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

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| PJM Interconnection, L.L.C. | ) | Docket No. AD19-16-000 |

**COMMENTS OF THE INDEPENDENT MARKET MONITOR FOR PJM**

Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor ("Market Monitor") for PJM Interconnection, L.L.C. ("PJM"),[1] submits these comments responding to the notice of information collection and request for comments issued in this proceeding on July 3, 2019 ("July 3rd Notice").

The efforts of Commission staff to create an improved common set of metrics that will improve the transparency of RTO/ISO markets and make intermarket comparisons easier is welcome and worthwhile. In most cases, calculating and posting the proposed metrics would represent a significant improvement. The Market Monitor includes here some suggestions for improvement of some of the listed metrics.

## I. COMMENTS

**Metric 1.** Reserve Margins: In PJM, the peak load forecast is calculated and posted prior to the capacity auction, so the amount of committed capacity used in the initial reserve margin calculation for a planning period should be based on the base residual auction results for that planning period, not the

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[1] Capitalized terms used herein and not otherwise defined have the meaning used in the PJM Open Access Transmission Tariff ("OATT"), the PJM Operating Agreement ("OA") or the PJM Reliability Assurance Agreement ("RAA").

committed capacity "at the time the Forecasted Peak Demand was calculated for the reporting period." In PJM, the calculated reserve margin for a planning period can change after the base residual auction as a result of updates to the peak load forecast, incremental auction results, and replacement capacity transactions. The Market Monitor recommends use, for the PJM metric, of the base residual auction results for relevant planning period(s).

**Metric 2.** Average Heat Rate: The average heat rate can be used to calculate changes in the efficiency of fuel consumption for power production but because it does not distinguish between the fuel used to start generators and the fuel used to produced power, some data points will be misleading. This will be a more significant issue for steam turbines and combined cycles that have low capacity factors or that start frequently. The average heat rate results in these cases would incorrectly indicate a decrease in efficiency because the decrease in average heat rate is the result of a change in the nature of plant operation. This issue also affects combustion turbines but to a lesser degree because combustion turbines require significantly less fuel to start. If a system average heat rate is used, this issue could be pointed out in the explanatory material.

**Metric 3.** The proposed fuel diversity metric is generation by fuel type and capacity by fuel type. This is a useful metric and the Market Monitor calculates and reports this metric. The Market Monitor has also recently developed an improved fuel diversity metric that permits use of a single number to compare fuel diversity across systems. The Market Monitor recommends use of Monitoring Analytics Fuel Diversity Index (FDI) in addition to, or in place of, the proposed fuel diversity metrics. Monitoring Analytics

developed the FDI to provide an objective metric of fuel diversity. The FDI metric is similar to the HHI used to measure market concentration. The FDI is defined as $1 - \sum_{i=1}^{N} s_i^2$, where $s_i$ is the share of fuel type $i$. The minimum possible value for the FDI is zero, corresponding to all generation from a single fuel type. The maximum possible value for the FDI results when each fuel type has an equal share of total generation. For a generation fleet composed of 10 fuel types, the maximum achievable index is 0.9. The Market Monitor calculates the FDI separately for energy output and installed capacity.[2]

**Metric 4.** No comments.

**Metric 5.** Based on the meaning of these metrics in the PJM market, the Market Monitor recommends that statistics on EEA Levels 1, 2 and 3 be reported separately, including a distinction between level 2 and level 3 alerts that were escalated from level 1, and level 2 and level 3 alerts that were triggered directly. In PJM, EEA Level 1 is issued concurrent with a Maximum Generation Emergency Alert. EEA Level 1 is based on expectation of forecasted system conditions resulting in all available resources loaded. EEA level 1 does not necessarily result in a real-time action to load maximum emergency generation or emergency load management resources, but provides an advance alert to prepare to perform if EEA level 2 is declared. EEA level 2 indicates the actual scheduling of emergency generation and load management resources. Not

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[2] *See 2019 Quarterly State of the Market Report for PJM: January through June* (August 8, 2019) at 167 & 260, which can be accessed at: <*http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2019/2019q2-som-pjm.pdf*> .

all EEA level 1 alerts translate to level 2 actions by reliability coordinators, and the proportion of level 1 alerts that translate to level 2 and then to level 3 (or directly to level 3) is a useful metric. The performance of resources during a gradually escalating emergency versus performance during a directly triggered emergency action (level 2 or level 3) provides useful information on the preparedness of resources to perform when they are most needed. Reporting level 1, level 2 and level 3 metrics separately is also consistent with the reporting in Metric 6, as EEA level 1 does not require actual performance from resources, whereas level 2 and level 3 do require actual performance from resources.

**Metric 6.** This metric is defined as a simple average of performance during all the EEA alerts in the reporting period. The performance during each individual EEA event is defined as the ratio of actual MW generated to the total available economic MW of a specific technology. The Market Monitor recommends that the numerator include generation MWh plus reserves plus regulation in order to include the entire generation performance. In PJM, EEA level 1 alerts are triggered concurrently with maximum emergency generation alerts and do not result directly in emergency generation or load resources being scheduled. For that reason, the Market Monitor recommends that this metric be modified to include performance only during EEA level 2 or higher alerts. For PJM and other RTOs with capacity markets, the denominator, $Pmax_{ik}$, should only include the committed capacity MW during the event, as performance from noncommitted resources is voluntary. More generally, where there is not a capacity market, the denominator of the performance metric, $Pmax_{ik}$ should use the emergency maximum of all MW of technology k, instead of the

proposed economic maximum, to calculate a metric consistent with the expected performance during an EEA level 2 alert.

The Market Monitor recommends that performance for RTO wide alerts and partial RTO alerts should also be reported separately, since an RTO wide performance metric for an event that was applicable only in a limited area is misleading.

The Market Monitor recommends that Demand Resources (DR) and Energy Storage Resources (ESR) be included in the metric in PJM and in markets where such resources are paid to take on a performance obligation.

**Metric 7.** No comments.

**Metric 8.** No comments.

**Metric 9.** No comments.

**Metric 10.** The Market Monitor recommends that, in addition to registered DR MW, that committed DR MW be included. Committed MW are the MW with a performance obligation based on the PJM Capacity Market. Curtailment service providers (CSP) typically register more DR MW than their committed capacity MW.

This metric uses the number of hours in a year, 8,760, as the denominator. The Market Monitor recommends using as the denominator the total number of unit hours run to produce energy, during the reporting period.

**Metric 11.** In order to calculate the percent of unit hours mitigated, the number of unit hours mitigated should be divided by the total number of unit hours run to produce energy, during the reporting period. Dividing the unit run hours in a year with 8,760, results in a less useful metric and a metric that is harder to interpret. The calculation details state: "Calculate the fraction of

unit hours in each reporting period that any generation unit(s) offer cap in the day-ahead (real-time) energy market was set due to mitigation and report that as a percent of the number of all unit hours." The term "all unit hours" should be defined as the total unit run hours in the day-ahead market and total unit run intervals in the real-time market.

**Metric 12.** The metric uses "monthly values from two consecutive FERC Form No. 714 reporting years and create a Net Energy for Load Value in MWh for that reporting period."[3] The Market Monitor recommends the use of single years, as anomalies such as those observed during extreme weather can be masked and two year average could be misleading.

**Metric 13.** Markup is a measure of resource offer behavior, indicating the extent to which a supplier increases its resource offer above its short run marginal cost. Economic theory indicates that the price cost markup is proportional to the degree of market power of the supplier.[4] The Market Monitor calculates markup for all PJM resources that submit both price-based and cost-based offers. The markup of marginal resource offers is of particular interest, because marginal resources directly affect LMP.[5] A simple market

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[3] The user guide defines the "Net Energy for Load Value" (at Page 15) as "Total generation plus imports minus exports minus losses." This appears to be a typo and should have stated plus losses, or including losses. This value references the FERC Form No. 714, Schedule 3. The "Net Energy for Load" on this form is defined as "the amount of energy that the balancing authority area requires internally including balancing authority area losses."

[4] *See* Tirole, Jean, *The Theory of Industrial Organization* (Cambridge: MIT Press, Eleventh printing (2000)) at 219.

[5] For further details, see *2019 Quarterly State of the Market Report for PJM: January through June* at 168–202 & 208–219.

summary markup metric is the average markup of marginal resources.[6] A more precise market summary markup metric is the markup contribution to LMP calculated using unit participation factors.[7]

The software used to clear the energy markets identifies marginal resources in every market clearing solution. The identity of the marginal resources should be required data to be provided to the RTO/ISOs by their software vendors.

As a resource specific metric, markup cannot be calculated from aggregate market supply curves as in the proposed metric. In an LMP market, the intersection of demand with the aggregate supply curve is not the market price, because LMP also includes congestion and losses. Calculating price, and thus price markups, using the intersection of demand with aggregate supply will systematically understate the market price. Also, the marginal resource determined by the intersection of the demand curve with the price-based aggregate supply curve is not the marginal resource determined by the intersection of the demand curve with the cost-based aggregate supply curve, so the proposed measure is not a resource specific metric. It is not markup. Its meaning is unclear, so it is not a useful measure of market performance.

**Metric 14.** The fuel adjusted LMP metric isolates changes in LMP directly attributable to the fuel cost of marginal resources from changes in LMP otherwise

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6 *See* Southwest Power Pool Market Monitoring Unit, *2014 State of the Market Report* at 131–134, which can be accessed at: <*https://www.spp.org/documents/29399/2014%20state%20of%20the%20market%20report.pdf*> .

7 *See 2010 State of the Market Report for PJM: Technical Reference for PJM Markets* at 27–31.

attributable to load, system topology, system dispatch, market design, marginal resource markups, and other components of marginal resource costs. Calculation of fuel adjusted LMP requires identification of marginal resources, their fuel in each market interval, and resource specific fuel costs. Locational fuel costs for marginal resources are necessary to calculate a meaningful metric, because the cost to move fuel from production areas to resources is a significant portion of the fuel cost in the RTO/ISOs and a fundamental driver of locational differences in energy prices.

The system wide LMP is a weighted average of the price of the marginal resources in each market interval. The weights are called unit participation factors.[8] The Market Monitor calculates the fuel adjusted LMP using the unit participation factors. In the first step, the fuel component's contribution of every marginal resource to the wholesale energy price is computed for every five minute interval. The fuel component is the incremental fuel cost's share of the total incremental cost of energy at the resource's dispatched MW point. In the second step, an adjusted fuel component for each marginal resource is derived using the fuel prices from the base year and an adjusted marginal resource price is calculated using the adjusted fuel cost. In the final step, the fuel adjusted wholesale energy price is obtained by weighting each fuel adjusted marginal resource price by its unit participation factor and summing the contributions of all the marginal resources. An annual fuel adjusted wholesale energy price is the

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8 *See 2010 State of the Market Report for PJM: Technical Reference for PJM Markets* at 27–30.

load-weighted average of the fuel adjusted price for the year. The Market Monitor recommends use of this approach.

The Commission staff's proposed metric for calculating the fuel adjusted wholesale energy prices will not provide meaningful results because the LMP markets have multiple marginal resources in most intervals. The proposed metric uses the fraction of hours that each fuel type was marginal to derive the fuel adjusted wholesale energy price. The proposed metric does not account for the amount of load affected by the price of the marginal resources, locational fuel costs, or the cost of other marginal fuels.

**Metric 15.** No comments.

**Metric 16.** The proposed metrics are acceptable and similar to what the Market Monitor calculates. The Market Monitor recommends inclusion of information on Auction Revenue Rights, which are a large source of congestion hedges for LSEs in PJM.

**Metric 17.** See comments on metric 12.

**Metric 18.** The method for calculating new entrant net revenues in this metric is not fully defined. The Market Monitor recommends using locationally adjusted energy and fuel forward contracts for energy market revenues and fuel costs. The Market Monitor recommends using proxy units for representative regions in the RTO.

**Metric 19.** The Market Monitor does not understand the intent of the metric. While the metric appears intended to be a measure of shortage in the energy market, much of the requested data are only for spinning reserves. In PJM, shortages can be triggered by spinning reserves (also called synchronized reserves) or primary reserves. Shortages can be triggered for the RTO

reserve zone or for the Mid-Atlantic and Dominion (MAD) reserve subzone. Each shortage can be independently triggered depending on the system conditions, and transmission constraints that limit the deliverability of reserves. The metrics do not differentiate among the types of shortages, and are defined as the aggregate of all shortages as defined by order 825.

Some of the component metrics in the spreadsheet calculate the size, price differential and price impact only using the MW and RMCP data for spinning reserves, during all shortages. If there were no spinning reserve shortage in a particular event with a primary reserve shortage, the size of that shortage, as defined, could be negative, and adding that to another event with spinning reserve shortage would reduce the measured size of the shortage.

The total duration of shortage events is in the denominator of some submetrics, while the numerator calculates the size and price differential only for spinning reserve regardless of the shortage trigger.

The Market Monitor recommends that each reserve product that has a defined requirement and can trigger shortage pricing as defined in Order No. 825 be reported separately for the submetrics. The Market Monitor recommends that the Commission then calculate the size, price differential and price impact of each of these products separately using the MW, market clearing price, and the duration applicable to these products separately.[9]

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[9] The spreadsheet formulas for the metrics 19.04, 19.06 and 19.08 reference the incorrect cells to use as the denominator. The formula for 19.04 uses the number of shortage events instead of the total

**Metric 20.** The net CONE metric for a CT is publicly reported by PJM for representative locations. The Market Monitor recommends that the FERC metric also explicitly include the gross CONE amount, and energy and ancillary service revenue offset amounts.

**Metric 21.** PJM computes the Capacity Emergency Transfer Objective (CETO) and Capacity Emergency Transfer Limit (CETL). The CETO is the required amount of import capability under the most limiting emergency scenario into a defined locational deliverable area (LDA). The CETL is the actual import capability into the LDA under the most limiting emergency scenario. It is not clear whether this metric is intended to include aggregate import and export limits for the RTO as a whole. In PJM, the LDAs follow a nested structure, which does not adequately represent all the emergency capacity transfers that are feasible among LDAs. For example, under the current structure, any capacity transfer between the Dominion LDA, which is modeled within the Rest of the RTO LDA, and the Pepco LDA needs to pass through MAAC and SWMAAC LDAs, although Dominion and Pepco regions are linked by several transmission lines. The commission should require the calculation of these metrics for all feasible inter LDA transfers based on electrical facts of the grid.

**Metric 22.** No comments.

**Metric 23.** No comments.

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duration. The formula for 19.06 uses the average duration of shortages instead of the total duration. The formula for 19.08 uses the average size of shortages instead of the total duration.

**Metric 24.** The proposed metric is a comparison of the forecast coincident peak demand of a sub-RTO/ISO region used in a capacity auction with the realized coincident peak demand. The Market Monitor requests confirmation that this metric should be calculated for each LDA that price separates in PJM and for PJM as a whole.

**Metric 25.** No comments.

**Metric 26.** This metric requires reporting of Performance Assessment Intervals (PAI) in PJM, or analogous events in other RTOs. The metric allows for reporting of data by PJM zone. However, since a PJM PAI may be triggered by emergency actions in the energy market in local, limited areas smaller than a zone, the metric should have the option to submit data for subzonal PAIs.[10] The Market Monitor recommends that the metrics for total capacity obligations, number of performance assessment events and duration of performance assessment events be collected corresponding to the specific area in which the event was declared, when the event was not for an entire zone.

**Metric 27.** See comments for metric 26.

**Metric 28.** See comments for metric 26.

**Metric 29.** See comments for metric 26.

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[10] The two instances of PAIs declared in PJM have been localized events due to multiple transmission outages. *See 2018 State of the Market Report for PJM: Volume 2 Section 3 Energy Market*, at 201-202.

## II. CONCLUSION

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

Respectfully submitted,

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