

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

PJM Interconnection, L.L.C.

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Docket No. ER18-88-000

COMMENTS OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to Rule 211 of the Commission’s Rules and Regulations,¹ Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor for PJM² (“Market Monitor”), submits these comments on the response of PJM Interconnection, L.L.C. (“PJM”) filed December 22, 2017, to the request for additional information from Commission issued November 22, 2017.

I. COMMENTS

- 1. PJM states that 90 percent of profitable UTCs create a divergence between the day-ahead and real-time energy markets on one end of the transaction. [footnote omitted] Please provide data analysis supporting this statement beyond information already provided in the Virtual Transactions Whitepaper.**

Profitable UTCs can simultaneously contribute to price convergence and price divergence at their source and sink points. The profitability of a UTC transaction is the net of the separate profitability of the component injection and withdrawal, meaning that a UTC can be profitable if the profit on one side of the UTC transaction exceeds the losses on the other side. This means that a UTC can be profitable and contribute to price divergence

¹ 18 CFR § 385.211 (2017).

² Capitalized terms used herein and not otherwise defined have the meaning used in the PJM Open Access Transmission Tariff (“OATT”) and the PJM Operating Agreement (“OA”).

on one side while contributing to price convergence at the other side. In addition, UTCs cannot, due to the fact that UTCs cannot affect overall system power balance, contribute to system-wide energy price convergence. Therefore UTCs cannot affect system wide price convergence if it were related to system-wide, systematic scheduling imbalances caused by generation or load withholding. However, UTCs can contribute to price convergence and price divergence between and among zones between day-ahead and real-time if injections and withdrawals are in different zones.

In 2016, 48.3 percent of all cleared UTC transactions were profitable and 51.7 percent of all cleared UTC transactions were unprofitable. Of cleared UTC transactions, 64.4 percent were profitable on the source side and 35.0 were profitable on the sink side but only 5.6 percent were profitable on both the source and sink side.³

Table 1 shows the number of cleared UTC transactions, the number of profitable cleared UTCs, the number of cleared UTCs that were profitable at their source point and the number of cleared UTCs that were profitable at their sink point in the first nine months of 2016 and 2017. In the first nine months of 2017, 53.6 percent of all cleared UTC transactions were net profitable. Of cleared UTC transactions, 63.3 percent were profitable on the source side and 37.5 were profitable on the sink side but only 4.9 percent were profitable on both the source and sink side.

³ See 2016 *State of the Market Report for PJM*, Vol. 2 (March 9, 2017) at 166.

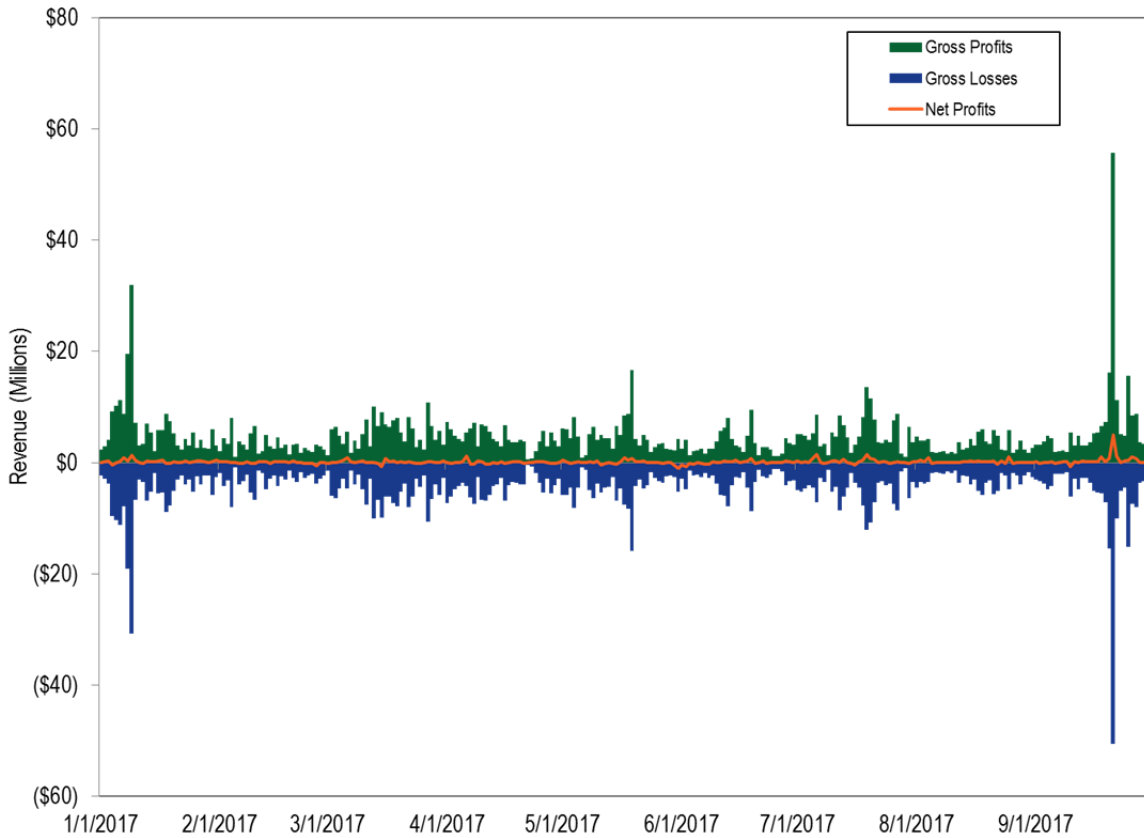
Table 1 Cleared UTC profitability by source and sink point: January 1 through September 30, 2016 and 2017⁴

Jan-Sep	Cleared UTCs	Profitable UTCs	UTC Profitable at Source Bus	UTC Profitable at Sink Bus	Profitable UTC	Profitable Source	Profitable Sink
2016	15,685,907	7,421,938	10,032,684	5,491,915	47.3%	64.0%	35.0%
2017	14,588,801	7,824,106	9,236,774	5,465,683	53.6%	63.3%	37.5%

Figure 1 shows total UTC daily gross profits and losses and net profits and losses in the first nine months of 2017.

⁴ See 2017 Q3 State of the Market Report for PJM, Vol. 2 (November 9, 2017) at 182. Calculations exclude PJM administrative charges.

Figure 1 UTC daily gross profits and losses and net profits: January 1 through September 30, 2017⁵



The Market Monitor found that UTC profitability was primarily driven by the predictably unmodeled transmission constraints in the day-ahead market that were binding in the real-time market. In such circumstances UTCs did not bring convergence in prices, commitment, or dispatch between the day-ahead and real-time markets. UTC profits resulting from these circumstances continued until PJM intervened and included the unmodeled constraints in the day-ahead market. There is no evidence that UTCs contribute to price convergence or to market efficiency improvements in the PJM market.

⁵ See 2017 Q3 State of the Market Report for PJM, Vol. 2 (November 9, 2017) at 182. Calculations exclude PJM administrative charges.

- 2. Please provide any data analysis, beyond information already provided in the Virtual Transactions Whitepaper, that has been conducted to compare the day-ahead and real-time locational marginal price convergence at: (1) PJM's proposed INC/DEC bidding locations with the current INC/DEC bidding locations; and (2) PJM's proposed UTC bidding locations with the current UTC bidding locations.**

No evidence has been provided that supports the claim that virtual bids converge day-ahead and real-time prices under the existing set of bid locations. There have been assertions that the use of virtual products by third party participants can result in price and market solution convergence. These assertions are based on conclusions drawn from work with theoretical static equilibrium models that assume that the day ahead and real time market models are identical and that the virtual products have profit incentives consistent with point specific price convergence. Within the PJM system, the assumption of identical day ahead and real time markets is not correct and the assumption that the profit incentives of UTC are consistent with point specific price convergence is also not correct.

As stated in the Market Monitor's response to question 1, profitable UTCs can simultaneously contribute to price convergence and divergence at their source and sink points. The profitability of a UTC transaction is the net of the separate profitability of the component of injection and withdrawal, meaning that a UTC can be profitable if the profit on one side of the UTC transaction exceeds the losses on the other side. A UTC can therefore be profitable and contribute to divergence on one side while contributing to convergence at the other side.

Further, there are systematic modeling differences between the PJM day-ahead and PJM real-time market. In PJM, the day-ahead market model is a simplified approximation of the real-time model with a greatly reduced number of enforced constraints. As a result of their impact on the day-ahead market solution time, PJM limits the number of potentially binding constraints that it includes in the day-ahead solution. On average, PJM only models about 25 percent of the physical transmission elements in the day-ahead market. PJM is selective in the constraints it enforces in the day-ahead market, based on its expectations

regarding real-time prices, real-time congestion and the set of generation units PJM believes it will require in the real-time market. The day-ahead enforced constraints and their limits change over time, and can change hourly within the day. PJM selects day-ahead constraints that are most important in aligning the hourly results of the day-ahead and real-time markets. Profitable nodal trading opportunities caused by these modeling differences do not improve the efficiency of the market. These are false arbitrage opportunities. If the price differences between the day-ahead and real-time market within a zone are created by the exclusion of a constraint in the day-ahead market, no amount of virtual activity will align the market results. The only outcome will be a wealth transfer among participants.

The effect of systematic modeling differences on day-ahead and real-time prices are minimized at PJM's aggregates, as they reflect zonal load weighted day ahead and load weighted real time averages of hourly nodal prices. Limiting bidding points to these aggregates reduces the opportunities for false arbitrage.

PJM's actions in selecting constraints in the day-ahead market are explicitly designed to converge the day-ahead and real-time market results and generally succeed in that effort. Virtual transactions that take advantage of PJM's mistakes when the day-ahead constraints do not match real-time constraints are simply extracting revenues from the market that would otherwise belong to load or generation and are not contributing to efficiency or convergence.

Virtual profitability of INCs, DECs and UTC is primarily a result of constraints not modeled by PJM in the day-ahead model that bind in the real-time market. As with INCs and DECs, UTCs did not bring convergence in LMPs, commitment, or dispatch between the day-ahead and real-time markets. UTC profits resulted from the modeling differences and continued until PJM included the relevant constraints in the day-ahead market. There is no evidence that UTCs contribute to price convergence or to market efficiency improvements in the PJM market.

- 3. PJM states that Virtual Transactions can skew transmission flows and congestion patterns in a manner inconsistent with real-time system operations, and in large volume, can significantly degrade the performance of the day-ahead energy markets. [footnote omitted] Please explain in detail: (1) how the impacts of Virtual Transactions on congestion degraded the performance of the day-ahead market in a way that is not consistent with the real-time market; and (2) how the current proposal to reduce bidding points for Virtual Transactions can address the identified performance issues related to congestion in the day-ahead market.**

As a result of their impact on the day-ahead market solution time, PJM limits the number of potentially binding constraints that it includes in the day-ahead solution. On average, PJM only models about 25 percent of the physical transmission elements in the day-ahead market.

PJM is selective in the constraints it enforces in the day-ahead market, based on its expectations regarding real-time prices, real-time congestion and the set of generation units PJM believes it will require in the real-time market. The day-ahead enforced constraints and their limits change over time, and can change hourly within the day. PJM selects day-ahead constraints that are most important in aligning the hourly results of the day-ahead and real-time markets. Constraints that are not enforced in the day ahead market cannot and do not restrict flows to physical limits in the day ahead market solution.

Unenforced constraints create false arbitrage opportunities that are often pursued via “penny bids” using the UTCs product. The pursuit of false arbitrage opportunities generate flows within the day ahead market which are not physically possible in the real time market.

If the point specific price differences between the day-ahead and real-time market at individual price nodes within a zone are created by the exclusion of a constraint in the day-ahead market, no amount of virtual activity will align the market results. The only outcome will be a wealth transfer among participants. In such circumstances, the profits pursued through UTCs cannot bring convergence in prices, commitment, or dispatch between the day-ahead and real-time markets, no matter how many MW of UTC offer in the day-ahead market.

PJM's proposal to limit UTC source and sink points eliminates opportunities to pursue false arbitrage opportunities created by differences in the day ahead and real time market model.

4. **PJM proposes to allow UTCs to bid only at hubs, load zones, and interfaces, but not generation buses. [footnote omitted] However, PJM stated in the Virtual Transactions Whitepaper that the inclusion of generation buses (as sources only) would allow market participants a method to hedge generation or load against real-time congestion.[footnote omitted] Please explain why it is appropriate to eliminate generation buses (as sources only) as bidding points for UTCs. Further, please explain why it is appropriate to eliminate generation buses as available bidding points for the sink side of a UTC.**

See PJM's response.

5. **Please provide any data analysis, beyond information already provided in the Virtual Transactions Whitepaper that compares day-ahead market solution times between: (1) PJM's proposed INC/DEC bidding locations and the current INC/DEC bidding locations; and (2) PJM's proposed UTC bidding locations and the current UTC bidding locations.**

See PJM's response.

6. **PJM states that it determines the distribution of day-ahead load within a zone using the real-time load distribution for that zone from the same day a week prior, and argues that allowing Virtual Transactions at individual load buses can undermine this distribution because it can shift transmission flows in a manner inconsistent with real-time operations. [footnote omitted] Please explain whether Virtual Transactions at individual load buses can also provide commitment and/or price convergence benefits if, for example, the real-time load distribution is different from the distribution that PJM models in the day-ahead market. Please provide any data analysis, beyond information already provided in the Virtual Transactions Whitepaper that compares the benefit to the harm caused by allowing Virtual Transactions at individual load buses.**

See PJM's response.

7. **Please list each category of pricing locations (e.g., nodes where generators have retired) that PJM proposes to remove from eligibility for INCs and DECs. For each category, please: (1) list the number of pricing locations that would be removed; (2) describe the purpose this type of pricing location currently serves in the market; and (3) provide a brief justification for removal from eligibility.**

See PJM's response.

8. **Please list each category of pricing locations (e.g., nodes where generators have retired) that PJM proposes to remove from eligibility for UTCs. For each category, please: (1) list the number of pricing locations that would be removed; (2) describe the purpose this type of pricing location currently serves in the market; and (3) provide a brief justification for removal from eligibility.**

See PJM's response.

9. **PJM proposes to transition UTCs from a nodal product to a zonal product. Please explain why it is appropriate to only allow UTCs to be available at the zonal level and to move away from pricing at the nodal level. Please provide any specific data analysis in your explanation.**

PJM's proposal does transition UTCs from a nodal product to a zonal product. PJM's proposal limits opportunities for UTCs to pursue false arbitrage opportunities that cannot result in nodal price convergence.

10. **PJM states UTCs, unlike INCs and DECs, do not have a real-time equivalent. [footnote omitted] Please provide further explanation than is stated in PJM's transmittal letter as to how a UTC does not have a real-time equivalent, in contrast to an INC or DEC.**

See PJM's response.

11. **Please explain how UTCs are modeled in the software compared to INCs and DECs. Are UTCs and INCs and DECs treated differently in day-ahead commitment and scheduling runs?**

See PJM's response.

12. Please explain how UTCs are modeled in the software compared to INCs and DECs. Are UTCs and INCs and DECs treated differently in day-ahead commitment and scheduling runs?

- a. PJM states that it proposes to allow UTC trading to occur at hubs, zones, and interfaces, but not at individual nodes.²¹ However, PJM's proposed Tariff language states that:

Up-to Congestion Transactions may only be submitted at hubs, Residual Metered Load and interfaces not described in Tariff, Attachment K-Appendix, section 2.6A(b).

Please clarify whether UTC trading is meant to occur at Residual Metered Loads or Load Zones.

See PJM's response.

13. PJM states that there are discrepancies between the day-ahead and real-time models that provide opportunities for Virtual Transactions to profit without providing any convergence benefit.²³ For example, PJM describes dead buses as disconnected from the system due to the topology surrounding the bus.²⁴ PJM states that dead buses are currently valid trading points in the day-ahead market and that LMPs for dead buses are calculated differently in the day-ahead and real-time markets. Please explain why PJM does not or is not able to address modeling discrepancies between the day-ahead and real-time markets. Are these discrepancies transient or persistent in nature? Would PJM's filing eliminate the availability of dead buses as virtual trading locations?

See PJM's response. See also Market Monitor answers to questions 1, 2 and 3.

II. CONCLUSION

The Market Monitor respectfully requests that the Commission afford due consideration to these comments as the Commission resolves the issues raised in this proceeding.

Respectfully submitted,



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Dated: January 12, 2018

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Eagleville, Pennsylvania,
this 12th day of January, 2018.



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