

139 FERC ¶ 61,130  
FEDERAL ENERGY REGULATORY COMMISSION  
WASHINGTON, D.C. 20426

Before Commissioners: Jon Wellinghoff, Chairman;  
Philip D. Moeller, John R. Norris,  
and Cheryl A. LaFleur.

PJM Interconnection, L.L.C.

Docket No. ER12-1204-000

ORDER ON COMPLIANCE FILING

(Issued May 17, 2012)

1. On March 5, 2012, PJM Interconnection, L.L.C. (PJM) submitted a compliance filing and proposed tariff changes to establish a revised compensation methodology governing the provision of frequency regulation service, as required by Order No. 755.<sup>1</sup> PJM states that, as required by Order No. 755, its compliance proposal establishes a two-part compensation methodology for frequency regulation service. PJM requests an effective date for its filing of October 1, 2012.

2. For the reasons discussed below, we accept PJM's compliance filing, subject to conditions, to become effective, as requested, on October 1, 2012. We also require PJM to make an additional compliance filing, within 90 days of the date of this order.

**I. Background**

**A. Frequency Regulation Service**

3. Frequency regulation is an ancillary service, as required under the Commission's *pro forma* open access transmission tariff (*pro forma* OATT).<sup>2</sup> It is relied upon by system

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<sup>1</sup> *Frequency Regulation Compensation in the Organized Wholesale Power Markets*, Order No. 755, 76 FR 67,260 (Oct. 31, 2011), FERC Stats. & Regs. ¶ 31,324 (2011) (Order No. 755), *order denying reh'g*, Order No. 755-A, 138 FERC ¶ 61,123 (2012).

<sup>2</sup> *See Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities and Recovery of Stranded Costs by Public Utilities and Transmitting Utilities*, Order No. 888, FERC Stats. & Regs. ¶ 31,036 at 31,705 (1996), *order on reh'g*, Order No. 888-A, FERC Stats. & Regs. ¶ 31,048 (1997), *order on reh'g*, Order No. 888-B, 81 FERC ¶ 61,248 (1997), *order on reh'g*, Order No. 888-C, 82 FERC

(continued...)

operators to control both actual and anticipated frequency deviations. A frequency deviation is caused when the supply of dispatched generation, or demand response resources, as measured in Hertz, fails to equal the amount of electricity actually consumed (i.e., load, plus losses), at a given moment. When such a deviation exceeds an acceptable range, the system can be impaired, with major deviations causing generation and transmission equipment to disconnect from the grid. In the worst case, a blackout can be triggered.

**B. Order No. 755**

4. In Order No. 755, the Commission found that the resources relied upon by regional transmission operators (RTOs) and independent system operators (ISOs) to provide frequency regulation service differ in both their ramping ability and the accuracy with which these resources can respond to the system operator's dispatch signal.<sup>3</sup> Order No. 755 further found that current compensation policies fail to acknowledge these operational differences. Specifically, Order No. 755 found that existing RTO/ISO compensation methods result in rates that are unjust, unreasonable, and unduly discriminatory or preferential, given that resources are compensated at the same level even when providing different amounts of frequency regulation service.<sup>4</sup> Order No. 755 further found that paying a uniform clearing price that includes opportunity costs would send efficient price signals reflecting the true cost of providing frequency regulation service.<sup>5</sup>

5. To accomplish this objective, Order No. 755 required each RTO/ISO to use market-based mechanisms to select and compensate frequency regulation resources based on a two-part payment methodology. First, Order No. 755 required that a capacity payment be made to a resource to keep its capacity in reserve in the event that it is needed to provide real-time frequency regulation service.<sup>6</sup> Second, Order No. 755 required that performance payments be made, that reflect the amount of work each resource performs in real-time in response to the system operator's dispatch signal.<sup>7</sup> Order No. 755, however, gave each RTO and ISO

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¶ 61,046 (1998), *aff'd in part and rev'd in part sub nom. Transmission Access Policy Study Group v. FERC*, 225 F.3d 667 (D.C. Cir. 2000), *aff'd sub nom. New York v. FERC*, 535 U.S. 1 (2002).

<sup>3</sup> Order No. 755, FERC Stats. & Regs. ¶ 31,324 at P 1.

<sup>4</sup> *Id.* P 64.

<sup>5</sup> *Id.* P 99

<sup>6</sup> *Id.* P 198.

<sup>7</sup> *Id.* P 199.

discretion in identifying the manner by which it would implement Order No. 755's required two-part payment methodology.<sup>8</sup>

6. Order No. 755 also acknowledged that the market rule revisions required by Order No. 755 contemplate fundamental changes to the way RTOs and ISOs procure and compensate frequency regulation services and that these rule changes may render existing RTO and ISO market power rules insufficient for purposes of addressing market power concerns.<sup>9</sup> Accordingly, Order No. 755 required each RTO/ISO to submit revised market power mitigation provisions, as appropriate to their redesigned frequency regulation markets, or explain how their current mitigation methods are sufficient to address market power concerns.

### **C. PJM's Existing Rules**

7. PJM states that its existing compensation rules for the provision of frequency regulation service fail to satisfy the requirements of Order No. 755. Specifically, PJM states that resources offering frequency regulation into the PJM frequency regulation market are currently permitted to submit capability offers only.<sup>10</sup> PJM adds that, under its existing rules, it does not consider any potential variation in the requested movement from a resource or the accuracy of that resource in its market clearing process. PJM notes that, instead, its market clearing process ranks regulation resources by cost, based on the sum of a resource's opportunity costs and offers for capability. PJM states that the highest ranked resource that clears is the marginal unit that sets the price for an hour, with each resource paid the clearing price times the amount of regulation capability that cleared the market.

8. PJM states that it estimates opportunity costs during its *ex ante* regulation market clearing process and subsequently provides an after-the-fact make-whole payment to individual units based on actual opportunity costs.

### **D. PJM's Compliance Proposal**

9. We summarize below the steps required under PJM's proposal to provide for a two-part payment to frequency regulation resources, from offer submission to settlement. This description is based on PJM's filed proposed tariff sheets and Operating Agreement, as well

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<sup>8</sup> *Id.* P 185.

<sup>9</sup> *Id.* P 136.

<sup>10</sup> *See generally* PJM OATT at Schedule 3 (Regulation and Frequency Response Service).

as draft Manual 11, 12 and 28, as available on PJM's website. As necessary, elements of PJM's proposal are also discussed below at section IV of this order.

### **1. Two-Part Offers**

10. Under PJM's proposal, regulation resources will be required to submit a two-part offer, consisting of a capability offer (a price associated with the amount of regulation capacity available) and a performance offer (a price associated with the amount of work provided by each unit). The capability offer will specify the price at which the resource offers regulation capability (\$/MW). PJM proposes to adjust each capability offer by a benefits factor (discussed below) and a historic performance score (also discussed below). PJM also proposes to add to the capability offers the estimated unit-specific opportunity costs (both cross-product and inter-temporal), as necessary. These estimates will be derived as part of the process of co-optimizing PJM's energy and ancillary services markets.

11. The performance offer will identify the price at which a resource offers regulation performance (\$/Change in MW). As with the capability offer, PJM states that it will adjust the performance offer by the benefits factor and the historic performance score. PJM will adjust the performance offer according to how much "mileage," or performance, is historically provided by this unit.

### **2. Benefits Factor**

12. The benefits factor is intended to capture the value that each resource brings to the market, following PJM's regulation signals.<sup>11</sup> Specifically, the benefits factor is intended to recognize that resources capable of following the dynamic automatic generation control (AGC) signal more quickly, will help PJM meet its system reliability needs, as established by the North American Electric Reliability Corporation (NERC). PJM explains that the benefits factor acts to reduce the capability and performance offers in order to make dynamic-signal resources more attractive to the market solution algorithm. However, because there are decreasing marginal benefits from each additional MW offered by a dynamic-signal resource, PJM states that its benefits factor will decrease as more dynamic-signal resources are cleared.

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<sup>11</sup> PJM notes that, as provided in its manuals, the dynamic regulation signal (RegD) is used for regulating resources with little or no physical characteristics that limit ramp rate. PJM also notes that the traditional regulation signal (RegA) is used for regulating resources with physical characteristics that limit ramp rate. RegD has a time constraint that allows for faster cycling. By contrast RegA takes into account the RTO frequency and tie error. See PJM Regulation Performance Senior Task Force <http://www.pjm.com/~media/committees-groups/task-forces/rpstf/20120330/20120330-item-07-regulation-d-definition-and-test.ashx>

### **3. Historic Performance Score**

13. The intent of the historic performance score is to ensure that a cleared resource is able to provide the amount of frequency regulation service needed. A resource that historically has not performed well will have its capability offer adjusted such that it appears more expensive in the merit-order bid stack. This historic performance score will reflect the resource's historical accuracy of providing regulation service averaged over a rolling 100 hours.

### **4. The Combined Offer**

14. Each two-part offer received by PJM will be combined into one offer that reflects both capability and performance. All available regulating resources' offers will then be ranked in ascending order of their merit order prices, and the lowest-cost set of resources necessary to simultaneously meet the PJM regulation requirement and the PJM synchronized reserve requirement will then be determined.<sup>12</sup> The highest merit offer associated with this lowest-cost set of resources represents the Total Regulation Market Clearing Price for that hour. From the group of cleared resources, PJM will then use the highest adjusted performance offer as the Performance Regulation Market Clearing Price (thus, the Performance Regulation Market Clearing Price need not necessarily be the performance offer of the marginal resource). The difference between the Total Regulation Market Clearing Price and the Performance Regulation Market Clearing Price will determine the Capability Regulation Market Clearing Price. Market offers are price-based unless an individual unit fails a market power screen, in which case a cost-based offer will be used as described in section IV.D, below.

### **5. Settlement**

15. In settlement, each resource will be compensated based on its amount of capability awarded and its performance in real-time. The capability payment will be a straightforward measure of the amount of capability cleared and the Capability-Regulation Market Clearing Price. Payment for performance will be based on the actual service provided by a resource in real-time, the Performance Regulation Market Clearing Price, adjusted by the resource's

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<sup>12</sup> Currently, PJM uses synchronized reserve and regulation scheduling software. PJM proposes to use the regulation offers, synchronized reserve offers, and commitment data to determine the total regulation market clearing prices and the synchronized reserve market clearing price. PJM's software ranks all available regulating resources in ascending merit order price, and simultaneously determines the least expensive set of resources necessary to provide energy, regulation and synchronized reserve for the operating hour taking into account any resources self-scheduled to provide any of these services. *See* PJM Manual 11.

Accuracy Score. In the event that a resource's compensation is made too small, due to PJM's estimation of opportunity cost, a make-whole payment is made to the resource.

16. Additionally, in real-time, PJM proposes to collect, every 10 seconds, performance data that can be used in analyzing each resource's accuracy in following the AGC signal. PJM proposes an Accuracy Score comprising three measures. The Accuracy Score can range from zero to one, with one being perfect accuracy.

17. The first component of the Accuracy Score is the Energy Score. This accounts for any difference between the energy the system operator requests and how much the resource provides. The closer a resource's actual response is to both the dispatch signal and its regulation capability assignment, the higher the Energy Score will be. Thus a resource that is sent a dispatch signal asking for the resource to move its entire capability, and which does move that entire amount in a 10 second interval, will receive a perfect Energy Score. As a resource's signal is limited more (due to ramping ability) and the resource performs more slowly, the Energy Score decreases.

18. The second component of the Accuracy Score is the Delay Score. The Delay Score measures the delay between when the system operator sends its Regulation Dispatch Signal and when the resource responds via its Regulation Response Signal, the latter of which relays to the system operator the resource's output in response to the dispatch signal. The Delay Score increases as the delay between signals decreases.

19. The third component of the Accuracy Score is the Correlation Score. This measures the correlation between the Regulation Dispatch Signal and the Regulation Response Signal. The Correlation Score increases as the correlation between the signals increases. The Accuracy Score is a summation of each component multiplied by a weighting factor.

## **II. Notice of Filing and Responsive Pleadings**

20. Notice of PJM's compliance filing was published in the *Federal Register*, 77 Fed. Reg. 14,511 (2012), with interventions and protests due on or before March 26, 2012. Notices of intervention and timely-filed motions to intervene were filed by the entities noted in the appendix to this order. In addition, motions to intervene out-of-time were submitted, on March 30, 2012, by Rockland Electric Company (Rockland), and on April 2, 2012, by Duke Corporation (Duke), respectively.

21. Protests and/or comments were submitted by DC Energy, LLC (DC Energy); Monitoring Analytics, LLC, PJM's independent market monitor (IMM); PSEG Companies (PSEG); Beacon Power, LLC (Beacon Power); Electricity Storage Association (ESA); American Municipal Power, Inc. (AMP); PJM Power Providers Group (P3); Dominion Resources Services, Inc. (Dominion); and Enbala Power Networks (USA), Inc. (Enbala). An answer to protests was submitted by PJM on April 10, 2012. Answers to answers were submitted on April 25, 2012, by PSEG Companies (PSEG) and Dominion Resources

Services, Inc. (Dominion), filing jointly, and by Dominion, filing separately, and on April 26, 2012, by Monitoring Analytics, LLC, PJM's independent market monitor (IMM).

### **III. Procedural Matters**

22. Pursuant to Rule 214 of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.214 (2011), the notices of intervention and timely, unopposed motions to intervene serve to make the entities that filed them parties to this proceeding. In addition, given the early stage of this proceeding and the absence of undue prejudice or delay, we grant the unopposed late-filed interventions of Rockland and Duke.

23. Rule 213(a)(2) of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.213(a)(2) (2011), prohibits an answer to a protest and an answer to an answer unless otherwise ordered by the decisional authority. We will accept the answers filed by PJM, PSEG, Dominion, and the IMM, because they have provided information that assisted us in our decision-making process.

### **IV. Discussion**

24. We accept PJM's compliance filing, subject to conditions and the submission of an additional compliance filing, within 90 days of the date of this order, to become effective, as requested, on October 1, 2012.<sup>13</sup> We find that PJM's compliance proposal generally satisfies the requirements of Order No. 755 and is a reasonable approach to compensating resources that provide frequency regulation service. However, as discussed in more detail below, we will require PJM to provide additional details and tariff language concerning several aspects of its proposal.

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<sup>13</sup> PJM states that its compliance proposal relies on a related, shortage pricing proposal, submitted in Docket No. ER09-1063-004. PJM notes that because its shortage pricing proposal remained pending, as of the date that PJM made its filing in this proceeding, it has included alternative proposed tariff sheets, to be considered. Given the Commission's conditional acceptance of PJM's shortage pricing proposal, in *PJM Interconnection, L.L.C.*, 139 FERC ¶ 61,057, at P 30 (2012) (Shortage Pricing Order), we hereby dismiss, as moot, PJM's alternative proposal. We also reject, as moot and beyond the scope of this proceeding, protest arguments made by the IMM in opposition to PJM's joint-optimization proposal, as conditionally accepted by the Commission in the Shortage Pricing Order. *Id.*

**A. Capacity Payment****1. Order No. 755**

25. Order No. 755 required that RTOs and ISOs provide for the payment of a uniform clearing price for capacity to all cleared frequency regulation resources that include the marginal resource's opportunity costs.<sup>14</sup> Order No. 755 also required that this uniform clearing price be market-based, as derived from market participants' bids for the provision of frequency regulation capacity.

26. Order No. 755 further required RTOs and ISOs to calculate each resource's cross-product opportunity costs (i.e., the foregone opportunity to participate in the energy or ancillary services markets), and to then add this cost to each resource's frequency regulation capacity offer.<sup>15</sup> In addition, Order No. 755 directed each RTO and ISO to allow a resource to include its inter-temporal opportunity costs, to the extent the resource has such costs, in its offer (i.e., the foregone value when a resource must operate at a given time, and therefore must either forego a profit from selling energy at a later time or incur costs due to consuming at a later time), provided such costs are verifiable.<sup>16</sup> Order No. 755, however, declined to specify the circumstances under which certain resources, including energy storage resources, at the time that they charge, should be treated as eligible to receive a capacity payment during the time that they charge.<sup>17</sup>

**2. PJM's Proposal**

27. PJM states that, under its proposal, each resource that provides regulation will receive a payment for capability equal to the Capability Market Clearing Price times the cleared capability megawatts (MW), with the Capability Market Clearing Price including the marginal resource's opportunity costs. PJM states that the Capability Market Clearing Price will be market-based and uniform, given that it will be derived from the two-part offer that comprises the Total Regulation Market Clearing Price. PJM's proposal also addresses Order No. 755's requirement that each RTO/ISO calculate an offeror's cross-product

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<sup>14</sup> Order No. 755, FERC Stats. & Regs. ¶ 31,324 at P 99.

<sup>15</sup> *Id.* P 102.

<sup>16</sup> *Id.*

<sup>17</sup> *Id.* P 100. The Commission recognized that methods for handling the charging state of energy storage resources varied among RTOs and ISOs, based on regional differences. Accordingly, the Commission permitted each RTO and ISO to address this issue, in its compliance filing, based on the given needs of its region. *Id.*

opportunity costs as an input to be added to a frequency regulation capacity offer. PJM proposes to estimate each offeror's opportunity costs on the basis of the expected value of the energy sales that would be foregone or rendered uneconomic by an increase in costs relative to the energy market for providing regulation.

28. With respect to Order No. 755's direction that each RTO/ISO allow a resource to include its inter-temporal opportunity costs in its offer, provided such costs are verifiable, PJM states that, currently, PJM calculates inter-temporal opportunity costs for hydropower units only and includes such costs in a hydropower unit's offer to sell frequency regulation service.<sup>18</sup> PJM explains that, under its proposal, the inter-temporal opportunity costs attributable to any resource may be considered, and that such costs will be defined in the manuals for each resource type that requests treatment. PJM also proposes to rely on a tariff revision accepted by the Commission in the Shortage Pricing Order, that eliminates shoulder-hour opportunity costs. Prior to PJM's tariff revision, shoulder-hour costs were included as a component of frequency regulation opportunity costs.<sup>19</sup> PJM asserts that the elimination of these costs as an opportunity cost is appropriate, given that these costs cannot be calculated in real-time.

29. With respect to Order No. 755's requirement that RTOs/ISOs address whether circumstances exist under which certain resources would not receive a capacity payment, PJM asserts that its proposal represents a resource-neutral approach that will provide both a capability payment and performance payment to all resources, including energy storage resources that are assigned to provide regulation and provide adequate response to a regulation control signal. PJM adds that a resource that cannot, or does not, provide an adequate response, due to insufficient energy, will cause its hourly accuracy score to decrease, thereby reducing compensation paid to that resource for that hour. PJM explains,

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<sup>18</sup> See PJM Manual 11 (Energy and Ancillary Services) at section 3.2.8 (Hydro Units). PJM calculates these inter-temporal opportunity costs by averaging the historical price of energy for both on-peak and off-peak hours based on historical prices. PJM utilizes the averaged set of on-peak and off-peak energy prices to estimate a hydropower unit providing energy in other hours, which are included in a resource's offer to sell frequency regulation service.

<sup>19</sup> PJM notes in its manuals that Regulation opportunity cost is divided into three components: (i) shoulder-hour preceding the initial regulating hour while the unit moves uneconomically into its regulating band to comply with the next hour's regulation assignment; (ii) in the actual regulating hour from reducing or raising the unit's output uneconomically for the purpose of providing regulation; (iii) shoulder-hour following the final hour of the regulation assignment while the unit moves from its uneconomic regulation set point back to its economic set point. See PJM Manual 11 <http://www.pjm.com/~media/documents/manuals/m11.ashx>

however, that an energy-limited resource that follows PJM's energy-neutral dynamic regulation signal is unlikely to become so constrained.

### **3. Protests and Comments**

30. The IMM argues that PJM's proposal to calculate the Capability Regulation Market Clearing Price for each regulation zone, by subtracting the performance Regulation Market Clearing Price from the Total Regulation Market Clearing Price, is inconsistent with Order No. 755's directive that regulation prices be uniform, market-based and reflect the incremental cost of providing regulation services, including actual, not estimated, opportunity costs.<sup>20</sup> The IMM asserts that, as such, PJM's proposed regulation market design fails to eliminate the need for make-whole payments, even with the use of actual ex post opportunity costs in the capability offers. The IMM further argues that PJM's proposal fails to provide a market-based capability result, on the basis of incremental cost to provide each service, with a total price that will not reflect the marginal cost to provide regulation.

31. Dominion and PSEG object to PJM's elimination of payment for shoulder-hour lost opportunity cost for units performing in the regulation market, as provided under PJM's existing tariff.<sup>21</sup> Dominion argues that, without the inclusion of these costs, generators will be exposed to costs in pre- and post-regulating hours without compensation. Dominion asserts that requiring generators to provide frequency regulation in the pre- and post-regulating hours without lost opportunity cost credits is unjust and unreasonable. PSEG agrees that PJM's proposal to eliminate shoulder-hour payments will reduce the incentives for traditional resources to provide frequency regulation service, contrary to the goals of Order No. 755. Dominion also objects to PJM's elimination of compensation, under the current method for providing inter-temporal lost opportunity credits to run-of-river and pumped-hydro storage resources providing regulation services. Dominion asserts that requiring run-of-river and pumped-hydro storage units to provide regulation service without lost opportunity cost calculation credits is unjust and unreasonable.

### **4. PJM's Answer**

32. In response to the IMM, PJM states that while the Capability Market Clearing Price will be a residual value that may not contain the marginal unit's opportunity costs, the total compensation paid to each resource for providing regulation service, i.e., the Total Regulation Market Clearing price, will reflect the marginal unit's lost opportunity costs, given that the Total Regulation Market Clearing Price (a price that is paid to market

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<sup>20</sup> The PJM Operating Agreement, at Schedule 1, provides that this residual sets the Capability Regulation Market Clearing Price for that market hour.

<sup>21</sup> *See id.* at section 3.2.2(d).

participants via the performance clearing price and capability clearing price), incorporates each resource's lost opportunity cost and is set using the highest ranked resource that clears.<sup>22</sup>

33. PJM states that while it is theoretically possible that PJM's proposal will not eliminate the need for make-whole payments, the scenario (use of actual five minute prices, rather than forecasted) outlined by the IMM is operationally unrealistic because the input to the regulation control signals drives both the fast- and slow- regulation signals in such a way that the signals tend to remain proportional. PJM adds that based on this proportionality, its proposal will likely eliminate make-whole payments and compensate resources for all costs. PJM states, however, that it will monitor this issue and proposes to submit a six-month report detailing the impacts of its proposal on the compensation for providing frequency regulation service and opportunity costs.

34. In response to PSEG and Dominion's argument regarding shoulder-hour opportunity costs, PJM argues that its proposal will adequately compensate resources for all opportunity costs, including shoulder-hour opportunity costs. PJM states that, as explained in its shortage pricing proposal, filed in Docket No. ER09-1063-004, eliminating shoulder-hour opportunity costs is necessary for the purpose of implementing co-optimization and real-time pricing, given that shoulder-hour opportunity costs cannot be calculated on a real-time basis. Regardless, PJM argues that its frequency regulation payment proposal will adequately compensate resources for all such opportunity costs because the resulting prices will be sufficiently high to ensure that each regulation resource is adequately compensated.

35. PJM also clarifies its position regarding inter-temporal lost opportunity credits for run-of-river and pumped-hydro storage resources providing regulation services (an issue raised by Dominion). Specifically, PJM clarifies that its proposal does not eliminate inter-temporal opportunity costs for hydropower units and the current process for estimating the inter-temporal opportunity costs based on day-ahead information for hydropower units will be used in the clearing process. PJM states that its proposal only expands the definition of resources eligible for such compensation.

## **5. Additional Answers**

36. Dominion argues that PJM's inter-temporal opportunity costs proposal is insufficient to protect hydro regulation resources from the significant losses that could be associated with the removal of the recalculation of the inter-temporal opportunity costs for hydropower units based on actual prices after the clearing process to determine the need for make-whole payments. Dominion and PSEG further argue that PJM's elimination of shoulder-hour payments will reduce incentives for traditional resources from providing frequency

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<sup>22</sup> See proposed Operating Agreement at Schedule 1, section 3.2.2(c).

regulation service, contrary to the goals of Order No. 755. Dominion and PSEG add that PJM's proposal to monitor payments for a six-month period, beginning October 1, 2012, will not adequately test the sufficiency of the revenue stream over the periods in which payments would most likely be insufficient. Dominion and PSEG assert that the greatest risk of revenue insufficiency would be during peak periods – most likely over the summer – when high prices during a shoulder period would likely not be offset by payments during the assignment period.

37. The IMM agrees with Dominion that PJM's market design should account and compensate for legitimately incurred costs of providing service. The IMM asserts that shoulder-hour opportunity costs are actual costs imposed on participants who participate in PJM's regulation market. The IMM further asserts that while PJM's proposal will, through the use of actual instead of estimated LMP, better reflect the actual cost of regulation, and thereby reduce the most significant source of out of market payments, PJM's proposal does not eliminate the need for uplift related to shoulder-hour costs.

## **6. Commission Determination**

38. We find that PJM's compliance proposal satisfies Order No. 755's requirement that all cleared frequency regulation resources be paid a uniform clearing price that includes the marginal resource's opportunity costs. Order No. 755 gives discretion to each RTO and ISO regarding the design of an RTO/ISO regulation market.<sup>23</sup> As proposed by PJM, the Total Regulation Market Clearing Price will be predicated on the offers to provide frequency regulation and thus will be market-based, as contemplated by Order No. 755. To select the most efficient resources, PJM will consider both capacity bids and performance bids. We find that PJM's proposal represents a reasonable method of selecting the most efficient resources providing frequency regulation.

39. We further find that the "residual" approach proposed by PJM for calculating the Capability Regulation Market Clearing Price for each regulation zone represents a market-based solution that is derived from participant bids, not an administratively-determined price.<sup>24</sup> The residual approach results in two separate and efficient clearing prices, even though the two clearing prices are extracted from a single, optimized clearing price that

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<sup>23</sup> Order No. 755, FERC Stats. & Regs. ¶ 31,324 at P 75.

<sup>24</sup> See proposed Operating Agreement at Schedule 1, sections 3.2.2(f):

PJM will calculate the Capability Regulation Market Clearing Price for each Regulation Zone by subtracting the Performance Regulation Market Clearing Price from the Total Regulation Market Clearing Price. This residual sets the Capability Regulation Market Clearing Price for that market hour.

considers both performance and capability. We find that this approach is consistent with Order No. 755's focus on promoting efficient price signals.<sup>25</sup> PJM's proposed solution also achieves the market operator's goal of minimizing the total costs of procuring both capability and performance. By combining a resource's offers for both capability and performance into one composite bid, PJM is able to ensure that the combined cost of frequency regulation capability and performance is minimized. Moreover, PJM's market-based approach improves on PJM's existing methodology, an approach that does not compensate resources in a way that reflects their differing performance levels. PJM's existing methodology sends the wrong price signal both to traditional resources and to those entities considering investments in new technologies to provide frequency regulation service. Under PJM's proposed revisions, resource owners will submit specific offers covering both capability and performance and will be compensated for the capability to provide regulation service and for actual performance in providing this service. We find persuasive PJM's assertions that its proposal should lead to reductions in the amount of frequency regulation capacity that PJM needs to procure in order to maintain reliability.

40. However, we find merit in PSEG and Dominion's argument that generators providing frequency regulation service at the direction of PJM should receive shoulder-hour lost opportunity costs. PJM has not adequately explained why incorporating the shoulder-hour in the frequency regulation price would be problematic. PJM explains that elimination of shoulder-hour opportunity costs, as accepted by the Commission in the Shortage Pricing Order, was necessary because shoulder-hour opportunity costs cannot be calculated on a real-time basis.<sup>26</sup> However, under PJM's proposal, regulation commitments will be made prior to the operational hour, based on forecasted prices used to determine the regulation clearing price and opportunity costs. As a result, five-minute pricing will be based on estimates, not based on real-time calculations.

41. Additionally, we note that Order No. 755 requires that opportunity costs be included in a resource's offer, provided that the costs are verifiable.<sup>27</sup> For example, if a resource moves uneconomically into its regulating band, to comply with the next hour's regulation assignment, or follows the final hour of the regulation assignment to provide frequency regulation, that resource should receive an opportunity cost payment. Therefore, we require PJM to explain in its compliance filing how it will ensure that eliminating shoulder-hour opportunity costs satisfies Order No. 755's requirement that inter-temporal opportunity costs be included in a resource's offer to sell frequency regulation service. We further require PJM to address, in its compliance filing, the relationship between eliminating

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<sup>25</sup> Order No. 755, FERC Stats. & Regs. ¶ 31,324 at P 72.

<sup>26</sup> Operating Agreement at Schedule 1, section 3.2.2(d) (Regulation).

<sup>27</sup> Order No. 755, FERC Stats. & Regs. ¶ 31,324 at P 103.

shoulder-hour opportunity costs and the calculation of frequency regulation prices on a five-minute basis.

42. We reject Dominion's argument that PJM's proposed revisions will inappropriately eliminate inter-temporal opportunity costs for hydropower units. We find reasonable PJM's clarification that, in fact, its proposal does not eliminate costs for hydropower units given that the opportunity costs will be included in the resource's offer.<sup>28</sup> Moreover, we find that PJM's proposal to rely on a stakeholder proceeding to determine the calculation formulas of inter-temporal costs of other types of resources is consistent with Order No. 755.<sup>29</sup> Specifically, Order No. 755 provides that RTOs and ISOs are allowed to determine whether they, or their market participants, will be responsible for calculating such costs. However, we reject PJM's proposal to include these calculations and formulas in its manuals. Given the potential impact of these calculations on the rates, terms and conditions of PJM's jurisdictional services, we require PJM to include these provisions in its tariff. We therefore direct PJM to include these provisions in its compliance filing.

43. With respect to the charge state of energy storage resources, we find that PJM's explanation satisfies Order No. 755's requirement. In Order No. 755, we recognized that some RTOs and ISOs manage the charge state of energy resources, while others do not.<sup>30</sup> We also found it appropriate to allow each RTO and ISO flexibility in addressing this issue and explaining any implications for compensation.<sup>31</sup> We agree with PJM that providing an energy-neutral dynamic regulation signal to an energy-limited resource makes it unlikely that such a resource will become constrained and unable to provide an adequate response.<sup>32</sup>

## **B. Benefits Factor**

### **1. PJM's Proposal**

44. As explained above (*see supra* section I.D.2), PJM proposes to use a benefits factor in the calculation of the Total Regulation Market Clearing Price. PJM explains that flexible, fast-ramping resources will follow a dynamic regulation signal (used for regulating

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<sup>28</sup> See PJM Manual 11 (Energy & Ancillary Services Market Operations) at section 3.2.8 (Hydro Units). See also Operating Agreement at Schedule 1, section 3.2.2(h).

<sup>29</sup> Order No. 755, FERC Stats. & Regs. ¶ 31,324 at P 103.

<sup>30</sup> *Id.* P 100.

<sup>31</sup> *Id.* P 101.

<sup>32</sup> See proposed Manual 12, section 4.4.2 (Regulation Signals).

resources with little or no physical limits on their ramp rate) that will be utilized first, to counteract sudden Area Control Error movements and will then slowly reset to a midpoint as the slower resources respond, such that the resources can work together. PJM states that its system algorithm will aim to procure twenty percent of its system's regulation requirement by fast-following resources.<sup>33</sup> PJM states that its proposed benefits factor is designed to create a common basis for the clearing engine to consider the impact that each resource will have on system control. PJM states that this "apples-to-apples" comparison will ensure the appropriate balance of resources and will allow uniform clearing prices to be set for all resources.<sup>34</sup> The benefits factor recognizes that resources capable of following the regulation signals aid PJM's ability to meet NERC reliability standards at the lowest possible costs.

## 2. Protests and Comments

45. ESA and Beacon Power argue that whether PJM's frequency regulation market operates in accordance with Order No. 755 cannot be determined based solely on the tariff language proposed by PJM. They claim that the specific formulas for clearing and settling the market will, under PJM's proposal, be relegated to the as yet to be determined provisions of PJM manuals. ESA and Beacon Power are further concerned that, under the draft PJM manual provisions circulated by PJM, PJM has proposed to calculate Order No. 755's required performance and capability payments using a formula that is both inconsistent with the tariff language proposed by PJM, in its compliance filing, and is contrary to Order No. 755.

46. ESA and Beacon Power note, for example, that PJM's proposed use of a benefits factor fails to comply with Order No. 755's directive that each resource be paid based on the actual quantity of frequency regulation service it provides because multiplying a resource's performance payment by the benefits factor can result in a resource receiving little to no payment even though it may have accurately provided frequency regulation service to PJM. Accordingly, ESA and Beacon Power urge the Commission to require PJM to submit, for Commission review (and within 60 days of the Commission's approval of PJM's compliance filing), the manual provisions on which PJM proposes to rely.

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<sup>33</sup> PJM commissioned KEMA, Inc. (KEMA) to study the trade-off between resources following the traditional regulation signal and those able to follow the new dynamic signal. KEMA found that by procuring approximately twenty percent of its regulation capacity as resources following the dynamic signal, PJM will be able to minimize its costs of regulation while remaining in compliance with the reliability standards established by NERC.

<sup>34</sup> PJM notes that the proposed Operating Agreement provision, at Schedule 1, section 3.2.2(f), provides that the benefits factor may be used only for market clearing purposes, but prohibits use of the benefits factor in the settlement process.

47. The IMM argues that PJM's compliance filing proposal lacks specificity regarding the exact nature of the benefits factor used in optimization and settlement. The IMM requests that the Commission reject PJM's compliance filing and remand the issue to PJM's stakeholder process for further deliberation and development within a defined time period. The IMM further argues that the provisions related to the benefits factor and other provisions must be made a part of PJM's tariff and not be relegated to the PJM Manuals. The IMM argues that PJM's tariff should clearly delineate the types of costs that will be considered appropriate to include in a resource's performance offer. The IMM adds that while PJM's tariff delineates items that can be included in cost offers, it does not, with the exception of the \$12 adder, indicate which elements are applicable to performance offers and which elements are not.

48. The IMM also argues that the use of the unit-specific benefit factor would result in the equivalent of a pay-as-bid outcome, rather than a single clearing price outcome. The IMM asserts that this approach fails to reflect the marginal rate of substitution, a failure that results in suboptimal ratios of fast-to-slow resources in the market solutions. The IMM adds that the use of unit-specific benefit factors for settlement purposes would result in non-uniform, discriminatory compensation among fast resources that cleared in the same market. The IMM argues that this would violate Order No. 755's requirement that prices be uniform and market-based, not administrative and discriminatory. Finally, the IMM argues that using five minute co-optimization is not required to eliminate make-whole payments in the frequency regulation market.<sup>35</sup> The IMM asserts that all that is needed to comply with Order No. 755 is the use of actual opportunity costs. The IMM proposes re-creating the clearing prices after the market hour closes based on the actual LMPs.<sup>36</sup>

### **3. PJM's Answer**

49. PJM agrees with ESA and Beacon Power that PJM's draft manual provision, as proposed to calculate Order No. 755's required performance and capability payments, is inconsistent with the tariff language proposed by PJM.<sup>37</sup> PJM asserts, however, that its tariff controls and that to correct the existing inconsistency, as between its tariff and its manuals, PJM will revise the relevant manual provision to preclude the use of the benefits factor for settlement purposes. PJM disagrees with ESA and Beacon Power, however, on

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<sup>35</sup> In its answer, the IMM reiterates concerns raised in its protest, regarding PJM's proposed regulation market design and the elimination of make-whole payments.

<sup>36</sup> PJM notes that the proposed Operating Agreement provision, at Schedule 1, section 3.2.2(f), provides that the benefits factor may be used only for market clearing purposes, but prohibits use of the benefits factor in the settlement process.

the issue of whether PJM's proposed manual provision should be made a part of PJM's tariff. PJM argues that the provision at issue addresses a level of detail that is best assigned to PJM's manuals. PJM further notes that reliance on a manual provision will give PJM's stakeholders the flexibility required to develop revisions to these provisions, as may be necessary, to reflect ongoing operational experience. PJM urges the Commission to allow the stakeholder process to continue to develop the final manual language.

50. PJM also challenges the IMM's assertion that PJM's proposed benefits factor will not result in a uniform or market-based clearing price. PJM responds that its proposed revisions will ensure that a performance clearing price is uniform and market-based because the clearing price will be based on the market participants' offers to provide service and will be paid to each cleared resource.

51. With respect to the IMM's argument that PJM's proposal lacks specificity with regard to the nature of performance offers, PJM responds that its proposed provision, at Schedule 1, section 1.10.1A(e) of the Operating Agreement, contains the same level of specificity as PJM's existing provisions pertaining to offers. Nonetheless, PJM acknowledges that proposed sections 1.10.1A(e)(i) and (ii) should be revised to clarify that section 1.10.1A(e)(i) applies to the capability offer and section 1.10.1A(e)(ii) applies to the performance offer. Accordingly, PJM requests that the Commission conditionally accept this aspect of PJM's compliance filing, subject to the submission of an additional compliance filing clarifying that section 1.10.1A(e)(i) applies to the capability offer and section 1.10.1A(e)(ii) applies to the performance offer.

#### **4. Additional Answers**

52. The IMM agrees that PJM should have the flexibility to revise the benefits factor based on operational experience, the characteristics of the regulation signals, and the resources providing regulation. Nevertheless, the IMM argues that the exact nature of the benefits factor used in optimization and settlement needs to be made explicit, to provide for either the use of a marginal factor, or the use of a unit-specific factor.

53. The IMM is also concerned that PJM's proposal may base market optimization and settlement on unit-specific assignments of benefit factors rather than the use of the marginal or incremental benefit factor of the last resource combination cleared. The IMM states that the KEMA study showed decreasing rates of substitution between fast and slow resources as the proportion of fast resources increases.<sup>38</sup> The IMM asserts that this means that the benefit of every fast resource being used, not just the last one, is declining as more fast resources are added to the regulation commitment. The IMM argues that the correct way to include this result in the optimization is to reflect the marginal rate of substitution when

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<sup>38</sup> See *supra* note 33.

determining the relative substitutability of fast and slow resources and therefore the correct market equilibrium. The IMM also argues that the correct approach results in a uniform price that reflects the marginal value of the resources being used.

## 5. Commission Determination

54. While we recognize the advantage of a benefits factor that would operate to adjust for the differences between resources, we find that PJM has provided insufficient information as to how the benefits factor would be calculated. The benefits factor, as proposed, recognizes that resources capable of following the regulation AGC signals aid PJM's ability to meet NERC reliability standards at the lowest possible costs. This correlation is supported by the KEMA Report, a PJM-commissioned study that shows that, through the use of the benefits factor, PJM will be able to determine the optimal mix of resources that can respond to the different AGC signals that allows it to minimize the total capability it needs to procure, while at the same time maintaining its compliance with NERC's Control Performance Standard 1.<sup>39</sup> PJM, however, fails to explain how its proposed benefits factor will be calculated and whether the same factor will apply to all units or whether a different factor will be used for each unit's offer. As intervenors note, moreover, some resources that are able to respond to the faster regulation signal (i.e., the dynamic regulation signal) can also sustain output for many hours, something the benefits factor assumes is not the case. PJM must include in the tariff as part of its compliance filing the details describing how the benefits factor will be determined.

55. The IMM argues that while PJM's proposed tariff revisions provide that participants in the regulation market must submit cost-based offers, these provisions fail to specify the determinants of the cost of performance in dollars per change in MW. We disagree. PJM's Operating Agreement provides the determinants of the cost of performance. PJM proposes to revise section 1.10.1A(e) of Schedule 1 of the Operating Agreement to: (a) require that each resource offering to provide frequency regulation submit a performance offer in dollars per change in MW; (b) differentiate between the capability offer and the performance offer; and (c) clarify that the adder of up to \$12.00 per MW regulation applies to capability offers if it satisfies the measurement and verification tests. However, PJM acknowledges that proposed sections 1.10.1A(e)(i) and (ii) should be further revised to clarify that section

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<sup>39</sup> *Id.*

56. 1.10.1A(e)(i)<sup>40</sup> applies to the capability offer and section 1.10.1A(e)(ii)<sup>41</sup> applies to the performance offer. Accordingly, we accept PJM's proposed provisions, subject to the additional clarification proposed by PJM. We direct PJM to include this clarification in its compliance filing.

57. With respect to the IMM's argument that PJM's joint optimization provisions will not eliminate make-whole payments, we find that, under PJM's proposal, a uniform clearing price will be paid that includes the marginal resource's opportunity costs, as Order No. 755 requires.<sup>42</sup> As the Commission found in the Shortage Pricing Order, moreover, PJM's joint optimization proposal will factor in the actual opportunity costs in reserve prices and provide a more efficient market signal to compensate investment in demand response technologies.<sup>43</sup>

58. In the Shortage Pricing Order, the Commission further found that, by calculating prices on a five-minute basis, PJM will be able to reduce its system's reliance on hour-ahead forecasts and resource-specific uplift payments.<sup>44</sup> Further, the Commission found that a five-minute clearing price for regulation resources is consistent with price setting for PJM's real-time energy and reserves operations, a finding which we re-affirm here, and thus enhances comparability across these markets. We also find that PJM's establishment of five-minute optimization of energy and reserves will help reduce after-the-fact, uplift to regulation resource compensation, and enhance price signals that will provide incentives for new innovative resources and technologies to meet PJM's frequency regulation needs.

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<sup>40</sup> Section 1.10.1A(e)(i) of Schedule 1 of the PJM Operating Agreement provides that a cost-based offer must consist of the costs (in \$/MW) of the fuel cost increase due to the heat rate increase resulting from operating a unit at lower megawatt output incurred from the provision of Regulation.

<sup>41</sup> Section 1.10.1A(e)(ii) of Schedule 1 of the PJM Operating Agreement provides that a cost-based offer must consist of the cost increase (in \$/MW) in variable operating and maintenance costs resulting from operating the unit at lower megawatt output incurred from the provision of Regulation.

<sup>42</sup> Order No. 755, FERC Stats. & Regs ¶ 31,324 at P 99

<sup>43</sup> Shortage Pricing Order, 139 FERC ¶ 61,057 at P 34.

<sup>44</sup> *Id.* P 193.

## C. Payment for Performance

### 1. Order No. 755

59. Order No. 755 requires that the second part of the two-part payment to be provided to frequency regulation resources be a performance payment that reflects the quantity of frequency regulation provided by a resource when the resource is accurately following the dispatch signal. Specifically, Order No. 755 requires that the cleared performance price be: (i) market-based;<sup>45</sup> (ii) paid uniformly to all resources cleared during the same settlement period;<sup>46</sup> (iii) measured based on the absolute (rather than the net) amount of energy injected or withdrawn from the system, as provided by the resource in response to the system operator's dispatch signal;<sup>47</sup> and (iv) calculated relative to the resource's accuracy in following the dispatch signal.<sup>48</sup> Order No. 755 also requires that the performance payment reflect the amount of work each resource performs in real-time.<sup>49</sup>

### 2. PJM's Proposal

60. As discussed earlier, PJM proposes to pay a Performance Regulation Market Clearing Price based on the highest adjusted performance offer of the resources that cleared the market. In addition, PJM proposes to calculate the performance payment based on the requested MW movement and the relevant resource's response to the regulation control signal.

61. PJM states that, based on these measurements and as further provided by its proposed manual revisions, it will calculate an accuracy score for a regulation resource for each 10 second interval. PJM states that, because this score is designed to operate as an objective standard, PJM will not give weight to any additional, subjective considerations regarding the response characteristics of a resource class, or other similar exceptions.

62. PJM states that to acknowledge the greater amount of frequency regulation service being provided by high performing resources, it will compensate a regulation resource for the absolute amount of the MW movement for regulation that the resource provides. PJM

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<sup>45</sup> Order No. 755, FERC Stats. & Regs. ¶ 31,324 at P 128.

<sup>46</sup> *Id.* P 131.

<sup>47</sup> *Id.* P 133.

<sup>48</sup> *Id.* P 151.

<sup>49</sup> *Id.* P 199.

states that it will send a dispatch signal to a frequency regulation resource every two seconds, measure the regulation resource's response to the dispatch signal every ten seconds and compensate the resource for the total MW amount of regulation up and down multiplied by the accuracy score.<sup>50</sup>

### **3. Protests and Comments**

63. The IMM argues that PJM's compliance filing proposal lacks specificity regarding the specific nature of performance offers and the interaction between performance offers and the performance clearing price used to clear and settle the market. The IMM adds that PJM's proposal confuses the incremental cost of performance with the total payments for performance per unit of capability. The IMM adds that PJM's proposal fails to delineate the types of cost that would be appropriate to include in a resource's performance offer. The IMM argues that, due to this lack of specificity, PJM's performance payment will not be market-based.

64. The IMM also argues that PJM's proposal, to set the payment for performance equal to the performance clearing price times the cleared capability MW, erroneously assumes a fixed relationship *before* the actual hour between a MW of cleared capability and the actual amount of work done for fast and slow resources. The IMM argues that, in fact, the amount of work actually done in any given hour (the actual total mileage of the regulation signal and the unit's effectiveness in following the signal) will vary according to system conditions and unit performance. The IMM adds that using a fixed ratio between capacity and mileage based on historical performance would result in over and under collection in any given hour. The IMM notes that, as such, PJM's proposal fails to specify how clearing prices will reflect the actual requested mileage based on the regulation signal and the actual performance of units in following that signal. The IMM requests that the Commission reject PJM's proposal, as submitted, and require PJM to complete the stakeholder process to fill in the missing, but essential, details of its proposals. The IMM further argues that these provisions must be made a part of PJM's tariff and not be relegated to the PJM Manuals.

65. Beacon Power and ESA also argue that tariff language cannot determine whether PJM's proposal is Order No. 755-compliant since the specific formulas for clearing and settling the market are contained in Manuals which are still being finalized. Beacon Power argues that, under Order No. 755, a resource's performance must be measured based on the absolute amount of regulation up and regulation down it provides in response to the system operator's dispatch signal. Beacon Power argues, however, that the PJM's tariff, at section 3.2.2(f), only provides that resources will be credited for regulation performance based on "the amount of regulation performance the resource provides during the market hour" which is not in and of itself clear that the tariff will be implemented in conformance with Order

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<sup>50</sup> See proposed Manual 28 at section 4.2 (Regulation Credits).

No. 755, because it does not state how performance will be measured. Beacon Power points out that the conforming language is to be contained in Manual 28, at section 5.2, wherein PJM plans to state that performance is measured by the actual mileage (MW movement) the resource is dispatched to provide.

#### 4. PJM's Answer

66. To the IMM's argument that PJM's proposal lacks specificity regarding performance offers and the performance clearing price, PJM asserts that while its tariff revisions may not address each and every implementation detail relating to these performance offers, the courts have long held that a public utility's tariff need not provide each such implementation detail in order to meet the requirements of FPA section 205.<sup>51</sup> PJM argues that, regardless, its proposed tariff revisions contain sufficient detail to allow the Commission to make a determination that PJM's proposal will ensure that both its capability and performance payments will be market-based and that the clearing prices will be uniform, as Order No. 755 requires.

67. In response to the IMM's argument that PJM's performance payment proposal fails to reflect the actual requested mileage based on the regulation signal and the actual performance of units in following that signal, PJM claims that the IMM's argument relies on a mischaracterization of the equation on which PJM proposes to rely, which represents that the performance payment will equal the performance clearing price times the cleared capability MW. PJM argues that the IMM's equation is incomplete because it attempts to demonstrate the unrelated point that the marginal unit's opportunity costs will be paid to each resource. PJM asserts that, in fact, its compliance proposal is based on a broader equation that factors in not only the performance clearing price and the cleared MW of regulation capability, but also the ratio of change in MW per MW of capability and the accuracy of the resource relative to the regulation control signal.

68. PJM states that the provisions with which ESA and Beacon Power express concern are simply draft proposals at this time and have not yet been adopted. PJM recognizes that the draft PJM Manual proposal, as ESA points out, can be read as inconsistent with the proposed tariff revisions. As a result, PJM states that it commits to revise the draft Manual language to conform to the tariff. PJM states that it does not believe the detail in question is appropriately filed as OATT or Operating Agreement provisions for Commission approval.

69. Instead, PJM proposes that ESA and Beacon Power permit the stakeholder driven process to continue to develop the final manual language, with the understanding that PJM will change the problematic price calculation provisions present in the current draft manual

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<sup>51</sup> See PJM answer at 9, citing *City of Cleveland v. FERC*, 773 F.2d 1368 at 1376 (D.C. Cir. 1985).

provision. PJM explains that a task force (the Regulation Performance Senior Task Force) plans to submit the proposed manual revisions to the PJM stakeholders for review and comment in August 2012. If the Commission finds that the additional details proposed for inclusion by PJM in the manuals should be stated in the OATT and Operating Agreement, PJM would not object to adding those details in its filed rules, pursuant to a subsequent compliance directive.

## **5. Commission Determination**

70. For the reasons discussed below, we find that PJM's performance payment proposal satisfies the requirements of Order No. 755, subject to conditions.

71. First, we agree with the IMM that PJM's performance payment fails to specify how clearing prices will reflect the actual requested mileage based on the regulation signal. While PJM describes the basic components of its proposal, PJM fails to explain how these components will be combined to calculate the accuracy score. While PJM's Manual 12 provides that the accuracy score will be the weighted average of the three components (i.e., the Energy Score, the Delay Score and the Correlation Score), PJM's proposal fails to define the process for calculating the various component scalars.<sup>52</sup> Accordingly, we direct PJM to include in its compliance filing additional tariff language detailing each component of the accuracy score, and describing how each component scalar in the accuracy score calculation will be determined.

72. With regard to Beacon Power's argument that the regulation up and regulation down provisions do not state how performance will be measured, we accept, PJM's proposal on this matter, subject to conditions. PJM's proposal, at Schedule 1, section 3.2.2(f) of the Operating Agreement, provides that resources will be credited for regulation performance based on the amount of regulation performance the resources provide during the market hour. PJM further notes, in its transmittal letter, that conforming language, at Manual 28 section 4.2, will provide that performance will be measured by the actual mileage the resource is dispatched to provide. However, given the effect of this manual provision on the rates, terms and conditions of PJM's jurisdictional services, we require PJM to file this provision as part of its tariff and to include this proposed tariff language in its compliance filing.

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<sup>52</sup> See proposed Manual 12 at sections 4.4.2 (Regulation Signals) and 4.5.6 (Performance Score Calculation) at <http://www.pjm.com/~media/committees-groups/task-forces/rpstf/20120330/20120330-item-05-psc-point-slope-add-on.ashx>.

73. As to the IMM's argument that the interaction between the performance offer and performance clearing price erroneously assumes a fixed relationship before the actual hour between a MW of cleared capability and the amount of work done, as we state above, we direct PJM to submit a compliance filing regarding the components of the accuracy score.

74. Similarly, because the accuracy score affects eventual settlement, we will require PJM to submit as part of its compliance filing, additional tariff language outlining the settlement process. This should include how the accuracy score is used to determine payments and how settlement is affected by make-whole payments.

#### **D. Market Power Mitigation**

##### **1. Order No. 755**

75. Order No. 755 found that the changes required by the Commission's Final Rule may render existing RTO and ISO market power mitigation rules insufficient to address market power concerns.<sup>53</sup> Accordingly, Order No. 755 required each RTO and ISO to submit revised market power mitigation provisions, as appropriate, to conform with the Commission's required rule changes, or explain how its current market power mitigation methods will continue to be sufficient to address market power concerns.<sup>54</sup>

##### **2. PJM's Proposal**

76. PJM states that, to determine if structural market power exists in the regulation market, PJM currently utilizes the three pivotal supplier test.<sup>55</sup> PJM proposes to incorporate the performance offer when calculating the total cost for its three pivotal supplier test. Specifically, PJM proposes to modify the components of total cost in the definition of available supply to clarify that the cost-based offer currently in the total cost is the adjusted capacity cost-based offer. PJM also proposes to include the adjusted performance cost-based offer in the definition of available supply in the three pivotal supplier test currently employed for the frequency regulation market.

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<sup>53</sup> Order No. 755, FERC Stats. & Regs. ¶ 31,324 at P 136.

<sup>54</sup> *Id.*

<sup>55</sup> See Operating Agreement at Schedule 1, section 3.2.2A. PJM explains that the three pivotal supplier test adds the regulation capability of a supplier to the regulation capability of the two largest suppliers in the regulation market. PJM adds that if that total regulation capability is greater than the surplus of total regulation capability exceeding the regulation requirement then the supplier would fail the test and be subject to mitigation.

### **3. Protests and Comments**

77. ESA argues that PJM's proposal fails to expressly permit energy storage resources to recover fixed costs. ESA argues that new entry of energy storage resources may occur to the extent that market prices exceed their fixed and operating costs. ESA adds, however, that a storage unit bid could be mitigated down to a cost-based offer (an offer that does not include any fixed costs). ESA asserts that because energy storage resources that provide frequency regulation service only cannot currently participate in PJM's capacity market (a market in which they would have been eligible to recover their fixed costs), the Commission should establish a rulemaking proceeding permitting these resources to do so.

### **4. PJM's Answer**

78. PJM argues that ESA's comments pertaining to fixed costs fall beyond the scope of Order No. 755. PJM contends that Order No. 755 does not require a compensation methodology to include a mechanism that allows energy storage resources to recover fixed costs. Contrary to ESA's comments, PJM argues, Order No. 755 did not mandate that the fixed cost of the storage assets may be amortized and included in the mileage bid of the two-part auction. Moreover, PJM states that the Commission stated in Order No. 755 that this rulemaking is not focused on any particular resource type, but rather is resource neutral. As a result, PJM contends that a revised compensation methodology that would include a mechanism to allow only energy storage resources to recover fixed costs would not be resource-neutral.

### **5. Commission Determination**

79. We find that PJM's proposed market power mitigation provisions satisfy the requirements of Order No. 755, subject to conditions. PJM's proposed revisions include performance offers in the process to determine regulation market clearing prices to which total cost is compared when determining available supply. Further, increasing the amount of regulation offered, which the other revisions proposed in this proceeding should accomplish, can increase competition in the regulation market thereby reducing the need to implement mitigation.

80. With respect to arguments pertaining to fixed costs for energy-limited resources, in Order No. 755 we found that the Final Rule is not focused on any particular resource type, but rather is resource-neutral.<sup>56</sup> Further, in Order No. 755, we found that the directives of the Final Rule will ensure that all eligible resources providing frequency regulation service within the existing RTO or ISO frequency regulation markets are compensated at the just

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<sup>56</sup> Order No. 755, FERC Stats. & Regs. ¶ 31,324 at P 194.

and reasonable rate. Therefore, we find that the fixed cost for energy-limited resource is beyond the scope of Order No. 755.<sup>57</sup>

81. However, we find that these market power mitigation provisions affect the rates, terms and conditions of PJM's jurisdictional services. Accordingly, we require PJM to incorporate the three pivotal supplier test calculations into its tariff and to include these proposed tariff revisions in its compliance filing.

## **E. Additional Issues**

### **1. Regulation Requirement**

82. PSEG states that, through an upcoming manual revision, PJM intends to reduce its existing regulation requirement (the total amount of regulation capacity required to be procured to maintain reliability) from 1 percent to 0.9 percent, based on the assumed availability of fast-following resources. PSEG opposes any such change. PSEG argues that reducing this requirement, without first gaining experience with PJM's new compensation rules, would be ill-advised and unnecessary.

83. We reject PSEG's protest as beyond the scope of this proceeding. While Order No. 755 found that a reduction in frequency regulation procurement was a benefit attributable to a two-part compensation scheme,<sup>58</sup> Order No. 755 does not mandate any reduction in frequency regulation capacity requirements, or require that any such justification be made, in conjunction with this compliance filing proceeding. Accordingly, PSEG's concerns are outside the scope of this compliance filing.

### **2. Evaluations**

84. AMP requests that PJM be required to submit periodic reports (either on a six-month, or annual basis), comparing the cost of regulation under PJM's new two-part regulation compensation methodology to the cost of regulation under PJM's current frequency regulation compensation methodology. AMP argues that this reporting requirement will allow interested parties, and the Commission, to evaluate whether the higher costs of frequency regulation are justified based on the benefits they provide and their overall cost savings, and would allow for the meaningful comparison to the cost of regulation under PJM's existing compensation methodology.

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<sup>57</sup> *Id.*

<sup>58</sup> *Id.* P 68.

85. PJM, in its answer, characterizes AMP's requests as a collateral attack of Order No. 755. PJM argues that, regardless, it is not possible to accurately create a report that tracks pricing under two separate parallel compensation methodologies. In addition, PJM points out that there are existing sources (i.e., the IMM's state of the market reports and PJM's Members Committee executive reports) that provide regulation prices, for tracking purposes.

86. We agree with PJM that AMP's request is a collateral attack on Order No. 755 that required RTOs and ISOs to submit a compliance filing pursuant to the rule. To the extent AMP requires further reports, it has not explained why the existing reports are not sufficient for its tracking purposes.

### **3. Clerical Errors**

87. ESA and Beacon Power note that PJM's proposed revisions to Schedule 1, section 3.2.2(f) and (g) of the Operating Agreement contain certain clerical errors, which PJM, in its answer, acknowledges. Accordingly, we direct PJM to make these corrections in its compliance filing.

The Commission orders:

(A) PJM's compliance filing is hereby accepted, subject to conditions, as discussed in the body to this order.

(B) PJM is hereby directed to make an additional compliance filing within 90 days of the date of this order, as discussed in the body of this order.

By the Commission.

( S E A L )

Nathaniel J. Davis, Sr.,  
Deputy Secretary.

## Appendix

### Intervenors

American Electric Power Service Corporation  
AES Energy Storage, LLC  
American Municipal Power, Inc. \*  
Beacon Power, LLC \*  
Consolidated Edison Energy, Inc. and  
Consolidated Edison Solution, Inc.  
DC Energy, LLC \*  
Dominion Resources Services, Inc. \*  
Duke Corporation \*\*  
Dynegy Power Marketing, LLC and  
Dynegy Marketing and Trade, LLC  
Electricity Storage Association \*  
Enbala Power Networks (USA), Inc. \*  
EnergyConnect, Inc.  
Exelon Corporation  
GenOn Parties  
Illinois Commerce Commission  
Monitoring Analytics, LLC \*  
New Jersey Board of Public Utilities  
NRG Companies  
Old Dominion Electric Cooperative  
PJM Industrial Customer Coalition  
PJM Power Providers Group \*  
PPL EnergyPlus, LLC  
PSEG Companies \*  
Rockland Electric Company \*\*

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\* protest and/or comment

\*\* motion to intervene out-of-time