February 11, 2015

The Honorable Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E., Room 1A
Washington, D.C. 20426

Re: PJM Interconnection, L.L.C., Docket No. ER15-643-000

Dear Ms. Bose:

On December 17, 2014, PJM submitted revisions to Attachment K-Appendix of the PJM Open Access Transmission Tariff ("Tariff"), and the identical provisions of Schedule 1 of the Amended and Restated Operating Agreement of PJM Interconnection, L.L.C. ("Operating Agreement"), in this proceeding ("Initial Filing"). The revisions propose to incorporate changes related to how PJM determines the price of reserves it procures in the Real-time Energy Market that exceed its normal real-time reserve requirements, and also how PJM allocates the costs of reserves procured in the Day-ahead Energy Market that exceed its normal day-ahead reserve requirements.

On January 27, 2015, the Federal Energy Regulatory Commission ("Commission") issued a deficiency notice seeking additional information regarding the Initial Filing. This letter is being submitted in response to the Deficiency Notice.

The Deficiency Notice directed PJM to include with this submittal at least one eTariff record, even if no tariff changes are otherwise required. In compliance with this requirement, PJM encloses the first eTariff record originally submitted in the Initial Filing. There are no changes to the Tariff revisions submitted in the Initial Filing. PJM requests an order be issued

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1 For convenience, where PJM refers herein to provisions of Attachment K-Appendix of the Tariff, those references are also intended to encompass the corresponding provisions of Schedule 1 of the Operating Agreement.

2 All capitalized terms that are not otherwise defined herein shall have the same meaning as they are defined in the Tariff or Operating Agreement.

3 PJM Interconnection, L.L.C., Docket No. ER15-643-000, Deficiency Notice (January 27, 2014) ("Deficiency Notice").

4 See id. at 4.
The Honorable Kimberly D. Bose, Secretary  
February 11, 2015  
Page 2  

by April 13, 2015 in this proceeding in compliance with the 60-day notice requirement in section 35.3(a)(1) of the Commission’s Regulations, 18 C.F.R. Part 35.

**Questions Related to Extended Reserves**

In the Initial Filing, PJM stated:

First, reserves from the first step of the [operating reserve demand curve (ORDC)]\(^6\) are more valuable to PJM, and priced at a higher level, because they are needed to account for major disruptions on the Transmission System, and are related to maintaining reliability and compliance with applicable North American Electric Reliability Corporation (“NERC”) standards. The reserves from the second step of the ORDC similarly help maintain reliability, but falling short of the extended reserve requirement would not cause a potential reliability violation. Second, the $300/MWh price is appropriate for reserves on the second step of the proposed ORDC based on an internal analysis of offer data for resources that are likely to be called on to provide reserves in the Operating Day. Third, PJM and its members agree that $300/MWh strikes the appropriate balance between the market’s willingness to pay for additional reserves in order to mitigate system uncertainty, and unnecessarily holding aside capacity for reserves that does not provide any appreciable reliability benefit.\(^7\)

With regard to these statements, the Commission asks the following questions in the Deficiency Notice:

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\(^5\) References herein to “Extended Reserves” shall apply equally to reserves needed to meet the proposed new definitions of Extended Primary Reserve Requirement and Extended Synchronized Reserve Requirement, which have not yet been accepted by the Commission. The Extended Primary Reserve Requirement “shall equal the Primary Reserve Requirement in a Reserve Zone or Reserve Sub-zone, plus additional reserves scheduled under emergency conditions necessary to address operational uncertainty. The Extended Primary Reserve Requirement is calculated in accordance with the PJM Manuals.” See Initial Filing, Proposed Tariff, Attachment K-Appendix, section 1.3.2B.01. The Extended Synchronized Reserve Requirement “shall equal the Synchronized Reserve Requirement in a Reserve Zone or Reserve Sub-zone, plus additional reserves scheduled under emergency conditions necessary to address operational uncertainty. The Extended Synchronized Reserve Requirement is calculated in accordance with the PJM Manuals.” See Initial Filing, Proposed Tariff, Attachment K-Appendix, section 1.3.2B.02.

\(^6\) See Initial Filing at 9-13 for discussion of the Operating Reserve Demand Curve (“ORDC”). As PJM discussed at length in the Initial Filing, PJM’s current ORDC is a “single step” ORDC that procures reserves necessary to meet PJM’s normally applicable real-time reserve requirements, and PJM proposes to add a “second step” to the ORDC in order to procure any needed reserves necessary to meet PJM’s Extended Reserve Requirements.

\(^7\) Initial Filing at 12-13.
1.a. Please explain how PJM chose to value the Extended Reserves at $300/MWh, whether any other values were considered, and why those values were rejected.

PJM Answer: As PJM explained in the Initial Filing, reserves that are utilized to meet PJM’s normally applicable real-time reserve requirements (“Synch/Primary Reserves”) are currently valued up to $550/MWh (and will be valued up to $850/MWh beginning June 1, 2015), and PJM proposes that any Extended Reserves that PJM procures will be valued up to $300/MWh, as opposed to being valued at $0/MWh as they are today. PJM articulated why Extended Reserves are less valuable than Synch/Primary Reserves in the Initial Filing:

[R]eserves from the first step of the [operating reserve demand curve] ORDC are more valuable to PJM, and priced at a higher level, because they are needed to account for major disruptions on the Transmission System, and are related to maintaining reliability and compliance with applicable North American Electric Reliability Corporation (“NERC”) standards. The reserves from the second step of the ORDC similarly help maintain reliability, but falling short of the extended reserve requirement would not cause a potential reliability violation.

To further clarify why Synch/Primary Reserves are inherently more valuable than Extended Reserves, Synch/Primary Reserves are procured in order to ensure that PJM may recover from the largest single contingency (i.e. biggest point of failure) on the Transmission System at any time. Extended Reserves will be committed to address risks posed by other operational uncertainties that PJM would like to guard against such as risk of equipment failure, uncertainty in projected load and interchange or potential fuel deliverability issues. These “other contingencies” do not present as immediate or grave a risk to the Transmission System as the single largest contingency. Therefore, Extended Reserves are simply not as valuable to PJM as Synch/Primary Reserves, which are currently capped at $550/MWh (rising to $850/MWh on

8 References herein to “Synch/Primary Reserves” shall apply equally to reserves needed to meet the proposed new definitions of Synchronized Reserve Requirement and Primary Reserve Requirement, which have not yet been accepted by the Commission. The Synchronized Reserve Requirement is defined as “the megawatts required to be maintained in a Reserve Zone or Reserve Sub-zone as Synchronized Reserve, absent any increase to account for additional reserves scheduled to address operational uncertainty. The Synchronized Reserve Requirement is calculated in accordance with the PJM Manuals.” See Initial Filing, Proposed Tariff, Attachment K-Appendix, section 1.3.33B.02A.

The Primary Reserve Requirement is defined as “the megawatts required to be maintained in a Reserve Zone or Reserve Sub-zone as Primary Reserve, absent any increase to account for additional reserves scheduled to address operational uncertainty. The Primary Reserve Requirement is calculated in accordance with the PJM Manuals.” See Initial Filing, Proposed Tariff, Attachment K-Appendix, section 1.3.29G.

9 See infra, answer to Question 1.c. for further explanation of why the maximum value for Synch/Primary Reserves will increase to $850/MWh beginning with the 2015/2016 Delivery Year, which is represented by the value of the Reserve Penalty Factor for Synch/Primary Reserves.

10 See Initial Filing at 12.

11 Id. at 12-13.
June 1, 2015, and a lower price cap on Extended Reserves is appropriate. However, as discussed in the Initial Filing, Extended Reserves provide value to the system and are worth more than $0/MWh (which is what they are valued at today). Thus, the appropriate level at which to cap the price of Extended Reserves is clearly between $0/MWh and $550/$850/MWh.

As PJM noted in the Initial Filing, the proposed $300/MWh cap for Extended Reserves is based on an internal analysis prepared by PJM, and was approved by stakeholders. The $300/MWh cap was discussed in the Energy/Reserve Market Pricing and Interchange Volatility ("ERPIV") stakeholder meetings, during which stakeholders examined several issues related to energy and reserve pricing, and several proposals were considered by stakeholders and PJM to address better aligning energy and reserve pricing. One of the proposals involved creating a separate real-time reserve market for reserves that are capable of responding in 30 minutes ("30-minute reserve market").

When considering creating a 30-minute reserve market, PJM’s staff concluded that the appropriate Reserve Penalty Factor for the 30-minute reserve proposal would have been $300/MWh based on observed clearing prices in PJM’s Day-ahead Scheduling Reserve Market, which is PJM’s day-ahead 30-minute reserve market. PJM presented its findings to stakeholders on July 28, 2014, and as part of that presentation, presented supporting documentation substantiating the $300/MWh cap, and answered stakeholder questions related to the appropriateness of that cap. PJM determined that the average Day-ahead Scheduling Reserves Market clearing price during hours in which the clearing price was not $0/MWh, plus three standard deviations, equaled $239/MWh. PJM then added a small additional margin to arrive at the $300/MWh level.

When PJM and its stakeholders instead decided to implement the “two step” ORDC model proposed in the Initial Filing, PJM conducted an additional internal analysis to confirm that the previously agreed upon $300/MWh Reserve Penalty Factor value continued to be appropriate in the context of pricing Extended Reserves. PJM describes this internal analysis in response to Question 1.b.

Other price caps for Extended Reserves were not seriously considered because PJM and its stakeholders believed that $300/MWh was an appropriate amount at which to price Extended Reserves, and this amount was unanimously approved by PJM’s stakeholders at the PJM Members Committee. By being set between $0/MWh and $550/$850/MWh, $300/MWh sends correct market signals to Market Participants by reflecting the value of Extended

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12 See Initial Filing at 13.


14 See id. at 6.

15 See Initial Filing at 1.
Reserves relative to Synch/Primary Reserves, and reflects the fact that Extended Reserves provide value to PJM and the Transmission System.

Ultimately, determining the “precise” amount at which Extended Reserves should be valued involves some level of subjectivity and is not an exact science. However, for the reasons PJM mentioned herein and in its Initial Filing, it is clear that Extended Reserves must be higher than $0/MWh to reflect their real value, but must be capped below the level of Synch/Primary Reserves because they are not as valuable as Synch/Primary Reserves. Thus, the $300/MWh level is certainly a reasonable level at which to price Extended Reserves (and ensures just and reasonable rates) because it sends correct market signals to Market Participants, is based on a quantitative analysis conducted by PJM and was approved unanimously by the PJM Members Committee.

1.b. Please provide any internal analyses that support the determination in part (a), above, including the analysis referenced by PJM in its filing.

**PJM Answer:** After determining that $300/MWh was an appropriate level at which to cap the price of Extended Reserves based on average Day-ahead Scheduling Reserves Market clearing prices, PJM conducted an additional analysis of combined turbine (“CT”) units’ offer prices to confirm that $300/MWh was an appropriate figure. PJM analyzed CT units’ offer prices because such units are the most likely to provide Extended Reserves.

The analysis in the attached Excel spreadsheet (Attachment A) compares the proposed $300/MWh Reserve Penalty Factor to the offer prices of resources likely to provide Extended Reserves and the lost opportunity cost (“LOC”) they would incur at different LMP levels.

**Materials Redacted-Confidential**

Based on this analysis, PJM confirmed that $300/MWh was a reasonable level at which to cap the price of Extended Reserves.

1.c. Why do the Reserve Penalty Factors increase to $850/MWh for the 2015/2016 Delivery Year, but it is not specified whether the Extended Reserve Penalty Factors will ever change?

**PJM Answer:** Reserve Penalty Factors for Synch/Primary Reserves are increasing to $850/MWh for the 2015/2016 Delivery Year as a result of the phased implementation of Reserve Penalty Factors for Synch/Primary Reserves, as described in the Tariff. PJM originally proposed Reserve Penalty Factors for Synch/Primary Reserves in 2010 as part of a broader package of reforms to establish just and reasonable pricing for operating reserve shortages in the PJM Region in compliance with FERC Order No. 719. The proposed Reserve Penalty Factor for Synch/Primary Reserves was always intended to eventually be $850/MWh, however,

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16 See id. at 8-13.

17 See Proposed Tariff Revisions of PJM Interconnection, L.L.C., Docket No. ER09-1063-004 (June 18, 2010), at 1.
in order to “ease the potential impact on loads and provide a smoother implementation for all market participants, PJM recommend[ed] a four-year transition that introduce[ed] and gradually raise[ed] the Reserve Penalty Factor.” \(^{18}\) The Commission accepted PJM’s proposed phased implementation of the Reserve Penalty Factor for Synch/Primary Reserves, \(^{19}\) and as indicated in the Tariff, the Reserve Penalty Factor for Synch/Primary Reserves was $250/MWh in the 2012/2013 Delivery Year, $400/MWh for the 2013/2014 Delivery Year, $550/MWh in the current 2014/2015 Delivery Year, and will be $850/MWh in the 2015/2016 Delivery Year and thereafter. \(^{20}\)

PJM and its stakeholders did not deem it necessary to propose a phased implementation for the Reserve Penalty Factors for Extended Reserves because PJM and Market Participants have operated with Reserve Penalty Factors for Synch/Primary Reserves for several years now, and the risks of significant price impacts or problems with implementing Reserve Penalty Factors for Extended Reserves are not present as they were in 2010 when Reserve Penalty Factors for Synch/Primary Reserves were first proposed.

1.d. PJM states in a situation where reserves are available at a price exceeding the penalty factor and a reserve shortage exists, PJM operators would manually commit those reserves and such resources would not be eligible to set the reserve clearing price. Please explain why the clearing price for the Extended Reserves should not reflect the cost of the most expensive resource procured to meet the Extended Reserves Requirement.

**PJM Answer:** The clearing price for Extended Reserves will not and should not always reflect the cost of the most expensive resource procured to meet the Extended Reserve Requirements. In order to understand why this is the case, it is important to understand why and how PJM utilizes penalty factors.

Penalty factors are used by PJM’s optimization engines (market dispatch software) to establish a hierarchy of importance to address different types of constraints. One example of a constraint is the power balance constraint which dictates that injections into PJM’s Transmission System must be at least equal to withdrawals from PJM’s Transmission System. \(^{21}\) The power balance constraint is the most important constraint that must be solved by PJM’s operators because all load in the PJM Region must be served. Another example of a constraint is the Reserve Requirement constraint. This constraint, defined for each day-ahead and real-time

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\(^{18}\) Id. at 3.

\(^{19}\) See *PJM Interconnection, L.L.C.*, 139 FERC ¶ 61,057, at P 62 (2012).

\(^{20}\) See Tariff, Attachment K-Appendix, Section 3.2.3A and Section 3.2.3A.001. PJM is proposing revisions to these sections and other sections of the Tariff and Operating Agreement to clarify when Reserve Penalty Factors are applicable to the Primary or Synchronized Reserve Requirements. See Initial Filing at 18, n. 32.

\(^{21}\) This concept is represented by the following equation: Import Transactions + Generation >/= Load + Losses + Exports.
reserve type, states that the amount of reserves on the system must be at least equal to the applicable Reserve Requirement.

While obtaining the required amount of reserves on the system is extremely important, it is not as important as maintaining adequate supply on the system to serve the system’s load. From a least cost optimization perspective, this is communicated to the dispatch engine by penalty factors. The more important a constraint, the higher the penalty factor used. For example, violation of the power balance constraint may impose a cost of $10,000/MWh, whereas violating (i.e. not honoring) the Reserve Requirement constraint may only impose a cost of $850/MWh. These penalty factors are used by the optimization engine to ensure that the Transmission System can be dispatched and in cases where all of the constraints imposed on the optimization engine cannot be accounted for, the least important (i.e. less expensive) constraints are those that are violated by the optimization engine software.

Using the penalty factors in the example above, the optimization engine that is solving the dispatch problem used to dispatch the Transmission System will always violate the Reserve Requirement constraint instead of violating the power balance constraint. Intuitively this makes sense because the Transmission System can temporarily operate without enough reserves because the probability of the largest system contingency occurring where the reserves being committed must actually be deployed is very small while the need to serve load is constant.

As mentioned in PJM’s response to Question 1.a, the penalty factors also indirectly work as price caps. For example, a $850/MWh Reserve Penalty Factor for a Synch/Primary Reserve Requirement constraint not only indicates that constraint’s order in the hierarchy of all other constraints, it also tells the dispatch and unit commitment engines that the most that can be spent on any one megawatt of reserves is $850/MWh. Beyond that level, the cost of violating the Reserve Requirement constraint is more cost effective than meeting the Reserve Requirement by using a unit that is more expensive than the Reserve Penalty Factor. In cases where a Reserve Requirement constraint is violated, the reserve price will be equal to the Reserve Penalty Factor, however, there are also implications on the energy price. If obtaining the next megawatt of energy requires the loss of one megawatt of reserves, then the cost to obtain the next megawatt of energy (equal to the Locational Marginal Price (“LMP”)) includes the cost of violating the Reserve Requirement constraint (the Reserve Penalty Factor). Because of this, the discussion of the level of penalty factors to be used when dispatching the system and calculating LMPs has a direct linkage to the “acceptable” level of prices. The higher the level of penalty factors that are used, the higher the resulting LMPs and reserve market clearing prices that will be calculated during reserve shortage conditions.

Ideally, the market clearing price will capture all actions taken by the operator to maintain reserves – regardless of the cost. The proposed $300/MWh Reserve Penalty Factor for Extended Reserves and the existing Reserve Penalty Factors for the Synch/Primary Reserve Requirements are set at levels that allow for all but the most extreme actions taken by system operators to be captured in market clearing prices. Setting the Reserve Penalty Factors at these levels strives to strike a balance between price transparency and accuracy and what some PJM Members would consider exposure to unreasonably high prices. Raising the Reserve Penalty Factors further will result in higher clearing prices which are not acceptable to some PJM Members. Further, it is not possible to set a Reserve Penalty Factor at a given level
and then adjust it after the fact to allow a higher cost to be captured within the Reserve Penalty Factor.

Reserve Penalty Factors are vital tools that PJM’s operators use to effectively and economically dispatch the Transmission System. Significantly changing how they function would require PJM to overhaul how it operates the Transmission System and would harm reliability. However, as long as they exist, there will always be the possibility that costs of a given unit used to produce reserves could exceed the Reserve Penalty Factor. PJM’s current Reserve Penalty Factors are set at levels meant to capture all but the most extreme actions taken by system operators in market clearing prices. They not only result in just and reasonable rates, but adhere to the best principles of market design.

Questions Related To Allocation of Costs Associated with Procuring Additional Day-Ahead and Real-Time Reserves

In the Initial Filing, PJM stated:

the Base Day-ahead Scheduling Reserves Requirement and Additional Day-ahead Scheduling Reserves Requirement are calculated in accordance with the PJM Manuals. The precise amount of each type of reserve that is procured varies based on numerous factors, and a stakeholder-approved calculation described in the PJM Manuals will determine the precise amount of reserves that will be needed to meet each of these day-ahead reserve requirements.

With regard to these statements, the Commission asks the following questions in the Deficiency Notice:

2.a. Please explain how PJM plans to calculate each of the additional reserve requirements, for both day-ahead and real-time. What factors will PJM consider in this calculation and what formulas will be used? Will PJM apply a consistent methodology

22 The proposed definition of Base Day-ahead Scheduling Reserves Requirement is substantively identical to the current definition of Day-ahead Scheduling Reserves Requirement: (“[the reserve requirement] shall mean the thirty-minute reserve requirement for the PJM Region established consistent with the Applicable Standards, plus any additional thirty-minute reserves scheduled in response to an RTO-wide Hot or Cold Weather Alert or other reasons for conservative operations.” See Tariff, Attachment K-Appendix, Section 1.3.1D.02 (current definition of Day-Ahead Scheduling Reserves Requirement); Initial Filing, Proposed Tariff, Attachment K-Appendix, Section 1.3.1B.01 (proposed definition of Base Day-ahead Scheduling Reserves Requirement).

23 Additional Day-ahead Scheduling Reserves Requirement “shall mean the portion of the Day-ahead Scheduling Reserves Requirement that is required in addition to the Base Day-ahead Scheduling Reserves Requirement to ensure adequate resources are procured to meet real-time load and operational needs, as specified in the PJM Manuals.” See Initial Filing, Proposed Tariff, Attachment K-Appendix, Section 1.3.1.01.

24 Initial Filing at 23-24.
when calculating these additional reserve amounts (i.e., will similar weather and risk scenarios result in fairly similar quantities of additional reserves)? Please provide an example of how PJM will calculate additional day-ahead or real-time reserves based on a hypothetical extreme weather alert or a hypothetical increase in operational uncertainty.

**PJM Answer:**

*Base Day-ahead Scheduling Reserves Requirement*

Following the issuance of a Hot or Cold Weather Alert, a Maximum Emergency Generation/Load Management Alert, or escalating emergency procedures (as defined in Manual 13: Emergency Operations) for the entire RTO, or the Mid-Atlantic Dominion or Mid-Atlantic regions, PJM will increase the Base Day-ahead Scheduling Reserve Requirement by the amount of any additional reserves scheduled above and beyond what is needed to meet the typical load and reserve requirements in order to account for operational uncertainty, provided that the alerts are issued prior to the close of the Day-ahead Energy Market bidding period. The increased Base Day-ahead Scheduling Reserve Requirement will be applied to the days for which the alert(s) were issued. The purpose of increasing the Base Day-ahead Scheduling Reserve Requirement to account for additional resources called for operational uncertainty is to ensure that this type of operator action, which is taken outside the market, is reflected in energy and reserve pricing. It is assumed that any additional reserves that are being scheduled will not be economic and therefore will be called on to provide energy at their minimum economic dispatch point. This in turn creates reserves through the additional ramping capability that is created when other resources must be backed down by a corresponding amount from the megawatt level to which they would otherwise be economically dispatched in order to maintain power balance. Therefore, the amount that is added to the Base Day-ahead Scheduling Reserve Requirement under such conditions is calculated by summing the minimum economic output of resources called on to provide additional reserves since this is a fair approximation of the additional reserves created by such operator actions.

Hypothetical Example:

- The morning prior to the Operating Day, operators schedule three additional generation units with a combined economic minimum of 1,000 MW as reserves in response to

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25 Operational uncertainty can result from a wide variety of factors and events, which all must be considered by PJM when deciding whether to adjust any of the applicable real-time or day-ahead reserve requirements. Specific factors that could result in operational uncertainty include, but are not limited to: higher than normal forced outage rates, uncertainty in projected load and interchange or potential fuel deliverability issues.

26 PJM has included modified methodologies for calculating the Day-ahead Scheduling Reserves Requirement in the Manuals, which under PJM’s proposal shall now equal the sum of the Base Day-ahead Scheduling Reserve Requirement and Additional Day-ahead Scheduling Reserve Requirement. See proposed revisions to PJM Manual 11, Section 11.2.1 (available at [http://www.pjm.com/~media/committees-groups/committees/mc/20141120/20141120-item-02d-erpiv-draft-manual-11-revisions-redline.ashx]; Initial Filing, Proposed Tariff, Attachment K-Appendix, Section 1.3.1D.02. (for proposed definition of Day-ahead Scheduling Reserves Requirement).
higher than average forced outage rates that were observed during similar operating conditions the prior week. This additional capacity is scheduled to be online from 5:00 AM on the Operating Day through 11:59 PM of the Operating Day.

- An additional 1,000 MW will be added to the Base Day-ahead Scheduling Reserve Requirement for hours 5 through 23 for that Operating Day.

**Additional Day-ahead Scheduling Reserves Requirement**

The Additional Day-ahead Scheduling Reserve Requirement, which approximates the amount of underbid load in the day-ahead market, will be implemented automatically and formulaically during periods where a Hot Weather or Cold Weather Alert, a Maximum Emergency Generation / Load Management Alert, or escalating emergency procedures (as defined in Manual 13: Emergency Operations) for the entire RTO, or the Mid-Atlantic Dominion or Mid-Atlantic regions, is in place, as long as the condition was known prior to the close of the Day-ahead Energy Market bidding period. The Additional Day-ahead Scheduling Reserve Requirement will be calculated as the difference between the hourly forecasted real-time load and the submitted Fixed Demand\(^{27}\) grossed up to account for the net of price sensitive bids and offers in the Day-Ahead Energy Market. Because the volume of cleared price sensitive bids and offers is unknown prior to the clearing of the Day-ahead Energy Market, the value must be approximated. This is done by applying the Seasonal Conditional Demand Factor to the known quantity of Fixed Demand in the market. The Seasonal Conditional Demand Factor represents the average percentage of demand in the Day-Ahead Energy Market from price sensitive bids expressed as a fraction of the fixed demand. The Seasonal Conditional Demand Factor is calculated as the historical average of Price Sensitive Demand plus Decrement Bids, minus Increment Offers, divided by Fixed Demand during the peak hours for the top ten peak load days in the same season the prior year.\(^{28}\)

Hypothetical example for a given hour:

- Real Time Load Forecast = 130,000
- Seasonal Conditional Demand Factor (SCDF) = 3.87%
- Fixed Demand = 123,000 MW
- Adjusted Fixed Demand = \((1 + \text{SCDF}) \times \text{Fixed Demand} = 127,760 \text{ MW}\)
- Additional Day-ahead Scheduling Reserves Requirement = Real Time Load Forecast – Adjusted Fixed Demand = 2,240 MW

**Extended Reserve Requirements**

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\(^{27}\) Fixed Demand is defined as “[p]urchases of a defined MW level of energy, regardless of LMP in the Day-Ahead Market.” See PJM Manual 35.

\(^{28}\) Full details of the calculation of the Additional Day-ahead Scheduling Reserves Requirement and the Seasonal Conditional Demand Factor are available on PJM’s website. See proposed revisions to PJM Manual 11, Section 11.2.1 (available at [http://www.pjm.com/~/media/committees-groups/committees/mc/20141120/20141120-item-02d-erpiv-draft-manual-11-revisions-redline.ashx](http://www.pjm.com/~/media/committees-groups/committees/mc/20141120/20141120-item-02d-erpiv-draft-manual-11-revisions-redline.ashx))
Any time a Hot Weather Alert, Cold Weather Alert or a Maximum Emergency Generation / Load Management Alert or escalating emergency procedure (as defined in Manual 13: Emergency Operations) has been issued for the Operating Day and additional MW are brought online by PJM dispatch to account for operational uncertainty, the Extended Synchronized Reserve and Extended Primary Reserve Requirements will be triggered. The Extended Synchronized Reserve Requirement and Extended Primary Reserve Requirements will be equal to the Synchronized Reserve Requirement or Primary Reserve Requirement plus the sum of the additional MW brought online for that hour needed to account for any operational uncertainty.

For example, assume during the Operating Day that the Synchronized Reserve Requirement is 1,300 MW and the Primary Reserve Requirement is 1,700 MW. Assume dispatchers must call 2,500 MW of emergency demand response in order to meet the peak load; however, they decide to call 3,000 MW of emergency demand response so that they have an additional 500 MW of reserves available in case a storm that is anticipated to hit and drop temperatures does not materialize as forecasted. The additional 500 MW would be added to the existing 1,300 MW Synchronized Reserve and 1,700 MW Primary Reserve Requirements for the hours the demand response was called for. The Extended Synchronized Reserve and Extended Primary Reserve Requirements would therefore be 1,800 MW and 2,200 MW, respectively.

While PJM utilizes consistent methodologies outlined in PJM’s Manuals when calculating the Base Day-ahead Scheduling Reserves Requirement and the Extended Reserve Requirements, unforeseen circumstances and variables can result in different quantities of additional reserves needing to be procured than what may be expected. This is due to the multitude of complex, interdependent factors and circumstances that must be considered by PJM’s operators when operating the Transmission System and anticipating the amount of additional day-ahead or real-time reserves that are needed at any given time.29

2.b. Please provide an estimate or range (in MW) of the quantity of excess day-ahead scheduling reserves and extended real-time reserves that PJM might commit under various scenarios (e.g., extreme weather alert and uncertainty about resource performance).

PJM Answer:

Additional Day-Ahead Scheduling Reserve Requirement

Had the proposed rule changes been in place during the top ten peak days in Winter 2014, the hourly Additional Day-Ahead Scheduling Reserve Requirement for those days would have ranged from 0 MW to roughly 7,000 MW, and would have been roughly 1,750 MW on average. Had the proposed rule changes been in place during the top ten peak days in Summer 2014, the hourly Additional Day-Ahead Scheduling Reserve Requirement for those

29 See infra, answer to Question 2.b for further details on why PJM’s operators must have flexibility when setting any reserve requirements.
days would have ranged from roughly 450 MW to roughly 9,500 MW, and would have been approximately 4,500 MW on average.

*Base Day-Ahead Scheduling Reserve Requirement, Synchronized Reserve Requirement and Primary Reserve Requirement*

It is important to note that the methodologies used to determine the precise amount of Extended Reserves and Base Day-ahead Scheduling Reserves Requirement intentionally build in flexibility so that PJM’s operators can adjust them as they see fit to maintain reliability. Not allowing such flexibility is contrary to several NERC Standards, which require PJM to carry an amount of reserves that PJM deems necessary, and execute any actions needed to maintain reliability on the Transmission System.\(^3\) Thus, the calculations’ built in flexibility is required in order for PJM to be in compliance with NERC standards and to ensure reliability of the Transmission System. Requiring otherwise would almost certainly cause PJM to violate NERC standards and would threaten the reliability of the Transmission System.

The intent of adding additional reserves to the Base Day-ahead Scheduling Reserves Requirement, Synchronized Reserve Requirement and Primary Reserve Requirement is to better align market clearing prices with system operators’ actions. The amount added to each requirement is therefore directly dependent upon the actions taken by operators. The amount of megawatts that are scheduled by PJM system operators to provide additional reserves is highly variable based on the operators’ assessment of the level of uncertainty on the system and the impact it would have on reliability if the risk were to materialize in real-time. System operators also consider the availability of shared reserves from neighboring balancing authorities and recent trends in interchange volatility, load forecast accuracy and forced outage rates when determining the amount of additional reserves to schedule in response to a given scenario. Therefore, the range of additional MW that may be scheduled for any specific type of scenario could vary greatly based on system operators’ assessment of the situation.

However, to give a general sense of the magnitude by which the requirements will be increased, the Base Day-ahead Scheduling Reserves Requirement will typically not be increased by more than 2,000 MW to 3,000 MW outside of the most extreme conditions when a significant forced outage rate is observed. In general, the Synchronized Reserve and Primary Reserve requirements will be increased by a smaller amount because system operators are more likely to rely on shared reserves to respond to real-time operational uncertainty. The Synchronized Reserve and Primary Reserve Requirements will typically be increased by 1,000

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MW or less, but the amount will vary based on operating conditions and the system operators’
assessment for the need for additional reserves in order to maintain reliability.

2.c. Will PJM notify market participants when it increases the day-ahead or real-time
reserve requirements and provide a reason for the increase (e.g. extreme weather alert or
conservative operations)? If so, will PJM state the quantity (in MW) of the additional
reserves it wishes to procure in addition to the base reserve requirements? How and
when will PJM notify market participants?

PJM Answer: PJM currently notifies Market Participants when it increases the day-ahead and
real-time reserve requirements, as applicable, and will continue to do so in the future if PJM’s
proposal is accepted. PJM’s emergency procedures that are implicated by Hot or Cold Weather
Alerts by definition put Market Participants on notice that PJM may approach a situation where it
cannot meet its reserve requirements (whether in real-time or day-ahead). Such alerts are
communicated to Market Participants publically via the emergency procedures section of PJM’s
eSuite application as soon as the condition is known to PJM.

Under PJM’s proposal, Hot or Cold Weather Alerts or escalating emergency procedures will
trigger the implementation of the Additional Day-ahead Scheduling Reserve Requirement.
Thus, the notification of such emergency procedures also informs Market Participants that the
Additional Day-Ahead Scheduling Reserve Requirement will be used. PJM cannot immediately
communicate the precise quantity (in MW) by which it will increase the Additional Day-ahead
Scheduling Reserves Requirement because it does not know what that amount is in advance of
clearing the Day-ahead Scheduling Reserves Market. This is because the Additional Day-
ahead Scheduling Reserves Requirement is calculated based on the amount of fixed demand
that clears in the Day-ahead Scheduling Reserves Market (which is not known until the market’s
bidding window closes at noon of the day prior to the Operating Day). However, PJM intends to
display the updated Day-ahead Scheduling Reserves Requirement (which under PJM’s
proposal will equal the sum of the Base and Additional Day-ahead Scheduling Reserves
Requirements31) in PJM’s eMKT application once the Day-ahead Scheduling Reserves Market
clears.

In the past, PJM has not frequently increased the Day-ahead Scheduling Reserves
Requirement (now proposed to be the Base Day-ahead Scheduling Reserves Requirement32)
and therefore does not have a pre-established procedure for communicating the change.
However, going forward, if PJM does increase the Base Day-ahead Scheduling Reserves
Requirement, PJM intends to communicate it through a special notification via PJM’s
Emergency Procedures application, as well as the reason for the increase. Further, under
PJM’s proposal, if PJM requires Extended Reserves in real-time, it will notify stakeholders
through a special notice via PJM’s Emergency Procedures application as soon as it is known

31 See Initial Filing, Proposed Tariff, Attachment K-Appendix, Section 1.3.1D.02.

32 See note 22, supra.
Extended Reserves are needed and the reason they are needed. PJM will communicate the quantity of Extended Reserves that are needed as well as the quantity increase of the Base Day-ahead Scheduling Reserves Requirement through a special notification via PJM’s Emergency Procedures application. PJM will make this communication as soon as such quantities are known to PJM.

2.d. Please provide a justification for your proposal that the methodology for determining the amount of Extended Reserves can be provided through Manuals instead of the Tariff.

PJM Answer: PJM included the methodology for calculating the precise amount of Extended Reserves needed in the Manuals based on its practice of including similar calculations in Manuals rather than the Tariff.

The definition of Day-ahead Scheduling Reserves Requirement was proposed by PJM in 2008, which is nearly identical to the definition in place today, and was part of a broader proposal modifying the manner in which PJM procures supplemental reserves needed for reliability. In the 2008 Filing, PJM stated that the Day-ahead Scheduling Reserves Requirement established “the amount of [Day-ahead Scheduling Reserves] that has to be procured, which is based on the regional reliability standards, and any additional amount necessary for reliability.” FERC accepted the filing and proposed definition of Day-ahead Scheduling Reserves Requirement. While this definition has remained largely unchanged since it was first approved by the Commission, the precise calculation for Day-ahead Scheduling Reserves Requirement has always been contained in PJM’s Manuals rather than in the Tariff. Accordingly, PJM has taken a similar approach with Extended Reserves by including the methodology for determining the amount of such reserves needed by PJM in the Manuals.

In addition, PJM believes the methodology should be in the Manuals rather than the Tariff because this approach is consistent with the “rule of reason” the Commission uses to determine whether a particular operator practice or procedure must be included within PJM’s filed rate. Like the methodology used to calculate the Day-ahead Scheduling Reserves


35 See id. at 5.

36 See PJM Interconnection, L.L.C., 123 FERC ¶ 61,232, at P 9 (2008). This order required PJM to make a compliance filing that was unrelated to the proposed definition of Day-ahead Scheduling Reserves Requirement.

37 See PJM Manual 13, Section 2.2.

Requirement, the methodology PJM’s operators use to determine the precise amount of Extended Reserves that should be procured does not significantly affect rates, terms and conditions of ratepayers, and therefore is appropriately included in the Manuals rather than the Tariff. Further, the methodology used by PJM’s operators to determine the precise amount of Extended Reserves needed to maintain reliability on the Transmission System involves a tremendous amount of technical and operational expertise. The Commission has explicitly held that “system operator[s] may rely on [their] manuals to implement the filed rate and provide technical details, in light of the multitude of occasions in tariff administration that require the exercise of technical or operational expertise.” Thus, it is appropriate to include the methodology in PJM’s Manuals rather than the Tariff, as PJM has proposed with respect to Extended Reserves.

3. Please explain why the proposed cost-allocation methodology for extended day-ahead reserves does not apply to all additional reserves procured by PJM during the "rebidding period" when load underbids.

**PJM Answer:** PJM did not make changes to its existing methodology for allocating the costs associated with all additional reserves procured during the “rebidding period” because that issue was not considered by the ERPIV stakeholder group and is outside the scope of the Initial Filing. It is helpful to understand how PJM procures the “additional reserves” referenced by the Commission during the rebidding period in order to see why this was the case.

During the rebidding period, PJM’s operators schedule additional system capacity to ensure PJM has enough reserves to meet the real-time load forecast and the desired reserve margin. In the Day-ahead Energy Market, PJM only schedules supply to meet the cleared day-ahead demand, adjusted by the supply/demand of Virtual Transactions plus the Day-ahead Scheduling Reserves Requirement. When the reserve adequacy run occurs at 6:00 p.m. during the rebidding period, PJM attempts to use the resources scheduled in the Day-ahead Energy

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39 *ISO-NE* at P 19; *see also Southwest Power Pool, Inc.*, 132 FERC ¶ 61,042, at P 57 (2010) (finding RTO's unfiled planning manual an appropriate means to ensure transparency and comparability without causing the Commission to manage the planning process); *Dominion Res. Servs. v. PJM Interconnection, L.L.C.*, 123 FERC ¶ 61,025, at P 51 (2009) (relying on PJM manuals for methodology to allocate costs identified in system impact study process).

40 PJM’s answer to Question 2.d applies equally to why PJM includes the calculation for the Base and Additional Day-ahead Scheduling Reserves Requirements in the Manuals rather than the Tariff.

41 See Tariff, Attachment K-Appendix, section 1.10.9 (“Following the initial posting by the Office of the Interconnection of the Locational Marginal Prices resulting from the Day-ahead Energy Market, and subject to the right of the Office of the Interconnection to schedule and dispatch pool-scheduled resources and to direct that schedules be changed in an Emergency, and absent extraordinary circumstances preventing the clearing of the Day-ahead Energy Market, a generation rebidding period shall exist. Typically the rebidding period shall be from 4:00 p.m. to 6:00 p.m. on the day before each Operating Day.”).
Market to meet the difference between the day-ahead cleared demand and the load forecast. When real-time load is higher than the day-ahead cleared demand, PJM depletes the day-ahead reserves PJM has scheduled (which under PJM’s proposal would include the Additional Day-ahead Scheduling Reserves Requirement) because PJM dispatches the day-ahead reserve units up in order to cover the difference between day-ahead and real-time load. If by doing this PJM no longer has enough reserves, PJM commits more units to ensure it has adequate energy and reserves to cover the real-time load plus the desired reserve quantity.

The megawatts that are committed in the rebidding period to make up for the fact that PJM no longer has enough reserves are only occasionally committed as Day-ahead Scheduling Reserves, and instead are overwhelmingly committed as energy. Thus, the costs associated with these additional megawatts, whether they are energy or reserves, are allocated via the Real-time Energy Market, rather than the Day-ahead Scheduling Reserves Market. This accounts for the different allocation methodologies for costs associated with meeting the Additional Day-ahead Scheduling Reserve Requirement and costs associated with the “additional reserves” procured during the rebidding period – which are almost never “additional reserves” but rather should be thought of as “additional energy.”

Because the costs of procuring these additional megawatts are allocated via the Real-time Energy Market, it is an issue predominantly related to energy uplift allocation. Energy uplift allocation was not addressed in the ERPIV (or accordingly the Initial Filing) because PJM already has a stakeholder group, the Energy Market Uplift Senior Task Force (“EMUSTF”), which has been addressing issues related to energy uplift allocation in PJM since July 2013.42 No stakeholder raised the issues of energy uplift cost allocation for units committed in the rebidding period, or the cost allocation of “all additional reserves” procured during the rebidding period, at the ERPIV. Had any stakeholder raised such issue, PJM would have directed them to address it at the EMUSTF because that is the appropriate forum.

4. PJM proposes to increase the day-ahead scheduling reserve in certain circumstances to account for uncertainty. Could PJM achieve the same level of certainty by keeping the total reserve requirement unchanged and instead changing the composition of that requirement by increasing the primary reserve requirement and decreasing the secondary reserve requirement?

**PJM Answer:** The reserves PJM carries give PJM a greater ability to respond to unforeseen system conditions when they do occur but they do not add certainty to the system. Unforeseen system conditions will occur regardless of the level of reserves and are no easier to predict even at higher reserve levels. Changing the rationing of total reserves to maintain a higher percentage of primary reserves would give PJM greater flexibility than it has today, but it would not address instances where PJM simply needs a greater volume of reserves than what it normally needs. For example, PJM typically schedules approximately 6% of the load forecast in 30-minute reserves for a normal Operating Day. If it is anticipated that severe weather may result in significant generator failures or load forecast uncertainty that exceed the typical 6%

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42 The first meeting of the EMUSTF was held July 30, 2013. See EMUSTF web page at http://www.pjm.com/committees-and-groups/task-forces/emustf.aspx.
threshold, PJM may seek to carry additional reserves to match the level of increased uncertainty. In any case where unforeseen system conditions occur that require PJM to carry more reserves, flexibility cannot be used as a substitute for the fact that PJM simply needs more reserves than it anticipated. Therefore, PJM could not achieve the same level of certainty by keeping the total reserve requirement unchanged and instead changing the composition of that requirement by increasing the primary reserve requirement and decreasing the secondary reserve requirement.

Respectfully submitted,

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Enclosure – Attachment A (Privileged and Non-Public) - Redacted
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 Audubon, PA, this 11th day of February, 2015.

Steven Shparber
Attorney for
PJM Interconnection, L.L.C.
Attachment A

Materials Redacted-Confidential