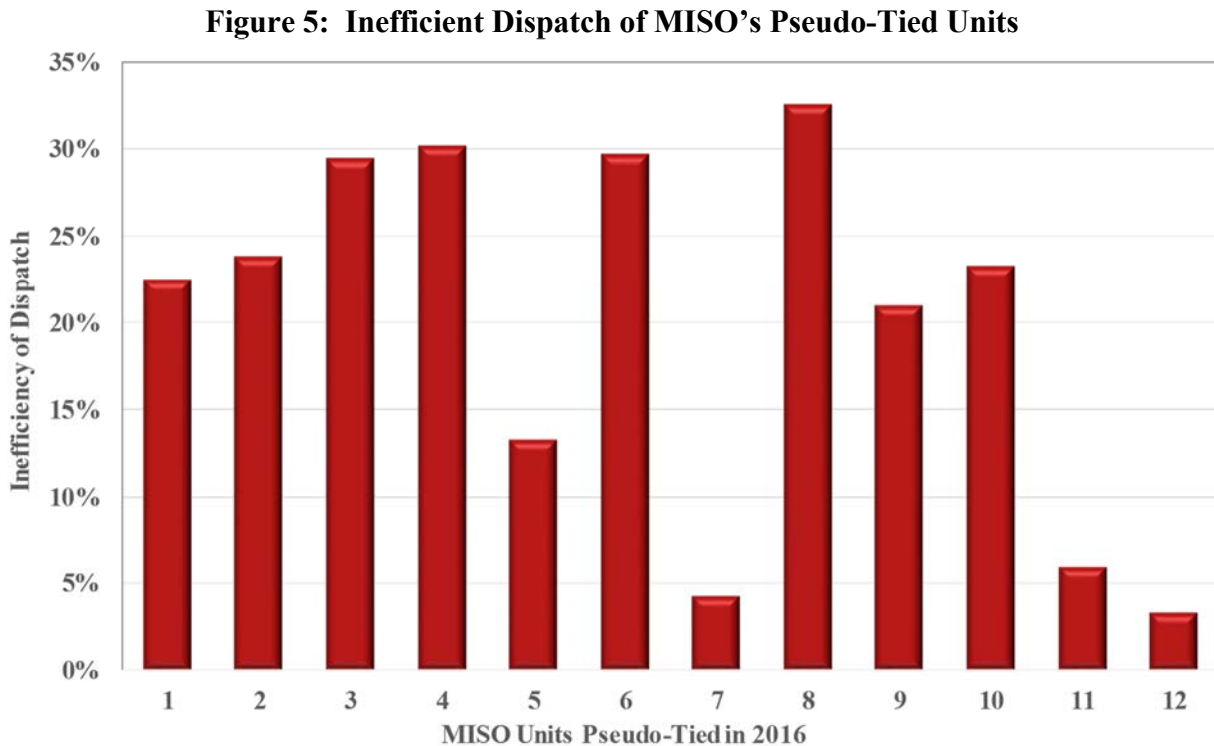
4. Market Results in MISO Demonstrate that Pseudo-Ties are Undermining Efficient Dispatch and Congestion Management

Based on our evaluation of the growing number of pseudo-ties to PJM that have been implemented in MISO, we have identified substantial dispatch inefficiencies and operational concerns. Dr. Patton performed an analysis of the dispatch inefficiencies associated with the 12 resources that were required to be pseudo-tied by PJM in 2016 to provide the CP product. A detailed description of this analysis is provided in Dr. Patton's affidavit.³⁰

. We measured the value of the dispatch inefficiencies by calculating the economic value of the output deviation. The output deviation is the difference between the units' actual output (based on PJM's dispatch) and where MISO would have dispatched them (given their costs and ramp rates). The net inefficiency is the value of the output deviation to MISO (based on MISO's LMPs) minus the change in production costs to the unit of producing the optimal output.

³⁰ See Patton Affidavit at 5-8.

These inefficiencies are particularly large when congestion is affected by the pseudo-tied units so we calculated the net inefficiency for each unit divided by the energy production costs of the online units in hours when congestion was greater than \$5 per MWh at the units' locations. The results of this analysis are shown in Figure 5 for each of the twelve currently pseudo-tied units.



The results of this analysis show that these units were dispatched inefficiently when they were online in 2016 and affecting constraints on MISO's transmission system. Eight of the twelve units exhibited average inefficiencies greater than twenty percent. In other words, these units generally ran at levels that were much higher or much lower than optimal during congested periods.

The figure above shows only the inefficiencies that occurred when the units were online. It does not include periods when the pseudo-tied units were not committed by PJM even though

they were clearly economic based on MISO's LMPs. When the inefficiencies in those periods are included, the weighted-average inefficiency exceeded 26 percent for all the pseudo-tied units.

These inefficiencies are substantial, but are likely understated in our analysis because they do not include two other types of inefficiencies:

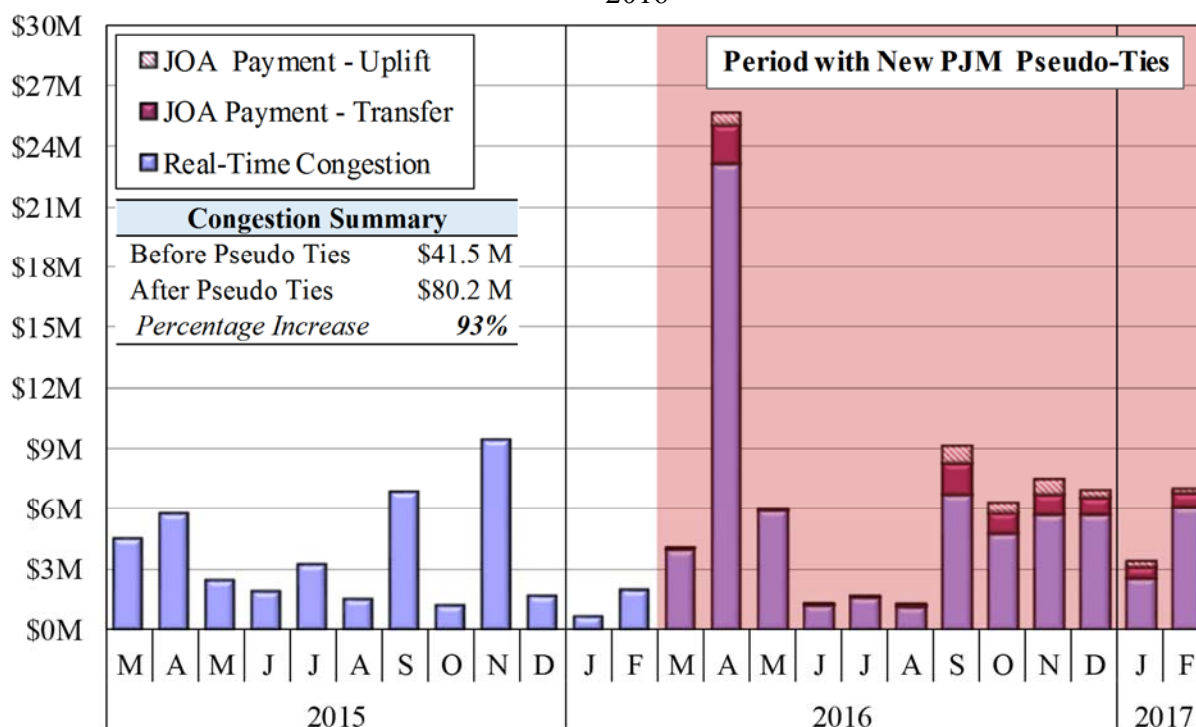
- Cases where the units would not have been economically committed by MISO (*i.e.*, they were uneconomically committed through the PJM markets); or
- Inefficiencies caused by MISO committing and dispatching other units inefficiently because it does not know how the pseudo-tied units will be dispatched.

PJM actually incurs some of the cost implications of these problems because inefficient congestion management will often increase congestion costs on MISO's market-to-market constraints for which PJM bears cost responsibility.

The inefficiencies shown above should ultimately result in higher costs of managing the constraints that are affected by the pseudo-ties, which Dr. Patton summarized in his analysis that is summarized below. Figure 6 shows the real-time congestion value on all constraints that are now market-to-market constraints because of the twelve units that were pseudo-tied to PJM in 2016. The real-time congestion value shown in this figure is calculated as the shadow price of the constraints times the total physical flow over the constraints, and is an accurate measure of the congestion actually occurring as the system is dispatched in real time.

The left side of the figure shows the monthly congestion on these constraints for the year that preceded the initiation of the first tranche of pseudo-ties on March 1, 2016. The second tranche of pseudo-ties began on June 1, 2016. The pink shading to the right shows the real-time congestion value on the same constraints in those months that these pseudo-ties were in place. The two classes of payments made under the MISO-PJM Joint Operating Agreement shown are the payments made by PJM to MISO associated with its market flows on these constraints.

Figure 6: Effects of Pseudo-Tying MISO Resources to PJM
2016



This figure shows that the real-time value of congestion on the new market-to-market constraints affected by the pseudo-ties has increased substantially since these units began being dispatched by PJM, some of which began in March and some in June 2016. As shown in the table, congestion costs on these constraints have risen 93 percent and the increases have been sustained. Five of the last six months have exhibited real-time congestion greater than or equal to \$6 million on these constraints. In contrast, the figure shows that only two months over the year prior to the pseudo-ties exhibited this level of real-time congestion. We expect these effects to rise in the future as the third tranche of external capacity resources begin in June 2017 and rise further still if natural gas prices rise.

These analyses represent only some of the potential costs and inefficiencies caused by the pseudo-ties. They do not include inefficiencies associated with congestion on the myriad of affected non-market-to-market constraints in MISO, the effects of conservative actions and

parameters used by MISO operators to account for the uncertainties regarding the commitment and dispatch levels of the pseudo-tied resources, inefficient commitments of the pseudo-tied units, and the inefficient commitment of other MISO generators because the pseudo-tied resources are missing from the day-ahead market.

Nonetheless, these analyses provide strong evidence that the pseudo-ties are decreasing the efficiency of the day-ahead and real-time markets in MISO, raising costs substantially, and ultimately producing unjust and unreasonable market outcomes.

C. The Affected RTOs, including PJM, All Have Serious Concerns with the Pseudo-ties

1. MISO has Raised Substantial Concerns with Pseudo-Ties

Although it was not addressed in the CP Order, pseudo-tying generally presents greater challenges and costs to the host RTO than to PJM. In response to FERC's CIL and CP Orders MISO began internal and stakeholder discussions on how to manage the reliability issues presented by the expected increase in pseudo-tying out of MISO to PJM. These discussions took place in a now retired MISO working group, the Pseudo-Tie Issues Task Team ("PITT").³¹ The product of this task team's work included a paper that summarizes the issues caused by the pseudo-ties.

The full issue paper is attached to this Complaint as Attachment II. However, the key economic and reliability concerns are excerpted below.³²

Overview: Why limited visibility poses problems

As noted above, many of the issues pertaining to pseudo-tied units revolve around the limited visibility that attaining BAs have of the MISO-controlled portion of the grid. For example, an attaining BA might instruct a pseudo-tied unit to increase its

³¹ For a description of the PITT and the posted meeting materials, see: <https://www.misoenergy.org/Library/MeetingMaterials-Retired/Pages/PITT.aspx>

³² See Attachment II.

output of energy without realizing that doing so would overload a local transmission element, jeopardizing reliability in the MISO system.

MISO, in turn, may have to guard against that possibility by committing one or more of the higher-priced units under its functional control to provide sufficient “counterflow” energy to ameliorate any potential congestion. And that could cause market-inefficiency and cost-related issues, because the costs of committing those units—whether they actually ran for congestion-management purposes or not—would be borne by MISO Market Participants.

Congestion-Management Issues

The primary concern here is that an attaining BA that lacks visibility into MISO’s system could change the output of a pseudo-tied unit without realizing that doing so would exacerbate congestion on the MISO-controlled portion of the grid, possibly even causing a MISO transmission operating limit to be exceeded.

Unit Commitment / De-Commitment Issues

The need for adequate modeling goes beyond just managing congestion. Other situations can arise in which [MISO] may have a need to commit or de-commit a pseudo-tied resource that it does not control to maintain the transmission system within thermal and voltage operating limits. The CMP and MISO’s Emergency Operating Procedures...do not authorize commitment/de-commitment, outside of declaring a “Safe Operating Mode.” Local transmission issues could require [MISO] to quickly commit or de-commit a pseudo-tied unit in order to maintain the reliable operation of the Bulk Electric System. Similarly, [PJM] may also allow their MISO-based pseudo-tied units to take outages at times that are not optimal for those units to be unavailable to MISO for addressing local issues that may arise on very short or no advanced notice.

Issues Related to Higher Costs, Increased Uplift & Market Inefficiencies

MISO’s lack of visibility into the operation of pseudo-tied units that are controlled by distant BAs may require MISO to take certain actions in the commitment and dispatch processes that could increase the costs borne by MISO Market Participants. This issue revolves around the fact that prior to the start of a given operating day in the Day- Ahead Market, MISO will likely not know if a pseudo-tied unit...will be called on to run by [PJM], and, if so, at what level(s) of output. This means MISO is not likely to know in advance if one or more pseudo-tied units will be dispatched in a manner that could cause or contribute to unsafe levels of transmission congestion on MISO-controlled portions of the grid.

Consequently, MISO may have to “assume the worst” and commit one or more of the higher- priced units under its functional control to provide enough counterflow energy—should it be needed—to ameliorate any congestion caused by pseudo-tied units. Even if these assume-the-worst units were not needed for congestion-

management purposes, the additional costs of committing them in the Day-Ahead Market would be borne by MISO Market Participants.

Similar issues exist in the Real-Time Market, as MISO will not know if pseudo-tied units will turn on, turn off, ramp up or ramp down in the next market interval. That means MISO must again assume the worst and “carve out” space to accommodate the uncertainty of the pseudo-tied units’ output. As a consequence, MISO will underutilize the transmission system, which will increase costs borne by MISO Market Participants.

Issues Related to Accurate Price Signals

In order for MISO-based pseudo-tied units to be committed, de-committed and dispatched in an efficient manner, their attaining BAs must act according to price signals that reflect market conditions within the MISO footprint where those units are located... This basic market process will be distorted if MISO-based pseudo-tied units are dispatched on the basis of prices in the areas outside of MISO where their energy will be sent, as opposed to the areas within MISO where the units are physically located.

Issues Related to Pseudo-Tied Units that Retire or Suspend Operations

Once a unit in the MISO footprint pseudo-ties to another BA, it is no longer considered a generation resource in MISO’s markets. Accordingly, owner of pseudo-tied units are not obligated to inform MISO of their decision to retire or suspend operations. When pseudo-tied units retire or suspend without notification, MISO cannot proactively model how their absence could affect the local transmission system to which they were connected. Moreover, they can no longer be used to address an emergency in the MISO footprint, which could cause reliability issues.

To address these issues, the PITT encouraged MISO and PJM to pursue alternatives to pseudo-ties that would achieve PJM’s objectives without causing these problems. To this end, MISO collaborated with the IMM to develop the Firm Capacity Delivery Proposal discussed in Section D.

2. MISO’s Concerns Have Been Manifested in its Operational Experiences with the Pseudo-Ties

Although only twelve units have been pseudo-tied to PJM to date, and although these pseudo-ties only began to be established thirteen months ago because of the PJM requirement, MISO’s identified concerns have been validated by actual operating experience.

On many days in 2016, MISO needed to request that PJM either commit or decommit pseudo-tied resources to manage local constraints. Based on our observations and experience as MISO's IMM, the delays caused by pseudo-tying and the loss of control by the MISO resulted in constraints exceeding their operating limits by as much as 40 percent in some cases. In other cases, MISO has had to seek emergency market to market coordination with PJM, or request that MISO transmission owners reconfigure breakers to manage transmission system conditions because it no longer has dispatch control of the pseudo-tied units.

Based on our review of MISO's operating logs, we are aware of at least ten days in 2016 where MISO operators had to take multiple extraordinary actions, often involving multiple units, to manage transmission system conditions because it lacked the visibility on future commitment status or dispatch level of pseudo-tied resources now controlled by PJM. There are many other days in which we understand that MISO has operated more conservatively, increasing the costs to MISO's customers, to account for its lack of commitment and dispatch control of the pseudo-tied units and the uncertainty regarding their commitment and dispatch by PJM.

3. NYISO has Raised Substantial Concerns with Pseudo-Ties

In addition to the issues raised in this Complaint regarding the impact of PJM's pseudo-tie rules on MISO, it is clear that other regions, particularly New York, also face substantial issues arising out of the PJM pseudo-tie rules. Potomac Economics serves as the Market Monitoring Unit for NYISO and, in this role, has extensive experience with congestion patterns and unique operational issues that would be affected by resources in New York pseudo-tying to PJM.

Fortunately, no resources in New York have yet to export capacity to PJM and, therefore, have not been subject to PJM's pseudo-tie requirement. As substantial as the harm has been in MISO, we believe the consequences in NYISO would be much worse. The NYISO system is

generally more congested than the MISO system, and is subject to a much wider array of transmission security and other local reliability requirements. Some of the requirements are embodied in New York's locational reserve products and its methodologies for establishing transmission limits, while other local reliability requirements are managed primarily through NYISO's operating procedures. Additionally, New York must coordinate the dispatch of its generation with the operation of the numerous phase angle regulators on its transmission system that allow it to govern the system flows. Hence, losing operational control of resources in New York could raise serious economic and reliability concerns. NYISO eluded to these concerns in its a protest of the PJM Filing ("NYISO Protest") filed last week.³³

The NYISO Protest highlights the unique features of the NYISO-PJM border, which includes seven phase angle regulators in operation, and three direct current lines interconnecting the two regions. The NYISO states that there are detailed rules in place to govern interchanges between the NYISO and PJM in order to ensure reliability and efficient outcomes, and that the PJM pseudo-tie rules ignore, and in some instances, contradict, those rules.³⁴

The NYISO also expresses major reservations about the impact of the PJM pseudo-tie rules on reliability and market operations in New York. The NYISO highlights the fact that the New York State Transmission System ("NYS Transmission System") is operated with a substantial degree of close coordination among the NYISO, the New York Transmission Owners, and individual Generators in the NYISO region. This coordination is an imperative in New York because of the substantial number of local reliability issues that must be addressed in the

³³ See Motion to Intervene One Day Out-of-Time and Protest of New York Independent System Operator, Inc., Docket No. ER17-1138-000, filed March 31, 2017 ("NYISO Protest").

³⁴ NYISO Protest at 7-8, 18-20, 28-32.

operation of the NYS Transmission System, particularly in and around New York City. These reliability concerns are highlighted by the fact that the New York State Reliability Council ("NYSRC") has developed, and enforces, a series of Reliability Rules applicable in New York State. The NYISO Protest expresses strong concerns that giving PJM dispatch control over Generators located in New York will not only upset the existing operational balance and coordination, but will also likely exacerbate reliability issues in New York.³⁵

In addition, the NYISO Protest highlights the fact that the PJM rules would interfere substantially with the NYISO's Day-Ahead and Real-Time Markets.³⁶ The NYISO explains that its ability to run efficient markets turns on its ability to accurately forecast congestion on its system, something that it will be unable to do if PJM has dispatch control over generators in the NYISO region. In essence, such generators would be operated as if they were located in PJM, while the reality would be that, because they were actually interconnected to the NYISO system, their dispatch by PJM would cause congestion issues on the NYISO system. Because PJM, and not the NYISO, would have dispatch control over those generators, it would be impossible for the NYISO to be able to accurately forecast the actual congestion impacts that such generators would trigger on its system. As a result, the NYISO's efforts to produce a least-cost dispatch would be severely impeded.

The NYISO also expresses strong concerns about a number of other aspects of the PJM pseudo-tie rules. For example, the NYISO objects to the fact that the PJM rules:

- Do not allow the NYISO to dispatch pseudo-tied units in circumstances in which they are not being used by PJM, and are needed for reliability purposes in New York;³⁷

³⁵ *Id.* at 14-17.

³⁶ *Id.* at 34-36.

³⁷ *Id.* at 13-14.

- Do not address the operations of Generators that provide capacity to more than one market (for example, partial capacity to PJM, and partial capacity to the NYISO); and
- Require the applicability of PJM deliverability rules in New York.³⁸

Finally, but just as importantly, the NYISO protest notes that the PJM proposal would require NYISO to make significant changes to its market and transmission operations, particularly with respect to the use of physical transmission rights, rather than the financial rights that NYISO has long used.

NYISO also notes that, contrary to PJM’s assertions and the requirements of the CP Order, PJM did not collaborate with NYISO before submitting its proposal to the Commission, stating that it “does not believe that it would be possible for [NYISO] to execute a pseudo-tie agreement under the terms and conditions proposed and described by PJM.”³⁹ NYISO emphasized that it “is not prepared to make significant substantive changes to its Tariffs and to the fundamental design of its markets in order to accommodate the requirements PJM seeks to impose on its external Generation Capacity Resources.”⁴⁰

4. PJM has Also Raised Substantial Concerns with the Impact of Pseudo-Ties on PJM Itself

Although the largest adverse effects of PJM’s requirements for external resources to pseudo-tie to PJM are incurred by PJM’s neighbors (particularly MISO to date, and potentially NYISO in the future), the PJM Filing acknowledged problems caused by the pseudo-ties in a number of areas that are summarized below.

³⁸ *Id.* at 27-28.

³⁹ *Id.* at 3.

⁴⁰ *Id.*

Effects on PJM's EMS System and Modeling

PJM has conceded that the requirements and modeling obligations it has accepted in requiring external capacity resources to be pseudo-tied to PJM have been much larger than anticipated. As the PJM Filing stated:

Pseudo-Ties into PJM, and any coordinated flowgates they impact, must be modeled in PJM's EMS and the EMS must perform real-time assessments on a continuous basis...To meet its NERC obligation to perform real-time assessments on a continuous basis, PJM utilizes a State Estimator application which requires reliable data (i.e., telemetry) and a robust model (i.e., closely tracking the physical configuration of the BES) for the entire area relevant to dispatched resources, including pseudo-tied resources...

PJM has encountered challenges completing the required real time assessments as they relate to the external BES area, for a number of reasons, including but not limited to:

- modifications to the external physical BES that are not reflected in the PJM EMS model;
- unplanned and planned outages of data links with external entities; and
- external telemetry data quality and availability.

Congestion Management Challenges and Compliance Risks

Pseudo-ties raise the largest congestion management concerns on the native RTO systems where the units are located. Nonetheless, the PJM Filing identified substantial congestion management concerns and other risks in PJM:

A Pseudo-Tie electrically moves a generator from its Native Balancing Authority Area to PJM's Balancing Authority. Consequently, the generation transfer is no longer visible to the Native BA, and any significant impacts from the pseudo-tied resource on the Native BA facilities will be recognized as regional congestion that must be managed through market-to-market ("M2M") or transmission loading relief ("TLR") flowgates.

The increase in Pseudo-Ties for resources seeking to provide capacity in PJM is requiring PJM to add a significant amount of M2M congestion management flowgates. For example, the seven Pseudo-Ties of generators located in the Midcontinent Independent System Operator, Inc. ("MISO") added for the 2016/2017 Delivery Year resulted in a 41% increase in total PJM-MISO coordinated flowgates located in MISO, from 220 before the Pseudo-Ties to 334 after the Pseudo-Ties. This

dramatic increase in flowgates raises concerns because it can subject pseudo-tied resources to curtailments based on external system bottlenecks that were not addressed when the Pseudo-Ties were originally evaluated.

. . . .In addition to these regional congestion concerns, both PJM and MISO have local reliability and local congestion management concerns with Pseudo-Ties into the PJM Balancing Authority Area. Certain Pseudo-Ties can impact local reliability limitations that are not recognized in the regional congestion management process. PJM is concerned that such local limitations could require out-of-merit dispatch commitments, curtailments, and unreimbursed uplift charges to PJM.⁴¹

Transmission Service Evaluation Process and Planning Requirements for External Resources

The PJM Filing states that current process, whereby external suppliers must acquire firm transmission into PJM, does not ensure that the external resources will be fully deliverable to PJM load and “potentially overlooks some external system impacts.”⁴²

Operational Impacts on Neighboring Systems

The PJM Filing raises concerns regarding pseudo-tied resources located in areas that are required to be tagged under NERC’s standards. This tagging requirement protects the external area whose transmission system is adversely affected by PJM’s dispatch of the pseudo-tied resources.

NERC standards require pseudo-tied resources to be tagged unless the resource is included in a congestion management procedure. By operation of this rule, Pseudo-Ties into the PJM Balancing Authority Area must be tagged when PJM does not have a formal congestion management procedure with the external system. This result, however conflicts with the definition of Capacity Import Limit contained in Article 1 of the RAA, which requires external resources to meet all requirements to be treated as equivalent to PJM Region generation that is not subject to tagging in order to qualify to be capacity for loads in the PJM Region. Thus, Article 1 ensures that resources on which PJM loads rely as capacity cannot be curtailed under NERC TLR procedures, which could make those resources unavailable when most needed during capacity emergency conditions.

⁴¹ PJM Filing at 9-10.

⁴² *Id.* at 11.

Pseudo-Ties Reduce the Deliverability of External Supply to PJM

Although PJM apparently doesn't realize it, pseudo-tying external capacity resources reduces the overall deliverability of external supply to PJM. Because pseudo-tying locks in the source of the export from the neighboring control area, it may load a constraint that prevents additional energy from being exported from that control area to PJM. This restricts not only capacity deliveries, but would also limit other emergency transfers, which MISO has routinely made to PJM when PJM has experienced emergency conditions.

Finally, it is important to recognize the concerns recognized by PJM that are caused by widespread pseudo tying of external resources to the PJM system represent only a small share of the total concerns caused by the pseudo-ties. The adverse effects of pseudo tying are much greater in the native RTO systems surrounding PJM where the resources are located as we describe above and have identified in MISO.

D. A More Efficient and Reliable Alternative for Delivering External Capacity

PJM considers pseudo-tying to be an essential part of its capacity performance framework. PJM argues that the pseudo-tie requirement allows PJM to monitor the output of its external resources and apply the same standards to internal and external resources. Given the problems created by pseudo-tying, it is fortunate that alternative capacity market procedures exist that can achieve PJM's operating and monitoring objectives without causing the adverse effects described in this Complaint. In this subsection, we discuss one such alternative that we have developed in collaboration with MISO, and previously discussed with PJM, which we refer to as "Capacity Delivery Procedures." This alternative was discussed with PJM and proposed one version it to stakeholders of both RTOs at the Joint and Common Market meeting in May 2016. The summary of the proposal that MISO presented is Attachment III to this Complaint.

The basic framework employed in the Capacity Delivery Procedures is not new. Although the details vary slightly, these procedures are very similar to the procedures that other RTOs utilize to deliver capacity. For example, similar procedures are used when NYISO delivers capacity to ISO New England (“ISO-NE”), which has implemented a capacity performance framework that is comparable to PJM’s. Although they have similar capacity performance rules, ISO-NE, unlike PJM, has never claimed that external resources must be pseudo-tied to its system to be treated comparably to internal resources.

The Capacity Delivery Procedures would facilitate efficient capacity trading between RTOs without the need to transfer physical dispatch control via pseudo-tying. They would also allow PJM to monitor its external capacity resources to enforce its capacity performance requirements. It is our hope that demonstrating that just and reasonable alternatives could replace PJM’s pseudo-tying regime will assuage any concerns the Commission might otherwise have about directing PJM to eliminate the pseudo-tie requirement.

1. Design Objectives

In developing any market design change, it is important to establish guiding principles and this case is no exception. We have identified three design principles that have guided our development of the Capacity Delivery Procedures.

1. Allow Internal and External Suppliers Non-Discriminatory and Comparable Access to Sell Capacity in PJM

This principle is meant to ensure a level playing-field where resources, internal and external, can compete to sell capacity in PJM. Such competition is important for ensuring that capacity is traded efficiently, which ultimately lowers costs for the RTOs’ customers and produces efficient incentives to guide investment and retirement decisions. This principle does not imply that deliverability issues should be ignored, or require that all generators be treated identically as we

will explain in the discussion below. As discussed in our recent protest of the PJM Filing, PJM's current and proposed pseudo tie rules violate this principle by erecting insurmountable uneconomic barriers for external capacity resources.

2. Facilitate Efficient Dispatch of External Resources

This is the principle that PJM's pseudo-tie requirement most clearly violates. Allowing PJM to dispatch units in MISO or NYISO (or other control areas outside of PJM), prevents these units from being efficiently dispatched and degrades the dispatch of other resources that remain under the dispatch control of the neighboring RTO. Therefore, an efficient alternative to the pseudo-tie requirement must allow the external capacity resources to continue to be committed and dispatched by the host RTO (MISO and NYISO) so that they can be optimized.

3. Allow for Comparable Application and Enforcement of Capacity Performance Requirements

PJM has certain Capacity Performance requirements that depend on the availability and performance of its capacity resources. It is largely this principle that motivated PJM to propose that external capacity resources be required to pseudo-tie to PJM. Therefore, it is essential that any alternative facilitate comparable application and enforcement of the capacity performance requirements and associated settlements.⁴³

⁴³ As the Commission has recognized, "comparable" treatment does not mean that differently-situated resources must be treated identically. Public utilities are permitted to treat differently-situated resources differently, as long as that different treatment is justified by the circumstances, and does not rise to the level of undue discrimination. *See, e.g., Offer Caps in Markets Operated by Regional Transmission Organizations and Independent System Operators*, 157 FERC ¶ 61,115 at P 158 (2016) (noting that the "verification process for demand response resources will necessarily differ from the verification process for generation resources" and that, because of the inherent differences between the two types of resources, the "Commission has recognized that demand response resources should receive comparable, but not necessarily identical treatment to generation resources.")

2. Efficient Capacity Delivery Procedures

We have worked with MISO to develop an alternative to pseudo-ties that satisfies the design principles described above, which we detail in this subsection. This alternative is embodied in a set of Capacity Delivery Procedures that are an efficient and effective way to allow external resources to serve PJM's capacity needs while allowing PJM to fully enforce its capacity performance requirements. These procedures build upon the RTOs' import and export processes and procedures in their day-ahead and real-time markets. However, they are structured to guarantee that PJM will always receive the capacity it has procured as long as the external resource is available, giving PJM comparable access to the output of the unit that it receives by pseudo-tying the unit to PJM.

The following are the Capacity Delivery Procedures we have proposed to MISO and PJM that accomplish the objective of efficient interconnected dispatch while meeting PJM's capacity market requirements. These procedures cover six key provisions that govern PJM's rights to the capacity, the host RTO's obligations to deliver the capacity, and the external capacity suppliers' obligations.

- i. The host RTO would be obligated to deliver energy associated with capacity resources in an amount equal to the lower of:*
 - ✓ *The quantity of capacity purchased by PJM; or*
 - ✓ *The maximum dispatch level of the resource (zero if the resource is on outage, or a reduced amount if the resource is derated due to a generation or transmission issue).*

This provision guarantees that external resources would be available for supplying the attaining RTO with energy so long as the capacity resource itself is not out of service or derated. In doing so, it ensures that PJM will receive the full value of the output of the capacity resource

that it procured. In fact, the output PJM would receive under these procedures will be equal to or greater than the output it would receive by pseudo-tying the generator to PJM.

- ii. The host RTO will schedule the firm export subject to notice being provided by PJM by:*
 - ✓ *20 minutes prior to real time if the resource is online; or*
 - ✓ *The length of the start-up time prior to real time if the resource is offline.*

This provision ensures that PJM would have comparable access to the output of the external capacity resource as if it were pseudo-tying the resource because this provision respects the start-up time of the unit if it is offline. If the unit is online, PJM will have access to the entire capability of the resource subject to the export scheduling deadline in MISO of 20 minutes. For most resources, this is superior to pseudo-tying the external resource because most resource have ramp rate limitations that would not allow PJM to ramp the unit up to its economic maximum in 20 minutes. Although the scheduling provisions could be adjusted, this scheduling provision seeks to emulate the access to the capacity that PJM receives through its pseudo-ties.

- iii. When scheduled, the external capacity supplier will settle the export with both RTOs consistent with the settlement of all imports and exports.*
 - ✓ *The export need not clear in the day-ahead market;*
 - ✓ *Exports called by the PJM would be scheduled in the real-time and necessary ramp would be allocated to it (ahead of non-capacity-backed exports);*

This provision ensures that PJM will receive the appropriate priority for its capacity deliveries and clarifies how the RTOs would settle with the capacity supplier when the capacity is called by PJM.

- iv. The host RTO would enforce a Day-Ahead must offer requirement on the external capacity resources and enforce any other capacity obligations on behalf of PJM.*

This provision ensures that the external capacity resources face the same capacity obligations as those borne by PJM's internal capacity resources to achieve comparability between the two classes of resources.

- v. *The host RTO would provide timely resource status information and other information necessary for PJM to enforce its capacity performance requirements.*

This information would include all information necessary to implement these procedures, as well as the information that PJM believes is necessary to enforce its capacity performance requirements. For each external resource, this information likely includes:

- Availability and commitment status of the resource;
- Offer parameters (Startup and Notification Times, Economic Maximum, etc.);
- GADS submittals;
- Outage and retirement requests; and
- Reported derates.

This information is an initial list, but the RTOs would need to work together to identify all of the necessary information. The firm capacity delivery obligations on MISO and NYISO would be explicitly linked to the availability and capability of the external capacity resources. Hence, this information should allow PJM “the unit-specific visibility of external resource performance necessary to accurately apply Non-Performance Charges to external resources”⁴⁴ and make the external capacity suppliers accountable to PJM for their performance, which were its primary arguments for requiring external capacity resources to be pseudo tied to PJM.

- vi. *The attaining RTO and the host RTO would have joint authority to review and approve planned outages as follows:*

- ✓ *The attaining RTO shall assess the capacity need for the resource; and*
- ✓ *The host RTO shall review the transmission implications of the outage.*

This provision allows PJM to review outage requests to ensure that they will have adequate resources to satisfy their system demands. The neighboring RTO will evaluate the transmission implications of the outage, which do not affect PJM.

⁴⁴ *PJM Interconnection, L.L.C.*, 151 FERC ¶ 61,208 at P 97.

We would stress that these Capacity Delivery Procedures may not be the only just and reasonable alternative to pseudo tying external capacity resources to PJM. It is possible that other alternatives would be equally effective or that these could be improved. Nonetheless, we believe that the Capacity Delivery Procedures are an excellent example of the type of alternative that would fully resolve the concerns that have been manifest with the pseudo-ties.

3. Benefits of Capacity Delivery Procedures

Relative to PJM's current pseudo-tying regime, the Capacity Deliverability Procedures described above will produce sizable benefits for PJM, the neighboring RTOs where the external capacity resources are (or will be) located, and the owners of the resources themselves.

Regional Economic and Reliability Benefits

The Commission has long encouraged eliminating seams between RTOs, particularly between MISO and PJM. The Joint and Common Market ("JCM") initiative has been active since the earliest days of the MISO and PJM markets. The very purpose of the JCM is to meet the Commission's policy on mitigating the adverse effects of the seams between the markets. The Commission has encouraged the JCM to work to better integrate the dispatch and planning of the two systems so that they operate as closely as possible to a single market. That is a difficult task, but much progress has been done over the years that has improved the coordination of the markets.

The emergence of large numbers of pseudo ties has reversed this progress and created much more severe seams problems. By transferring the operational control of a resource that is located on one RTO system to a different RTO, the ability to operate the resource to minimize costs and maximize reliability is lost. One must recognize that PJM and its neighbors all operate on an interconnected electric system – the eastern interconnect – and provisions that undermine the

efficiency and reliability of one or more RTOs (MISO and NYISO in this case) will raise costs and reduce reliability for all customers in the eastern interconnect.

The Capacity Delivery Procedures provide substantial benefits to the entire eastern interconnection by ending the adverse effects of the pseudo ties, allowing each RTO to optimally dispatch the resources that are located on its respective system. Ultimately, this will result in lower costs for the customers of each of the affected RTOs and improved reliability. We recognize that most of these adverse effects are borne by others and not by PJM, but the Commission should consider *all* the regional effects in determining whether PJM's Tariff is just and reasonable, not just the adverse effects that have arisen in PJM.

Benefits for PJM

Most of the benefits of the Capacity Delivery Procedures will accrue to the regions outside of PJM, but PJM will also benefit from the implementation of these procedures. The Capacity Delivery Procedures ensure that PJM will receive the resource adequacy benefits of the capacity it has procured by guaranteeing that it will be delivered on a firm basis to PJM. In doing so, MISO or NYISO will have the ability to optimize its dispatch and manage any transmission congestion that could affect the export to PJM.

Pseudo-tying reduces this redispatch flexibility and requires that the power come from the external resource. If the external resource overloads a transmission constraint in MISO or NYISO, those RTOs will have the authority to curtail the resource or to declare a level 5 TLR that could compel PJM to reduce the output or decommit the unit. This possibility makes the pseudo-tied resource a less reliable source of supply than it would be if it were delivered to PJM via the Capacity Delivery Procedures. As long as the aggregate levels of capacity exports from MISO or NYISO remain at reasonable levels (which can be ensured by establishing reasonable Capacity

Import Limits), the probability that transmission would prevent MISO or NYISO from delivering the capacity to PJM would effectively be zero.

In fact, this dispatch flexibility increases the overall deliverability of resources to PJM. Because pseudo-tying locks in the source of the export from the neighboring control area, it may load a constraint that prevents additional energy from being exported from that control area to PJM. This restricts not only capacity deliveries, but would also limit other emergency transfers, which MISO has routinely made to PJM when PJM has experienced emergency conditions. Hence, allowing the neighboring control area to dispatch its system optimally and manage any resulting congestion will increase the aggregate deliverability to PJM.

A secondary benefit to PJM from these procedures is that they will substantially reduce the burden on PJM of having to expand its transmission model and EMS systems to include the pseudo-tied resources. Additionally, this change will sharply reduce the number of market-to-market constraints that must be coordinated between PJM and its neighbors, which reduces PJM's customers' exposure to congestion on other RTOs' systems and improves PJM's ability to model its own constraints in its day-ahead and real-time markets.

Finally, these procedures facilitate more robust competition in the PJM capacity market between internal and external suppliers. By allowing PJM to access surplus capacity efficiently in neighboring regions, prices in PJM will not be artificially inflated. In its last three Base Residual Auctions, PJM has cleared between 3.9 and 4.7 GW of imports. Dr. Patton estimates the potential annual capacity cost increases in PJM associated with erecting unreasonable barriers to importing external capacity resources as described in his affidavit attached to this Complaint.⁴⁵ Dr. Patton shows that the costs increases would be highly variable, ranging from \$0.5 to \$4 billion annually.

⁴⁵ Patton Affidavit at 11-13.

While higher capacity costs that are due to true supply and demand conditions are efficient, higher capacity prices that are the sole result of uneconomic barriers to capacity trading are inefficient and unreasonable. Hence, eliminating uneconomic barriers to capacity trading will substantially benefit the customers in PJM and in neighboring RTOs.

Benefits to Capacity Suppliers

Finally, the Capacity Delivery Procedures benefit the external capacity suppliers by eliminating unnecessary risks and barriers to capacity trading. To the extent that the current rules, as well as the additional restrictions proposed by PJM, serve as barriers to capacity sales by some or all external suppliers, the rules and restrictions are unduly discriminatory. Removing these unreasonable barriers and allowing the external capacity suppliers the opportunity to compete to sell capacity in PJM will benefit them.

Likewise, the risk of being curtailment and paying substantial capacity performance penalties facing a pseudo-tied resource under the Capacity Performance framework greatly exceed the transmission risks that face internal PJM capacity resources since PJM operates the transmission system within PJM. Imposing this unnecessary risk on external capacity resources is discriminatory, placing them at a competitive disadvantage to internal capacity resources and raising their costs of selling capacity into PJM. Implementing the Capacity Delivery Procedures will ensure that external capacity suppliers are on a level playing field to internal resources, and are not exposed to unnecessary or unreasonable risks and costs associated with delivering its capacity to PJM.

4. These Procedures Ensure Comparability of External and Internal Resources

The Capacity Delivery Procedures are designed to ensure comparability under PJM's Capacity Performance framework between PJM's internal and external resources by providing

comparable access to each class of resource, and providing no undue advantage to either class of resources. This section summarizes how the Capacity Delivery Procedures ensure this comparability, focusing on the key elements.

Commitment and scheduling in the day-ahead and real-time markets

The capacity import to PJM from an external resource may be called or scheduled by PJM in the day-ahead or real-time market. However, the transaction need not be scheduled in the day-ahead market to be available to PJM. Under the Capacity Deliverability Procedures, the operational flexibility should be equal to or better than the pseudo-tie alternative.

Internal and external generation are treated comparably

Under the Capacity Delivery Procedures, PJM will have access to firm energy only to the extent that the external capacity resource is available. If it is derated, forced out of service, or otherwise unavailable (including due to local transmission or interconnection issues), the supplier will be subject to capacity performance penalties. Additionally, because MISO and NYISO can provide any necessary information or assistance required by PJM to enforce the capacity performance requirements, the external resources will be subject to the full array of capacity performance obligations.

Deliverability Will be Ensured

The Capacity Delivery Procedures do not undermine the requirement that external capacity resources be deliverable to PJM. First, MISO and NYISO resources are subject to comparable deliverability tests to ensure that they can be delivered to their host RTO networks and, if not, must make network upgrades. Second, the aggregate level of capacity transfers would be established that would address any potential system-to-system deliverability issue that could affect the neighboring RTOs' ability to guarantee the delivery of the capacity to PJM. As long as

this aggregate limit is not exceeded, the external capacity resources will be fully deliverable to PJM. PJM can ensure that this aggregate limit is not exceeded by requiring the external capacity supplier to obtain firm transmission service from the neighboring RTO or system, and imposing a Capacity Import Limit in the capacity auction itself.

III. COMPLIANCE WITH ADDITIONAL RULE 206 REQUIREMENTS

A. Description of the Parties

1. PJM Interconnection, LLC

PJM is a Regional Transmission Organization and Commission-jurisdictional public utility responsible for providing open-access transmission and administering wholesale energy, capacity, and ancillary services markets through all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia.

2. Potomac Economics, Ltd

Potomac Economics, Ltd. is a firm specializing in expert economic analysis and monitoring of wholesale electricity markets. Potomac Economics has served as the independent Market Monitor for Midcontinent Independent System Operator, Inc. (“IMM”) since 2002. Potomac Economics serves in a substantially similar role for the New York Independent System Operator, Inc. (“NYISO”), ISO New England, Inc. (“ISO-NE”), and the Electric Reliability Council of Texas.

B. Impacts on Complainant

Rule 206(b)(4) and (5) require Complainants to make a good faith effort to quantify the financial and non-financial impacts or burdens (if any) created for the Complainant as a result of respondent’s actions or inactions. Potomac Economics does not have a direct financial interest in outcome of the electricity market because it does not participate in any market. However,

Potomac Economics serves as the Commission-approved independent market monitor for both the MISO and the NYISO, *i.e.*, the market that is currently most affected by pseudo-ties and the market that is potentially most vulnerable to them. The issues raised in this Complaint are therefore directly relevant to Potomac Economics' responsibility to monitor the performance of the Commission-jurisdictional markets in those regions and to bring problems affecting them to the Commission's attention. PJM's pseudo-tie requirement therefore has a fundamental impact on Potomac Economics' core mission as a market monitor under Order No. 719 and the Commission's implementing regulations

C. Related Proceedings

Rule 206(b)(6) requires complainants to "state whether the issues presented are pending in an existing Commission proceeding or a proceeding in any other forum in which the complainant is a party, and if so, provide an explanation why timely resolution cannot be achieved in that forum" There are other Complaint proceedings pending before the Commission that pertain to the allocation of congestion charges to pseudo-tied generation in the MISO and PJM.⁴⁶

PJM and MISO have also both recently made Section 205 filings that attempt to improve their pseudo-tie rules. But to the best of Potomac Economics' knowledge there is no pending Commission proceeding addressing the fundamental question of whether PJM's pseudo-tie requirement has proven to be unjust and unreasonable.

⁴⁶ See Midcontinent Independent System Operator, Inc. and PJM Interconnection L.L.C. *Status Update*, Docket Nos. EL16-108-000, EL17-29-000, EL17-31-000, EL17-37-000 (March 27, 2017) (providing informational update on efforts by MISO and PJM to resolve "congestion overlap" issue related to pseudo-tied generation in each RTO in four pending complaint dockets).

D. Documents that Support the Complaint

Rule 206(b)(8) requires that Complaints “include all documents that support the facts in the Complaint in possession of, or otherwise attainable by, the complainant, including, but not limited to, contracts and affidavits. . . .” The facts underlying this Complaint are set forth above and supported by the Attachments, including the Patton Affidavit.

E. Alternative Dispute Resolution Procedures

Rule 206(b)(9) requires that complainants specify whether the Enforcement Hotline, Dispute Resolution Service, tariff-based dispute resolution mechanisms, or other procedures were used, and if so why not. It also requires complainants to indicate whether alternative dispute resolution (“ADR”) under the Commission’s supervision could successfully resolve the Complaint. Potomac Economics has not availed itself of any ADR mechanisms and does not believe that any such mechanism could resolve the legal question raised by the Complaint. Only the Commission itself can establish that PJM’s pseudo-tie rules are unjust, unreasonable, and unduly discriminatory. Potomac Economics likewise does not believe that there is any realistic prospect of a negotiated resolution with PJM. Potomac Economics and MISO have raised these concerns repeatedly with PJM and PJM has affirmatively rejected making this change voluntarily.

F. Notice of Complaint

In accordance with Rule 206(b)(10), a form of notice suitable for publication in the Federal Register is attached to this Complaint.

G. Service

In accordance with Rule 206(c) a copy of this Complaint has been served on PJM, each of the individual state regulators that is a member of the Organization of PJM States, Inc. (“OPSI”), and each party in Docket No. ER17-1138-000.

IV. CORRESPONDENCE AND COMMUNICATIONS

All correspondence and communications in this proceeding should be addressed to:

Dr. David B. Patton
Potomac Economics, Ltd.
9990 Fairfax, Boulevard, Suite 560
Fairfax, VA 22030
(703) 383-0720

V. CONCLUSION

For the reasons stated above, Potomac Economics, respectfully requests that the Commission grant its Complaint and Order PJM to:

- i. Work cooperatively with MISO, NYISO, and other external control area operators as appropriate, to develop and file reasonable capacity delivery procedures (or a suitable alternative), and capacity import limits that reflect the aggregate deliverability of resources from each area.
- ii. Remove the requirements from its tariff that require external capacity resources to be pseudo-tied to PJM, at a minimum from control areas with approved capacity delivery procedures.

Respectfully submitted,

/s/ David B. Patton

David Patton
President
Potomac Economics, Ltd.

April 5, 2017

ATTACHMENT I

Affidavit of Dr. David Patton

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

Potomac Economics, Ltd.

v.

PJM Interconnection, L.L.C.

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Docket No. EL17-____-000

**AFFIDAVIT OF
DAVID B. PATTON, PH.D.**

I. Qualifications and Purpose

1. My name is David B. Patton. I am an economist and the President of Potomac Economics Ltd. Our offices are located at 9990 Fairfax Boulevard, Fairfax, Virginia 22030. Potomac Economics is a firm specializing in expert economic analysis and monitoring of wholesale electricity markets. Potomac Economics has served as the Independent Market Monitor (“IMM”) for Midcontinent Independent System Operator, Inc. (“MISO”) since 2002. Potomac Economics serves in a substantially similar role for the New York Independent System Operator, Inc. (“NYISO”), ISO New England, Inc. (“ISO-NE”), and the Electric Reliability Council of Texas (“ERCOT”).
2. As the Market Monitor for both MISO and NYISO, Potomac Economics is responsible for assessing the competitive performance of the markets that the RTOs administer, including identifying and remedying market design flaws and abuses of market power. This work has included preparing a number of reports that assess the performance of these markets and providing advice on numerous issues related to market design and economic efficiency. Among the issues that we monitor are the interactions between the MISO and NYISO markets and those of neighboring regions, and the impacts of those neighboring regions on the RTOs’ operations. Of particular relevance to this proceeding is the interaction of RTOs’ markets and the markets of the PJM Interconnection, L.L.C.’s (“PJM”).
3. I am very familiar with the PJM’s existing pseudo-tie requirements and the adverse impacts that they are having on MISO’s markets and operations. I have also assessed the potential

future adverse impacts associated with the proliferation of PJM pseudo-ties on both the MISO and other system operators in the Eastern Interconnection (particularly the NYISO).

4. I have worked as an energy economist for 26 years, focusing primarily on the electric utility and natural gas industries. I have provided strategic advice, analysis, and expert testimony in the areas of electric power industry restructuring, pricing, mergers, and market power. I have also advised Regional Transmission Organizations on transmission pricing, market design, and congestion management issues. With regard to competitive analysis, I have provided expert testimony and analysis regarding market power issues in a number of mergers and market-based pricing cases before the Federal Energy Regulatory Commission (“the Commission”), state regulatory commissions, and the U.S. Department of Justice.
5. Prior to my experience as a consultant, I served as a Senior Economist in the Office of Economic Policy at the Commission, advocating on a variety of policy issues including transmission pricing and open-access policies, market design issues, and electric utility mergers. As a member of the Commission’s advisory staff I worked on policies reflected in Order No. 888, particularly on issues related to power pool restructuring, independent system operators (“ISOs”), and functional unbundling. I also analyzed alternative transmission pricing and electricity auctions proposed by ISOs.
6. Before joining the Commission, I worked as an economist for the U.S. Department of Energy. During this time, I helped to develop and analyze policies related to investment in oil and gas exploration, electric utility demand side management, residential and commercial energy efficiency, and the deployment of new energy technologies. I have a

Ph.D. in Economics and a M.A. in Economics from George Mason University, and a B.A. in Economics with a minor in Mathematics from New Mexico State University.

7. The purpose of this affidavit is to support the analysis and factual assertions made in the complaint to which this affidavit is attached. In particular, it provides a more detailed discussion of three analyses referenced in the complaint that I performed to evaluate some of the adverse effects of the pseudo-ties in the MISO and PJM markets.

II. The Factual Assertions and Analyses Set Forth in the Complaint Are Correct

8. In the attached complaint, Potomac Economics asks the Commission to find that PJM's requirement that external Capacity Performance Resources in the PJM Reliability Pricing Model ("RPM") be pseudo-tied to PJM in order to avoid the applicable Capacity Import Limits ("CILs"), as well as other rules designed to implement the pseudo-tie requirements, are unjust and unreasonable. Potomac Economics asks the Commission to order PJM to modify its Open Access Transmission Tariff ("OATT") and Reliability Assurance Agreement to eliminate these pseudo-tie requirements.
9. The complaint demonstrates that the PJM pseudo-tie requirements are unjust and unreasonable because they impose substantial costs and related burdens on MISO and other neighboring regions, without any corresponding benefits to these regions or to PJM. The complaint shows that the PJM pseudo-tie rules substantially decrease market efficiency and degrade reliability, because they transfer operational control of the external Capacity Performance Resources from the native RTOs (MISO and NYISO) to PJM. This transfer of operational control over such resources gives rise to a substantial increase in transmission constraints that must be managed by market-to-market procedures. The

pseudo tying also triggers still other constraints and related reliability issues on neighboring systems that would not be coordinated under market-to-market procedures, but must be addressed unilaterally by the RTOs to which the pseudo-tied resources are interconnected. This pseudo ties also result in substantial dispatch inefficiencies and related congestion management issues in MISO and potentially in NYISO.

10. The complaint supports these assertions through our monitoring and analyses of market operations and outcomes in MISO and NYISO as the Market Monitor for these RTOs. Collectively, these analyses affirm our assertion that the PJM pseudo-tie rules impose substantial costs on MISO and other regions external to PJM, while providing no offsetting benefits to these entities, and comparatively minor benefits to PJM itself. In short, the analyses in the complaint demonstrate clearly that the PJM pseudo-tie rules are unjust and unreasonable.
11. I was closely involved in the development of Potomac Economics' complaint. I was personally involved in conducting all of the underlying analyses, including those described in the following sections, and in framing each argument. In my judgment, all of the factual assertions and analyses contained in the complaint are correct. In my opinion, PJM's pseudo-tie requirements and the related pseudo-tie rules are unjust and unreasonable and that the Commission should grant the relief sought by the complaint.

III. Dispatch Efficiency and Congestion Effects of the Pseudo-Tied Resources

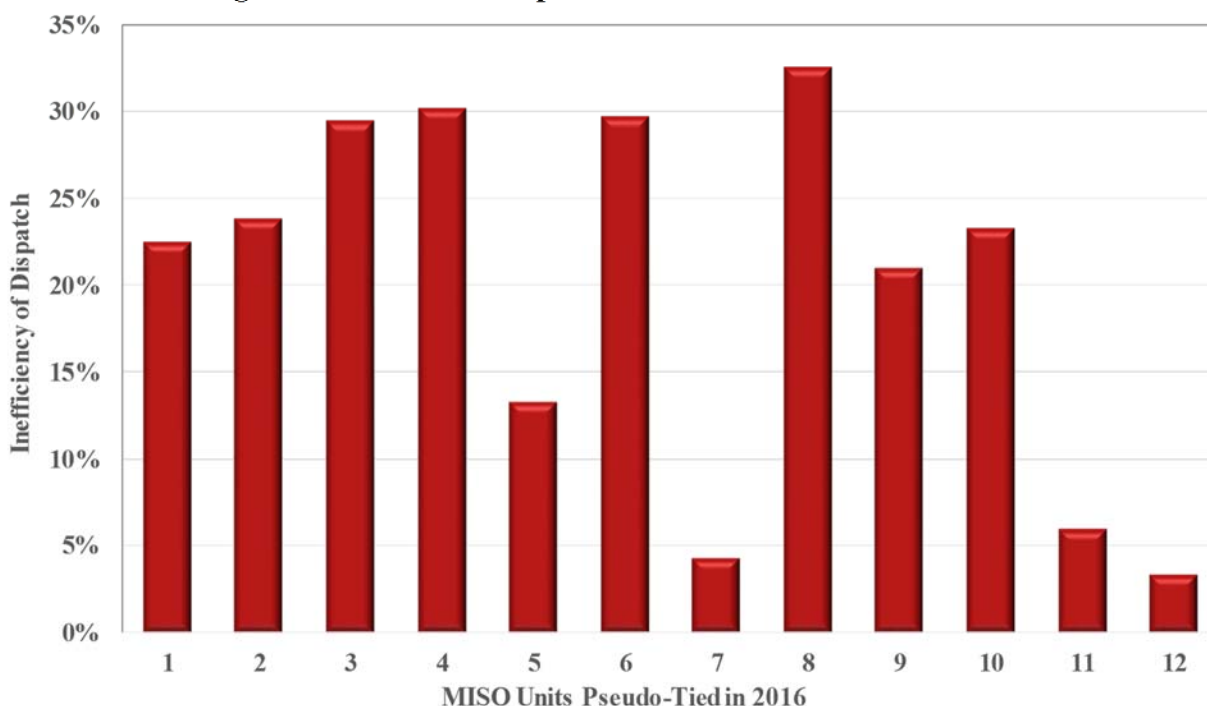
12. As the IMM for MISO, we have identified substantial dispatch inefficiencies and operational concerns associated with the proliferation of pseudo-ties. Many of these inefficiencies and operational issues are difficult or impossible to quantify. However, I

have produced two analyses designed to illuminate the problems caused by PJM pseudo ties in MISO.

13. First, I performed an analysis of the dispatch inefficiencies associated with the 12 resources that were pseudo-tied by PJM in 2016. I measured the value of the dispatch inefficiencies by calculating the economic value of the output deviation. The output deviation is the difference between the optimal dispatch level in MISO minus the units' actual output (based on PJM's dispatch). The output deviation will be positive when the unit produces less output than optimal in MISO and negative when it produces more output than optimal in MISO.
14. The optimal dispatch by MISO is based on our estimate of its production costs and ramp rate limitations. It is important to include ramp rates in the analysis because resources cannot instantaneously move to the most economic dispatch level. The optimal dispatch in MISO (based on its LMPs) is the benchmark because MISO's dispatch and prices fully capture all of the market-to-market constraints, non-market-to-market constraints, and transmission losses based on MISO's more complete and accurate model of the system where the unit is located.
15. I calculate a *net inefficiency* as the value of the output deviation to MISO (based on MISO's LMPs) minus the change in production costs to the unit of producing the optimal output. Hence, I calculated a value equal to: $(\text{output deviation} * \text{LMP}_{\text{MISO}}) - (\text{production cost of the output deviation})$. This value is generally positive and represents forgone production costs savings when the unit is under producing and inefficient production costs when the unit is over producing.

16. These inefficiencies are particularly large when congestion is affected by the pseudo-tied units. Therefore, I calculated the net inefficiency as a percentage for each on-line unit in hours when congestion was greater than \$5 per MWh at the units' locations by dividing the value of the net inefficiency by the total energy production costs of the units. The results of this analysis are shown in the Figure 1 for each of the twelve currently pseudo-tied units.

Figure 1: Inefficient Dispatch of MISO's Pseudo-Tied Units



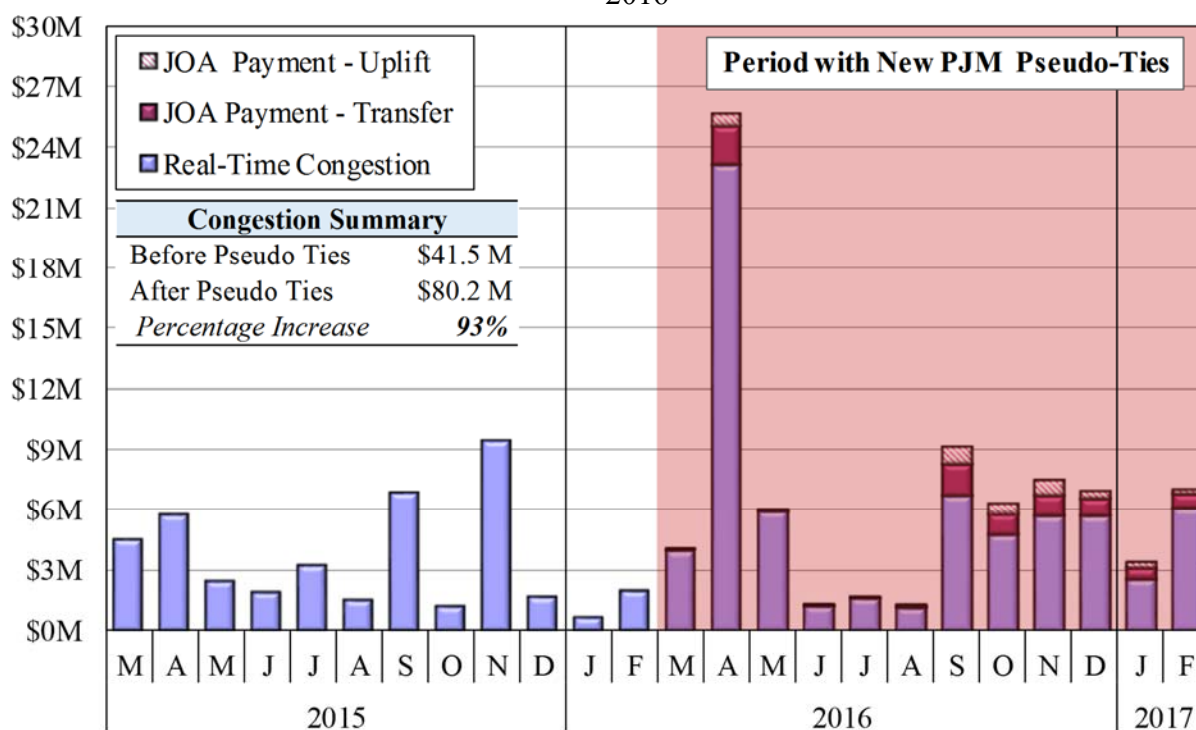
17. These results show that these units were dispatched inefficiently when they were online and affecting constraints on MISO's transmission system. Eight of the twelve units exhibited average inefficiencies greater than twenty percent. In other words, these units generally ran at levels that were much higher or much lower than optimal during congested periods.
18. The figure above shows only the inefficiencies that occurred when the units were online. It does not include periods when the units were clearly economic based on MISO's LMPs, but were not committed by PJM. This was a frequent occurrence for one set of pseudo-tied

units. When the inefficiencies in those periods are included, the weighted-average inefficiency exceeded 26 percent for the twelve pseudo-tied units.

19. These inefficiencies are substantial, but are very likely understated in our analysis because they do not include two other types of inefficiencies:
 - Cases where the units would not have been economically committed by MISO (*i.e.*, they were uneconomically committed through the PJM markets); or
 - Inefficiencies caused by MISO committing and dispatching other (non-pseudo-tied) units inefficiently because it does not know how the pseudo-tied units will be dispatched.
20. PJM incurs some of the costs implications of these problems because inefficient congestion management will often increase congestion costs on MISO's market-to-market constraints for which PJM bears cost responsibility.
21. Ultimately, the commitment and dispatch inefficiencies caused by pseudo-tying resources to PJM results in higher costs of managing the constraints that are affected by the pseudo-ties. Hence, monitoring the value of real-time congestion on constraints that are affected by the pseudo-ties is instructive. Figure 2 shows the real-time congestion value on all constraints that are now market-to-market constraints because of the twelve units that were pseudo-tied to PJM in 2016. To perform this analysis, we identified all constraints that bound in 2015 and 2016 that would qualify as market-to-market constraints only because of the pseudo-tied units. This includes constraints that were not market-to-market constraints in 2015, but would have become market-to-market constraints given the impacts of the pseudo ties that began in 2016.

22. Having established this fixed set of constraints that are most affected by the output of the pseudo-tied units, I then calculated the total economic value of real-time congestion on these constraints. The real-time congestion value is calculated as the real-time shadow price of the constraints times the total physical flow over the constraints. The real-time shadow price is MISO's marginal cost of managing the constraint. This accurately measures of the congestion actually occurring as the system is dispatched in real time.

Figure 2: Effects of Pseudo-Tying MISO Resources to PJM
2016



23. The left side of the figure shows the monthly congestion on these constraints for the year that preceded the initiation of the first tranche of pseudo-ties on March 1, 2016. The second tranche of pseudo-ties began on June 1, 2016. The pink shading to the right shows the real-time congestion value on the same constraints in those months that these pseudo-ties were in place. The two classes of payments made under the MISO-PJM Joint

Operating Agreement shown in this figure are the payments made by PJM to MISO associated with its market flows on these constraints.

24. Figure 2 shows that the real-time value of congestion on the new market-to-market constraints affected by the pseudo-ties has increased substantially since these units began being dispatched by PJM, some of which began in March and some in June 2016. As shown in the table, congestion costs on these constraints have risen 93 percent and the increases have been sustained. Five of the last six months studied exhibited real-time congestion greater than or equal to \$6 million on these constraints. In contrast, the figure shows that only two months over the year prior to the pseudo ties exhibited this level of real-time congestion.
25. I expect these effects to increase in the future as additional pseudo-ties begin as soon as June 2017. Additionally, I would note that congestion costs generally rise as natural gas prices rise because the MISO units that are re-dispatched to manage system flows are most often natural gas-fired units. Hence, inefficient congestion costs incurred because of the pseudo ties will likely rise further if natural gas prices rebound.
26. Again, I would note these analyses represent only some of the potential costs and inefficiencies caused by the pseudo ties. They do not include inefficiencies associated with congestion on the myriad of affected non-market-to-market constraints in MISO, the effects of conservative actions and parameters used by MISO operators to account for the uncertainties regarding the commitment and dispatch levels of the pseudo-tied resources, inefficient commitments of the pseudo-tied units, and the inefficient commitment of other MISO generators because the pseudo-tied resources are missing from the day-ahead

market. Although I believe these inefficiencies are substantial, there are extremely difficult to fully quantify.

27. Nonetheless, taken together with our evaluation of the dispatch efficiency of the pseudo-tied resources, the escalating congestion on these constraints indicate that the pseudo ties are decreasing the efficiency of the day-ahead and real-time markets in MISO, raising costs substantially, and ultimately producing unjust and unreasonable market outcomes.

IV. Range of Potential Price Effects in the PJM Capacity Market from Restricting External Capacity Resources

28. PJM's pseudo-tie requirement and proposed restrictions on pseudo-ties will reduce or eliminate imports of external capacity resources into PJM. This will result in sizable and uncertain capacity price increases that I discuss in this section. In recent years, PJM has cleared between 3900 and 4700 MW of external capacity resources. Over time, the effects on prices and capacity costs of excluding some or all of these imports from the PJM capacity market will be large and variable. In this section, I calculate the likely range of such price effects. The size of the price effects are determined by the slope of PJM's capacity demand curve and the elasticity of the supply in the range near the clearing price (determined by the amount of supply offered in this range).

High End of Price Effect Range -- No Supply Response

29. The highest effects will occur if there are no external resources offered close to the clearing price. In this case, the quantity that clears in the PJM auction will fall by an amount equal to the reduction in imports. The price change under these conditions will be determined by the slope of the capacity demand curve. Based on the slope of the PJM demand curve in

the 2019/2020 Base Residual Auction (“BRA”), if PJM were to clear 3000 MW less supply because external resources are restricted from selling, the clearing price in the BRA would rise roughly \$80 per MW-day. By multiplying this price increase by the quantity of capacity procured by PJM, I estimate that capacity costs in PJM would rise by more than \$4 billion.

Low End of Price Effect Range – Substantial Supply Response

30. The cost increase will be lower than the estimate above to the extent that PJM receives capacity offered at price levels close to the clearing price. Such offers will limit the price increase by clearing internal resources in place of the external resources. To evaluate this case, we reference a scenario analyses produced by PJM related to its Base Residual Auction (“BRA”) for planning year 2019/2020.¹ In particular, PJM presents a scenario that reduces supply offers outside of MAAC by 3000 MW. In reality, this scenario is similar to reducing external capacity resources by 2000 MW because roughly 1000 of the reduction is located in local zones where the procurements do not change significantly (e.g., ComEd and ATSI).
31. In this scenario, the RTO-wide price increases only \$7 per MW-day because PJM had a substantial quantity of capacity offers priced within \$7 of the original clearing price of \$100 per MW-day. For example, this \$7 per MW-day increase resulted in almost 1100 MW of additional resources clearing in MAAC and roughly 300 MW of additional resources clearing in other zones. These extra-marginal offers greatly mitigate the price

¹ This analysis is posted on PJM’s website at: <http://pjm.com/~media/markets-ops/rpm/rpm-auction-info/2019-2020-bra-scenario-analysis.ashx>

effects of excluding external resources in the short-term. Given that this scenario essentially reveals the effects of reducing imports by 2000 MW, I scaled the price effects up to estimate effects of losing 3000 MW of imports and found estimated an increase in total capacity costs of more than \$600 Million.

Estimated Range of Price Effects

32. The offers that would mitigate the price increase were offered near \$100 per MW-day, well below the cost of building a new unit in PJM (i.e., the “cost of new entry” or CONE). PJM cannot expect over the long-run to have a large quantity of offers that are priced well below CONE to mitigate the price effects of excluding external capacity resources. Over the long-run as these moderately-priced capacity offers diminish, the annual capacity cost increases in PJM associated with erecting uneconomic barriers to external capacity should increase. Based on the analysis above, the cost increase in any given year will be uncertain, but should fall in the range of \$0.5 billion to \$4 billion.
33. This concludes my affidavit.

ATTESTATION

I am the witness identified in the foregoing affidavit. I have read the affidavit and am familiar with its contents. The facts set forth therein are true to the best of my knowledge, information, and belief.



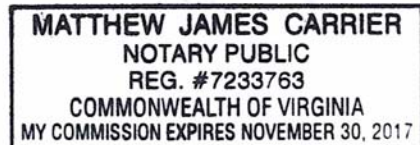
David B. Patton

April 4, 2016

Subscribed and sworn to before me
this 4th day of April, 2017



Notary Public



My commission expires: Nov. 30, 2017

ATTACHMENT II

MISO Pseudo-Tie Issue Paper

Pseudo-Tied Generation That Lacks Local Visibility:

Implications for reliability, costs, unit commitment/de-commitment processes, congestion management and other operational functions in the MISO footprint

Introduction

MISO is receiving an increasing number of requests for “pseudo-ties,” which allow electricity generating units that are physically located within the boundaries of the MISO Balancing Authority (BA) area to be operationally controlled and dispatched by a neighboring BA. Pseudo-tied units send their energy out of the MISO footprint to their “attaining” BAs, as they are known, using elements of the transmission system that are under MISO’s functional control.

Purpose of this Issues Statement

The objective of this paper is to identify the potentially problematic issues associated with existing and proposed pseudo-tied units located in parts of the MISO footprint where their attaining BAs lack visibility into how their use of these assets could detrimentally affect the MISO-controlled portion of the grid. Documenting these issues will help ensure that the appropriate stakeholder forum(s) will study these matters and propose solutions or alternate ways of delivering the capacity if deemed necessary.

MISO’s goal: Enabling the reliable, efficient delivery of capacity/energy

MISO’s overall goal in this area is to ensure that all of the MISO-based capacity and associated energy that clears markets operated by PJM Interconnection and other external entities is delivered in a reliable and efficient manner. While the pursuit of this goal may involve developing new processes, procedures and rules for pseudo-tied generation, it could also entail devising reliable and efficient alternatives to pseudo-ties. In other words, if transferring capacity/energy from MISO-based units to attaining BAs can be accomplished using means that are more reliable and efficient than pseudo-ties, MISO believes those options should be explored. Regardless of what avenues may be pursued in this area, all work will be conducted in a transparent manner through the MISO stakeholder process.

Interior & seams areas both affected

The issues identified in this paper are more likely to materialize when attaining BAs operate pseudo-tied units that are located deep within the interior portions of the MISO footprint. This is because attaining BAs typically lack a detailed and comprehensive ability to model power flows, transmission congestion and other dynamics in the innermost portions of the MISO region. However, pseudo-tied units that are located on or near MISO’s seams with neighboring BAs may also give rise to some of the detrimental issues described in this paper. Where appropriate, this paper attempts to identify the subset of issues associated with pseudo-tied units located on or near MISO’s seams.

Overview: Why limited visibility poses problems

As noted above, many of the issues pertaining to pseudo-tied units revolve around the limited visibility that attaining BAs have of the MISO-controlled portion of the grid. For example, an attaining BA might instruct a pseudo-tied unit to increase its output of energy without realizing that doing so would overload a local transmission element, jeopardizing reliability in the MISO system.

MISO, in turn, may have to guard against that possibility by committing one or more of the higher-priced units under its functional control to provide sufficient “counterflow” energy to ameliorate any potential congestion. And that could cause market-inefficiency and cost-related issues, because the costs of

committing those units—whether they actually ran for congestion-management purposes or not—would be borne by MISO Market Participants.

Allowing generation to pseudo-tie out of MISO can also cause other issues, including:

- Making it difficult to accurately calculate market flows which could cause reliability issues with congestion-management processes (TLR and M2M).
- Complicating market processes for committing and de-committing units.
- Sending inaccurate price signals, which could create market inefficiencies and reliability issues.
- Creating uncertainty about how to make pseudo-tied units financially “whole” for operating in situations deemed necessary by their “native” BAs.
- Raising questions about what type of transmission service pseudo-tied units should have, and how the costs of needed transmission upgrades for pseudo-tied units are allocated.
- Creating uncertainty for native BAs when pseudo-tied units either suspend their operations or are retired from service without advance notification.
- Potentially double-charging congestion costs to pseudo-tied units.

Historical Context & Background

Historically, the pseudo-tie requests that MISO has received have involved units located near MISO seams with neighboring BAs, such as PJM Interconnection and Southwest Power Pool. To date, pseudo-tied units located near MISO seams have not led to significant reliability events. This has been due to the limited volume of pseudo-ties, and the fact that they are located electrically near their attaining BAs' borders. However, even pseudo-tied units located near MISO's seams could potentially give rise to certain issues, such as complicating the unit commitment/de-commitment process.

Recent Trends & Developments

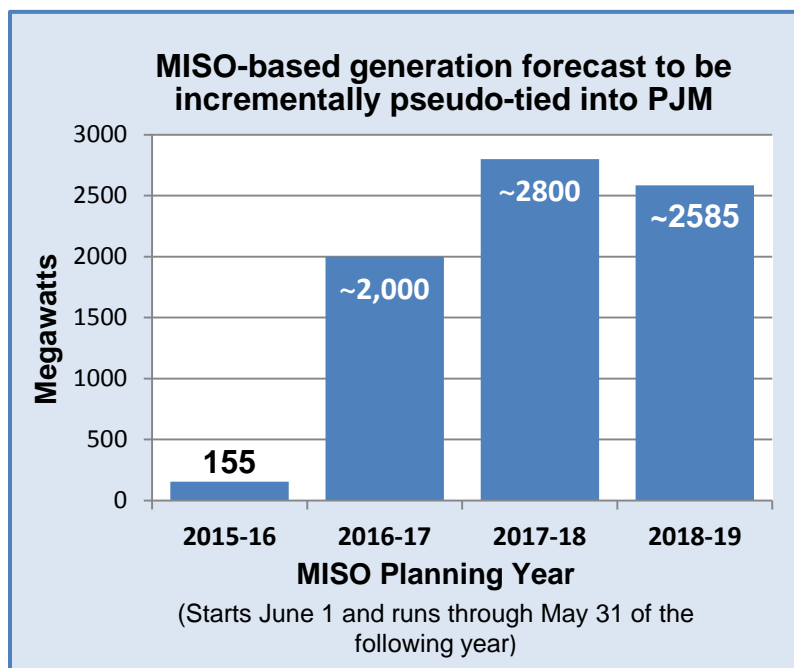
In a shift away from this historical pattern, MISO is now receiving pseudo-tie requests from units that are located deep within the footprint, where attaining BAs have very limited or no modeling-based visibility of how their use of these pseudo-tied units could affect the MISO-controlled grid system.

For example, MISO-based generation pseudo-tied into PJM is expected to increase incrementally from 155 MW in 2015-16 to about 2,000 MW in 2016-17, and to about 2,800 in 2017-2018, as the chart on the right illustrates.

Much of this pending pseudo-tied generation is located in load pockets within the MISO system, and the units in question may need to utilize frequently congested elements of the MISO-controlled transmission system to move their energy to PJM. These and other factors could increase the chances that these pseudo-tie requests, if granted, could give rise to potentially detrimental issues in the MISO region.

Additional details on these potential issues

MISO staff has identified a number of potential issues regarding pseudo-tied units controlled by BAs



that have limited or no insight into how dispatching them could affect the MISO system. The following table, which reflects feedback offered by stakeholders, highlights these areas of concern:

Issues Related to Grid Reliability
<p>Congestion-Management Issues: The primary concern here is that an attaining BA that lacks visibility into MISO’s system could change the output of a pseudo-tied unit without realizing that doing so would exacerbate congestion on the MISO-controlled portion of the grid, possibly even causing a MISO transmission operating limit to be exceeded.</p> <ul style="list-style-type: none"> • MISO, PJM, SPP and other system operators are parties to a Congestion Management Process (CMP) that is designed to allow two or more entities to monitor and control the flow of energy through Coordinated Flowgates, which help to manage congestion. • Through the CMP, neighboring entities coordinate to determine how they can relieve congestion by dispatching the resources in both of their footprints in the most economical manner possible. To date, this process has worked well in the vicinity of market seams, where neighboring BAs have reasonable modeling-based visibility into each other’s systems. • However, the pseudo-tie requests that MISO is now receiving from units located deep within the footprint may raise congestion-related concerns because the attaining BAs that would dispatch those units do not have a detailed understanding of how their use of those units could affect the MISO system. • Without detailed transmission network models, an attaining BA’s real-time applications could not determine accurate market flows and generator sensitivities. Consequently, as MISO’s Independent Market Monitor (IMM) has observed, congestion-management processes, including Market-to-Market and NERC Transmission Loading Procedures, will not work properly, possibly leading to reliability issues. • Additional Coordinated Flowgates would be created if MISO grants the pseudo-tie requests that are currently pending for units located deep within the footprint. Accurate modeling of the pseudo-tie units and area transmission system is necessary to support a larger number of Coordinated Flowgates. • If MISO grants the pseudo-tie requests that are currently pending for units located deep within the footprint, MISO would need to work with neighboring BAs to establish additional Coordinated Flowgates. Attaining BAs would need to support such additional flowgates by accurately modeling the portions of the MISO footprint where their pseudo-tied units are located, including the low-voltage transmission system.
<p>Unit Commitment / De-Commitment Issues: The need for adequate modeling goes beyond just managing congestion. Other situations can arise in which a “native” BA—meaning the BA in which a pseudo-tied unit is physically located—may have a need to commit or de-commit a pseudo-tied resource that it does not control to maintain the transmission system within thermal and voltage operating limits.</p> <ul style="list-style-type: none"> • The CMP and MISO’s Emergency Operating Procedures discuss re-dispatch of generation in neighboring footprints, but do not authorize commitment/de-commitment, outside of declaring a “Safe Operating Mode.” • Local transmission issues could require a native BA or transmission operator to quickly commit or de-commit a pseudo-tied unit in order to maintain the reliable operation of the Bulk

Electric System.

- Similarly, neighboring system operators may also allow their MISO-based pseudo-tied units to take outages at times that are not optimal for those units to be unavailable to MISO for addressing local issues that may arise on very short or no advanced notice.

Issues Related to Higher Costs, Increased Uplift & Market Inefficiencies

As described briefly above, MISO's lack of visibility into the operation of pseudo-tied units that are controlled by distant BAs may require MISO to take certain actions in the commitment and dispatch processes that could increase the costs borne by MISO Market Participants.

- This issue revolves around the fact that prior to the start of a given operating day in the Day-Ahead Market, MISO will likely not know if a pseudo-tied unit (or units) located deep within the footprint will be called on to run by its attaining BA, and, if so, at what level(s) of output.
- This means MISO is not likely to know in advance if one or more pseudo-tied units will be dispatched in a manner that could cause or contribute to unsafe levels of transmission congestion on MISO-controlled portions of the grid.
- Consequently, MISO may have to "assume the worst" and commit one or more of the higher-priced units under its functional control to provide enough counterflow energy—should it be needed—to ameliorate any congestion caused by pseudo-tied units.
- Even if these assume-the-worst units were not needed for congestion-management purposes, the additional costs of committing them in the Day-Ahead Market would be borne by MISO Market Participants. This is the case because currently, the market provides no mechanisms to allocate these costs to the pseudo-tied units and their attaining BAs.
- The costs of committing additional units to guard against potential congestion issues caused by pseudo-tied units also have the potential to increase uplift.
- Similar issues exist in the Real-Time Market, as MISO will not know if pseudo-tied units will turn on, turn off, ramp up or ramp down in the next market interval. That means MISO must again assume the worst and "carve out" space to accommodate the uncertainty of the pseudo-tied units' output. As a consequence, MISO will underutilize the transmission system, which will increase costs borne by MISO Market Participants.

Issues Related to Accurate Price Signals

In order for MISO-based pseudo-tied units to be committed, de-committed and dispatched in an efficient manner, their attaining BAs must act according to price signals that reflect market conditions within the MISO footprint where those units are located. High prices generally signal the need for additional generation, while low prices signal the need to reduce generation.

- This basic market process will be distorted if MISO-based pseudo-tied units are dispatched on the basis of prices in the areas outside of MISO where their energy will be sent, as opposed to the areas within MISO where the units are physically located.
- Unless attaining BAs develop, maintain and operate detailed and accurate transmission models of the MISO-controlled areas where their pseudo-tied units are physically located, they will be unable to develop and send accurate price signals to those units.

- The following hypothetical example illustrates why attaining BAs must be able to model the system and market conditions in the vicinities of their remote, pseudo-tied units so they send appropriate price signals:
 - Assume there is a unit in a local load pocket in MISO that is pseudo-tied into PJM via either the low-voltage or high-voltage transmission system. Further assume that this unit has a contributing shift factor on a constraint that is binding.
 - Under this hypothetical scenario, MISO may calculate a Locational Marginal Price (LMP) of \$10/MWh that reflects the unit's contribution to the binding constraint. But if PJM does not have the ability to accurately model the transmission system in that part of MISO, it may calculate an LMP of \$50/MWh.
 - In this example, the pseudo-tied unit **should** respond to the \$10/MWh price signal and **reduce** its output of energy to reflect the actual market conditions—including the binding constraint on the transmission system—that exist where it is physically located.
 - But if the unit is dispatched on the basis of the \$50/MWh price signal that does not accurately reflect local market conditions, the unit may **ramp up** its output of energy, thereby increasing costs and reliability risks in the MISO system.

Issues Related to Making Committed Pseudo-Tied Units Financially Whole

- Even though MISO does not have nominal control of the pseudo-tied units within the footprint, situations may occasionally arise that require MISO to request commitment of a pseudo-tied unit to address a local reliability issue that cannot be remedied in any other way. In these types of situations, there may not be formal processes or procedures in place for the pseudo-tied units to be financially compensated for their fuel and other costs.
- While these types of situations may be worked out on a case-by-case basis, they may also require more formal procedures, such as tariff changes.

Issues Related to Pseudo-Tied Units Obtaining Appropriate Transmission Service

- Historically, MISO has not required pseudo-tied units to obtain long-term firm transmission service to move their energy from MISO to their attaining BAs. As was explained above, this is because pseudo-tied units have historically been located on or near MISO's seams with their attaining BAs, which allowed them to move their energy with short-term firm service without causing transmission problems in the MISO footprint.
- However, because MISO is now receiving pseudo-tie requests from units that are located in the interior parts of the footprint far away from their attaining BAs, there is a greater potential for those units to cause or contribute to the types of transmission-related issues and higher costs that are described throughout this paper.

Issues Related to Pseudo-Tied Units that Retire or Suspend Operations

- Once a unit in the MISO footprint pseudo-ties to another BA, it is no longer considered a generation resource in MISO's markets. Accordingly, owner of pseudo-tied units are not obligated to inform MISO of their decision to retire or suspend operations.

- When pseudo-tied units retire or suspend without notification, MISO cannot proactively model how their absence could affect the local transmission system to which they were connected. Moreover, they can no longer be used to address an emergency in the MISO footprint, which could cause reliability issues.

Issues Related to Double-Counting Congestion for Pseudo-Tied Units

- This potential issue revolves around the fact that MISO and PJM both collect congestion fees for generating units that are physically located in the interior of the MISO footprint and pseudo-tied to PJM.
- MISO plans to charge congestion fees based on the partial path from the pseudo-tied unit's location in MISO to the PJM interface. Conversely, PJM plans to charge congestion based on the entire path from the pseudo-tied unit's location in MISO to PJM load.
- These different methods of calculating congestion raise the possibility that MISO-based pseudo-tied units will be charged in both systems for the same binding market-to-market constraints.

Conclusion / Next Steps

MISO staff believes that the issues identified in this paper pose pressing challenges that should be urgently addressed through the stakeholder process. Staff respectfully asks the Steering Committee to assign these issues to the appropriate stakeholder forum(s) for further study and action. And since many of the pending pseudo-tie requests would result in the transfer of capacity/energy from the MISO footprint to the PJM region, MISO will continue to work with PJM to ensure that these transfers will be accomplished in a reliable and efficient manner.

As explained above, MISO's overall goal in this area is to ensure that all of the MISO-based capacity and associated energy that clears PJM's Capacity Market is delivered without jeopardizing the reliability of the MISO system or imposing additional costs and operational inefficiencies on MISO Market Participants. If that result can be achieved by developing new processes, procedures and rules for pseudo-tied generation, MISO would support pursuing that approach in collaboration with stakeholders and PJM. However, if MISO, PJM, asset owners and/or stakeholders identify any alternatives to pseudo-ties that may be able to accomplish this deliverability goal in a more reliable and efficient manner, MISO would support exploring those alternatives as well.

ATTACHMENT III

**MISO Proposal of
Capacity Delivery Procedures
at
Joint and Common Market Meeting
May 2016**

MISO Proposal

- The Host RTO:
 - Would be obligated to deliver energy associated with capacity resources
 - Will schedule the firm export subject to notice being provided by the attaining RTO
 - Shall not curtail the firm exports until it declares Capacity Emergency (Level 5) that results in the shedding of firm load
 - Would enforce a Day-Ahead must offer requirement on all external capacity sales
 - Would provide timely resource status information necessary to enforce attaining RTO's capacity performance framework
- When scheduled, the external capacity supplier will settle the export with both RTOs
- Both RTOs would have joint authority to review and approve planned outages

NOTICE OF COMPLAINT

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

Potomac Economics, Ltd.)	
)	
Complainant)	
)	
v.)	Docket No. EL17-____-000
)	
PJM Interconnection, LLC)	
)	
Respondent)	

Notice of Complaint
(April ___, 2017)

Take notice that on April 6, 2017, Potomac Economics, Ltd. (“Potomac”) filed a formal complaint pursuant to Sections 206 and 306 of the Federal Power Act against the PJM Interconnection, LLC (“PJM”). The Complaint asks that the Commission direct PJM to revise its Open Access Transmission Tariff (“OATT”) and Reliability Assurance Agreement Among Load-Serving Entities in the PJM Region (“RAA”) to eliminate the existing requirement that resources located external to PJM seeking to offer as Capacity Performance Resources in PJM be pseudo-tied into PJM. The Complaint asserts that PJM’s pseudo-tie requirement is unjust, unreasonable, and unduly discriminatory.

Potomac certifies that copies of the complaint were served on PJM, the Organization of PJM States, Inc. agencies and all of the parties in Docket No. ER17-1138-000.

Any person desiring to intervene or to protest this filing must file in accordance with Rules 211 and 214 of the Commission’s Rules of Practice and Procedure (18 CFR 385.211 and 385.214). Protests will be considered by the Commission in determining the appropriate action to be taken, but will not serve to make protestants parties to the proceeding. Any person wishing to become a party must file a notice of intervention or motion to intervene, as appropriate. The Respondent’s answer and all interventions, or protests must be filed on or before the comment date. The Respondent’s answer, motions to intervene, and protests must be served on Complainants.

The Commission encourages electronic submission of protests and interventions in lieu of paper using the “eFiling” link at <http://www.ferc.gov>. Persons unable to file electronically should submit an original and 14 copies of the protest or intervention to the Federal Energy Regulatory Commission, 888 First Street, N.E., Washington, D.C. 20426.

This filing is accessible on-line at <http://www.ferc.gov>, using the “eLibrary” link and is available for review in the Commission’s Public Reference Room in Washington, D.C. There is an “eSubscription” link on the web site that enables subscribers to receive email notification when a document is added to a subscribed docket(s). For assistance with any FERC Online service, please email FERCOnlineSupport@ferc.gov, or call (866) 208-3676 (toll free). For TTY, call (202) 502-8659.

Comment Date: 5:00 pm Eastern Time on (insert date).

Kimberly D. Bose
Secretary