

141 FERC ¶ 61,134
FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

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

PJM Interconnection, L.L.C.

Docket Nos. ER12-1204-001
ER12-1204-002
ER12-2391-000
ER12-2391-001
(not consolidated)

ORDER ON COMPLIANCE FILING AND ACCEPTING
PROPOSED TARIFF CHANGES, SUBJECT TO CONDITIONS

(Issued November 16, 2012)

1. In this order, we address compensation issues related to the provision of frequency regulation service, as presented by two related filings submitted by PJM Interconnection, L.L.C. (PJM).¹ First, we address PJM's compliance filing as amended (PJM's August compliance filing), submitted in response to the Commission's May 17, 2012 order.² For the reasons discussed below, we accept PJM's August compliance filing, subject to conditions, and the submission of an additional compliance filing within 60 days of the date of this order. We also address revisions related to frequency regulation proposed by PJM on August 2, 2012, pursuant to section 205 of the Federal Power Act (FPA).³ For the reasons discussed below, we accept, in part, and reject, in part, PJM's proposed tariff changes

¹ Frequency regulation is an ancillary service, as required under the Commission's *pro forma* open access transmission tariff (*pro forma* OATT). It is relied upon by system operators, such as PJM, to control both actual and anticipated frequency deviations, as 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.

² *PJM Interconnection, L.L.C.*, 139 FERC ¶ 61,130 (2012) (May 17 Order).

³ 16 U.S.C. § 824d (2006).

(PJM's tariff filing), subject to conditions and the submission of a compliance filing within 60 days of the date of this order, to become effective October 1, 2012.

I. Background

2. On March 5, 2012, PJM submitted its initial compliance filing (PJM's initial compliance filing) in response to the Commission's Final Rule on frequency regulation compensation.⁴ In that filing, PJM proposed to require regulation resources to submit a two-part offer, consisting of a capability offer (a price associated with the amount of regulation capability available) and a performance offer (a price associated with the amount of work provided by each unit). PJM also proposed to adjust each capability offer and performance offer by benefits factor, and the regulation resource's historic accuracy score.

3. PJM noted that its benefit factor was designed to encourage the participation of an optimal mix of fast-responding resources and slow-responding resources. Specifically, PJM noted that the benefits factor was designed to reflect, in the Total Regulation Market Clearing Price, the relative impact that a given resource will have on system control, whether it follows a fast-responding regulation signal, as used for a resource capable of responding quickly, or a traditional regulation signal, as used for a resource with a slower response capability, recognizing that a faster-responding resource assists PJM in meeting its system reliability needs. PJM stated that the intent of its historic accuracy score would be to ensure that a resource that has not performed well, in the past, as measured by its accuracy of providing regulation service averaged over a rolling 100 hours, would have its capability offer adjusted such that it appears more expensive in the merit-order bid stack.

4. In the May 17 Order, the Commission conditionally accepted PJM's compliance filing, subject to the submission of an additional compliance filing to become effective on October 1, 2012.

II. Compliance Filing

5. PJM's August compliance filing was submitted on August 15, 2012 and then, amended on August 23, 2012. Notice of PJM's August compliance filing, was published in the *Federal Register*, 77 Fed. Reg. 51,988 and 52,394 (2012), with interventions and protests due on or before September 13, 2012.

6. Comments generally supportive of PJM's compliance filing were timely filed by the Electricity Storage Association (ESA) and Beacon Power, LLC (Beacon Power). A protest

⁴ *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).

was filed by PSEG Companies (PSEG). In addition, Monitoring Analytics, LLC, acting as PJM's independent market monitor (IMM), submitted comments. Answers to protests and comments and/or answers to answers were filed by PJM on August 29, 2012, and by Beacon Power, on October 9, 2012 and November 14, 2012. PJM, in its answer, acknowledges the errors identified by the IMM in its comments.⁵ Answers to answers were filed by PJM, on October 25, 2012, and by the IMM, on October 26, 2012.

7. Rule 213(a)(2) of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.213(a)(2) (2012), 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, Beacon Power, and the IMM because they have provided information that assisted us in our decision-making process.

8. Except as otherwise noted below, we find that PJM's compliance filing satisfies the requirements of the May 17 Order. We direct PJM to submit an additional compliance filing within 60 days of the date of this order.

A. Shoulder-Hour Payments

1. May 17 Order

9. The May 17 Order found that generators providing frequency regulation service should receive payment for shoulder-hour lost opportunity cost,⁶ i.e., for the ramping-up time preceding the initial regulating hour and the ramping-down time following the final hour of a regulation assignment.⁷ The May 17 Order also found that while PJM had defended its provision, removing these costs from the regulation service price, based on its claim that these costs cannot be calculated on a real-time basis, regulation commitments are, in fact, made prior to the operational hour, based on *forecasted* prices used to determine the regulation clearing price and opportunity costs, such that regulation pricing, as calculated at five-minute intervals, will be based on *estimates*, not real-time calculations. The May 17 Order therefore directed PJM to explain, in its compliance filing: (i) how it will ensure that

⁵ PJM's answer, which was submitted in both Docket Nos. ER12-1204-002 and ER12-2391-000, is further discussed in section III, below, given this pleading's focus on PJM's proposed section 205 revision to the PJM Operating Agreement at Schedule 1, section 3.2.2A.1(b)(i).

⁶ Shoulder-hour opportunity costs, as explained below, include the costs incurred by a resource over the ramping-up time preceding the initial regulating hour and the ramping-down time following the final hour of a regulation assignment.

⁷ May 17 Order, 139 FERC ¶ 61,130 at P 40.

eliminating shoulder-hour opportunity costs satisfies Order No. 755's requirement that opportunity costs be included in a resource's offer, provided that costs are verifiable;⁸ and (ii) the relationship between eliminating shoulder-hour opportunity costs and the calculation of frequency regulation prices.⁹

2. PJM's Compliance Proposal

10. PJM states that it has complied with the Commission's directive by explaining why it is not feasible to incorporate shoulder-hour opportunity costs in the frequency regulation price.¹⁰ PJM notes that it calculates regulation prices on a real-time basis, i.e., every five minutes, using actual opportunity costs for each five-minute interval, non-inclusive of shoulder-hour opportunity costs, which cannot be calculated on a real-time basis. PJM asserts that this approach is reasonable, given that any shoulder-hour opportunity costs that do exist can be addressed by way of PJM's proposed after-the-fact make-whole payment, as presented in PJM's tariff filing in Docket No. ER12-2391-000 (discussed in section III, below).

11. PJM asserts that any attempt to incorporate costs from outside the operating hour would present three specific problems. First, PJM argues that its dispatch software optimizes energy, reserves, and regulation based on the incremental cost of each product in the relevant five-minute interval. PJM states that including costs from outside this five-minute interval would lead to an inaccurate calculation of the incremental cost calculated by its software. Second, PJM notes that only a portion of the shoulder-hour costs occur after the regulating hour, and therefore PJM cannot determine that portion of the cost until after the conclusion of the following shoulder-hour. Finally, PJM states that regulation resources often provide regulation for multiple hours once they begin to provide the requested service, and PJM has no mechanism that would allow it to spread the opportunity costs incurred over the duration of the service provided. PJM states that, regardless, real-time prices will adequately cover each regulation resource's shoulder-hour opportunity costs, given that the inclusion of real-time lost opportunity costs into the clearing prices creates a pricing structure that will compensate all regulation resources, at a five-minute interval, based on the lost opportunity costs of the marginal resource.

⁸ *Id.* P 41 (Order No. 755, FERC Stats. & Regs. ¶ 31,324 at P 72).

⁹ *Id.*

¹⁰ *Id.* PP 40-41.

3. Responsive Pleadings

12. PSEG argues that PJM's compliance filing should be rejected and that its planned October 1, 2012 implementation date should be delayed until such time as adequate explanation is provided as to why shoulder-hour payments are not included in the frequency regulation service price. PSEG notes that, under PJM's August compliance filing, PJM continues to exclude shoulder-hour payments from the regulation service price and argues that PJM does so, without reasonably explaining (as the May 17 Order required) why such inclusion is not possible. PSEG asserts that PJM's claim that its software is unable to accommodate such inclusion is unsupported, and thus non-compliant with the May 17 Order, and otherwise begs the question of why such software could not be designed and implemented, consistent with Order No. 755's requirement that opportunity costs be included in a resource's offer.¹¹

4. Commission Determination

13. We reject PSEG's argument that PJM's compliance proposal fails to explain, as required by the May 17 Order, why shoulder-hour payments should not be included in the frequency regulation price. PJM's proposal to provide after-the-fact, make-whole payments, where a resource's opportunity costs and offer are not covered by the regulation price, should mitigate PSEG's concern that a resource may be committed and not receive payment for all of its opportunity costs.¹² Under PJM's proposal, PJM will calculate opportunity costs and provide a make-whole payment to a regulation resource where the resource's offer, plus opportunity costs, is higher than the total regulation market-clearing price.¹³ Additionally, as the Commission determined in the May 17 Order, and as we reaffirm here, the 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.¹⁴

14. In the May 17 Order, the Commission required PJM, in its compliance filing, to: (i) explain how it would ensure that eliminating shoulder-hour opportunity costs satisfied Order No. 755's requirement that inter-temporal opportunity costs be included in a

¹¹ PSEG Protest at 9 (Order No. 755, FERC Stats. & Regs. ¶ 31,324 at P 103).

¹² PJM Answer at 7.

¹³ See sections 3.2.2(b), 3.2.2.A.1, and 3.2.2(e) of the PJM OATT and the parallel provision in its Operating Agreement.

¹⁴ May 17 Order, 139 FERC ¶ 61,130 at P 58.

resource's offer; and (ii) address the relationship between eliminating shoulder-hour opportunity costs and the calculation of frequency regulation prices on a five-minute basis.

15. We find that PJM's compliance filing satisfies the directives in the May 17 Order and Order No. 755. Moreover, as discussed in section III, below, PJM will provide a make-whole payment that will satisfy PSEG's concern about ensuring sufficient payment for the shoulder-hours.

B. Inter-Temporal Opportunity Costs

1. May 17 Order

16. The May 17 Order found that PJM's proposal to rely on a stakeholder proceeding to determine the calculation of formulas of inter-temporal costs of other types of resources consistent with Order No. 755. However, we rejected PJM's proposal to include these calculations and formulas in its manuals and required PJM to include these provisions in its tariff.¹⁵

2. PJM's Compliance Proposal

17. PJM proposes to revise section 3.2.2(d) of Schedule 1 of the Operating Agreement to include the inter-temporal opportunity costs for hydropower units – the only class of regulation resource for which PJM calculates inter-temporal opportunity costs. PJM explains that in the future, it will submit to the Commission additional revisions to section 3.2.2(d) Schedule 1 of the Operating Agreement to include the inter-temporal opportunity costs formulas for regulation resources other than hydropower units after such costs have been proposed, developed, and approved through the PJM stakeholder process.

3. Commission Determination

18. We find that PJM's proposal to include inter-temporal opportunity costs for hydropower units and its commitment to file with the Commission additional amendments for regulation resources other than hydropower after stakeholder deliberations satisfies the May 17 Order's directives. We therefore accept PJM's proposed tariff revisions.

C. Capability and Performance Offers

1. May 17 Order

19. The May 17 Order directed PJM to submit proposed revisions to its OATT and Operating Agreement to clarify that section 1.10.1A(e)(i) applies to a regulation resource's

¹⁵ *Id.* P 58.

capability offer and section 1.10.1A(e)(ii) applies to a regulation resource's performance offer.¹⁶

2. PJM's Compliance Proposal

20. PJM explains that in accordance with the Commission's directive, it revised its OATT and Operating Agreement to clarify that sections 1.10.1A(e)(i) and 1.10.1A(e)(ii) of Schedule 1 of the Operating Agreement apply to, respectively, the capability offer and performance offer. Additionally, PJM explains that it proposed to update each section to provide more specificity relating to the cause of the costs associated with the provision of regulation service.

3. Commission Determination

21. We find PJM's proposed clarifications to the capability and performance offer, in its OATT and Operating Agreement, satisfies the May 17 Order directives.¹⁷ We also find the proposed provisions regarding the cause of costs reasonable.

D. Accuracy Scores

1. May 17 Order

22. The May 17 Order found that PJM had failed to specify how the various components of the accuracy score will be combined to calculate the total accuracy score.¹⁸ Specifically, the May 17 Order found that PJM's proposal failed to define the process for calculating the various component scalars. Accordingly, the May 17 Order directed PJM to include provisions, in its tariff, detailing each component of the accuracy score, and describing how each component scalar in the accuracy score calculation will be determined.

¹⁶ *Id.* PP 55-56.

¹⁷ Sections 1.10.1A(e)(i) and (ii) of Attachment K-Appendix of the PJM OATT and the parallel provisions in the Operating Agreement, state, in relevant part:

(i) The costs (in \$/MW) of the fuel costs increase due to the steady-state heat rate increase resulting from operating the unit at a lower megawatt output incurred from the provision of regulation shall apply to the capability offer; (ii) The cost increase (in \$/Δ MW) in costs associated with movement of the regulation resource incurred from the provision of regulation shall apply to the performance offer[.]

¹⁸ May 17 Order, 139 FERC ¶ 61,130 at P 71.

2. PJM's Compliance Proposal

23. PJM proposes a new provision, at Schedule 1, section 3.2.2(k) of its Operating Agreement, describing how each component of the accuracy score will be calculated. PJM states that section 3.2.2(k) contains a description of the accuracy score and its relationship to the three components of the accuracy score, i.e., the energy score, the delay score, and the correlation score.¹⁹

3. Responsive Pleadings

24. PSEG argues that while performance scores are necessary to meet the directives of Order No. 755, PJM's proposed methodology for calculating these performance scores is flawed, given PJM's failure to suspend the regulation event, in those circumstances where the resource is providing a regulation service, but is then required to respond to a synchronized reserve event within a two minute window. PSEG asserts that PJM's policy could create a disincentive for a resource to respond to an emergency. In addition, PSEG argues that PJM's policy fails to include a process for other events that may affect a performance score.²⁰

¹⁹ The accuracy score is based upon PJM's measurement of a regulation resource's response to the dispatch signal. The accuracy score may range from zero to one with the highest score being achieved by following exactly the regulation control signal within a ten-second delay allowed for propagation. PJM will telemetrically distribute PJM's dispatch signal to a regulation resource and measure the regulation resource's response to the regulation dispatch signal via a response signal sent to PJM by the regulation resource every two-seconds. Based on these measurements, PJM will calculate an accuracy score for a regulation resource for each ten-second interval that is based on three factors: an energy score, a delay score and a correlation score. Additionally, the historic accuracy score will be based on a rolling average of the hourly accuracy scores, with consideration of the qualification score. *See* PJM filing, at proposed Schedule 1, section 3.2.2(k) of the PJM Operating Agreement and the parallel provision in Attachment K-Appendix of the PJM OATT.

²⁰ PSEG notes, for example, that if PJM is late in requesting a traditional resource to ramp up to a required service level, the resource may not be able to reach its required level at the appropriate time and thus would be considered inaccurate under PJM's performance scores. PSEG argues that this would be unfair to a resource that has responded as quickly as it could, given the information provided at the time.

4. Commission Determination

25. We accept, subject to conditions, PJM's proposed tariff revisions describing how each component of the accuracy score (i.e., the energy score, the delay score and the correlation score) will be calculated.²¹ The May 17 Order directed PJM to include in its compliance filing additional tariff language describing how each component scalar in the accuracy score calculation will be determined.²² While section 4.5.6 of Manual 12 provides that the component scalars will be weighted equally, PJM has not adopted this provision in its tariff, as the May 17 Order required. Accordingly, we require PJM to include in its compliance filing tariff language incorporating the above-described provision of Manual 12.

26. We reject PSEG's argument that PJM proposed tariff language, clarifying its methodology for calculating accuracy scores, fails to suspend the regulation event, in those circumstances where the resource is providing a regulation service, but is then required to respond to a synchronized reserve event within a two minute window. As we determine, in section III, below, continued suspension of performance scoring beyond the two-minute window would result in compensation to resources that are unable to follow the regulation control signal down during an important time for system control.

E. Benefits Factor Calculations in Market Clearing

1. May 17 Order

27. The May 17 Order recognized the advantages of using a benefits factor in the market clearing process, because it is designed to adjust for the differences between resources, but found that PJM had provided insufficient information as to whether the same factor would apply to all units or whether a different factor would be used for each unit's offer.²³

2. PJM's Compliance Proposal

28. PJM proposes to incorporate a new section 3.2.2(j) of Schedule 1 of the Operating Agreement to clarify that PJM will calculate a unit-specific benefits factor for all units and describe how it will calculate the unit-specific benefits factor. PJM explains that it will also calculate an effective megawatt (Effective MW)²⁴ for fast-responding and traditional

²¹ See section 3.2.2(k) of the PJM OATT and the parallel provision in its Operating Agreement.

²² May 17 Order, 139 FERC ¶ 61,130 at P 71.

²³ *Id.* P 54.

²⁴ PJM explains, in the transmittal of its tariff filing, that it will translate each fast-

regulation resources.²⁵ PJM explains that it determines the benefits factor based on the expected impact of a fast-responding resource on PJM's ability to comply with the reliability criteria established by the North American Electric Reliability Corporation (NERC). PJM states that this determination will be based on: (i) off-line models, including those reflected in an engineering study undertaken by KEMA, Inc. at PJM's request (KEMA Study);²⁶ (ii) analysis of the regulation signals; and (iii) historical operational data, as accumulated by PJM. PJM states that historical operational data will be given increasing weight to the benefits factor determination over time.

29. PJM states that it developed the fast-responding resource signal in 2009 and that it has made several updates to these signals to enhance their utilization. PJM further claims that it is committed to continuing to explore ways to utilize all resources to the extent they can benefit system control and will update the manuals through the stakeholder process to reflect these operational changes.

3. Commission Determination

30. We find that PJM's proposal satisfies the directives of the May 17 Order with respect to market clearing. Consistent with the May 17 Order directives, PJM provides sufficient information as to how the benefits factor will be calculated.²⁷ For example, PJM proposes to calculate both a unit-specific benefits factor and a marginal benefits factor for the fast-responding and traditional regulation signals.²⁸ Under PJM's proposal, each resource will

responding regulation resource's offered MWs into traditional MWs by adjusting a regulation resource's total incremental cost by the unit-specific benefits factor thereby decreasing the cost of regulation resource in the commitment and pricing process when the benefits factor is above one (i.e., calculating an Effective MW). The formula for calculating Effective MWs is (Offered MWs x Unit Specific Benefits Factor).

²⁵ In the transmittal letter accompanying its tariff filing, PJM notes that, initially, the unit-specific benefits factor for all traditional regulation resources will be one and, therefore, the Effective MWs will be equal to the offered MWs.

²⁶ See <http://www.pjm.com/~media/committees-groups/committees/mc/20120126/20120126-item-06-pjm-kema-final-study-report.ashx>.

²⁷ May 17 Order, 139 FERC ¶ 61,130 at P 54.

²⁸ The marginal benefits factor is equal to the unit-specific benefits factor of the last MW selected to provide regulation from a resource following the dynamic regulation signal. The marginal benefits factor for the traditional regulation signal will be equal to one.

be assigned a unit-specific benefits factor based on its order in the merit stack for the applicable regulation signal. PJM's proposal also provides that the unit-specific benefits factor is the point on the benefits factor curve that aligns with the last MW, adjusted by historical performance that a given resource will add to the fast-responding resource stack.²⁹ We also find that the use of the benefits factor in market clearing allows PJM to minimize the total capability it needs to procure, while maintaining its compliance with NERC's Control Performance Standard 1.³⁰ For the above reasons, we accept PJM's proposal to use the benefits factor in market clearing. We discuss in section III, below, our rejection of PJM's proposed benefits factor, as applied to the settlement process.

F. Mileage Assessments

1. May 17 Order

31. In its initial compliance filing, PJM planned to adopt language at section 4.2 of Manual 28 that stated that, regulation performance would be measured by the actual mileage³¹ the resource is dispatched to provide.³² The May 17 Order found that, given the

²⁹ See section 3.2.2(j) of the PJM OATT and the parallel provision in its Operating Agreement.

³⁰ The KEMA Study analyzed the trade-off between resources following the traditional regulation signal and those able to follow the new dynamic signal. KEMA Study 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.

³¹ See Manual 28, section 4.2 at 16-18, as effective as of the date of PJM's March 5, 2012 Compliance Filing, at: <http://www.pjm.com/committees-and-groups/task-forces/~media/committees-groups/task-forces/rpstf/postings/manual-language-post-filing.ashx>: In real-time, the resource will move to follow the regulation signal, generating performance in Δ MW proportional to its assignment. The credit would then be: regulation performance credit = (assignment MW) – actual mileage of signal followed by resource) x (actual performance score) x (performance clearing price \$/MW) x (marginal benefits factor by signal type). PJM calculates the hourly credit for each assigned regulating resource by multiplying each increment of such regulation in MWs during the hour by the Capability Regulation Market Clearing Price (C-RMCP) for that hour plus the performance credits for that hour based on the following calculations: regulation RMCP credits = hourly-integrated regulation MW x C-RMCP x marginal benefits factor + hourly-integrated regulation MW x actual mileage of signal x performance score x P-RMCP x marginal benefits factor.

³² May 17 Order, 139 FERC ¶ 61,130 at P 72.

effect of this Manual provision on the rates, terms and conditions of PJM's jurisdictional services, PJM was required to file this provision in its tariff.³³

2. PJM's Compliance Proposal

32. PJM proposes to revise its Operating Agreement, at Schedule 1, section 3.2.2(g), to specify that each regulation resource will be credited for its regulation performance by multiplying the "Assigned MWs"³⁴ by the performance regulation market-clearing price and the accuracy score calculation, as described in proposed section 3.2.2(k).³⁵ PJM also proposes to eliminate, from this provision, the actual mileage from the performance payment settlement. PJM states that this revision is appropriate given that PJM includes each resource's actual mileage in the price formation used in the clearing process and therefore each resource that clears the market will recover its cost for movement in the performance payment.

3. Responsive Pleadings

33. Beacon Power objects to PJM's proposed removal of actual mileage from the performance payment credit. Beacon Power argues that, under PJM's proposal, performance payments will not be made on a uniform basis relative to the amount of movement (up or down) a resource provides in response to the system operator's dispatch signal, contrary to the requirements of Order No. 755 and the May 17 Order.

³³ *Id.*

³⁴ The term "Assigned MW," for fast-responding or traditional regulation signals, is the assigned hourly regulation quantity (MW) that is cleared from the regulation market system. It is assigned for each individual resource that is qualified to regulate in the PJM market. This value, although typically static for the hour, will be sent on a 10 second scan rate. Resources will receive a separate assignment for the fast-responding or traditional regulation signal if the regulating resource is dual qualified, but the regulating resource will be assigned to follow only one signal for the hour. *See* Manual 12, section 4.4.2 (Regulation Signals).

³⁵ Section 3.2.2(k) of the PJM OATT and the parallel provisions of its Operating Agreement provide that PJM will calculate each regulation resource's accuracy score. The accuracy score will be the weighted average of a delay score, correlation score, and energy score for each ten second interval. For purposes of setting the interval to be used for the correlation score and delay scores, PJM will use the maximum of the correlation score plus the delay score for each interval.

34. Beacon Power notes that, in Order No. 755, the Commission mandated that resources be paid uniformly for performance and directed that performance be measured based on the amount of movement (up or down) a resource provides in response to the system operator's dispatch signal.³⁶ Beacon Power further notes that, in the May 17 Order, the Commission reiterated that resources must be credited for regulation performance based on the amount of regulation performance the resources provide, during the market hour, and required PJM to address this allowance, at Schedule 1, section 3.2.2(f), with language stating that regulation performance will be measured by the actual mileage the resource is dispatched to provide.³⁷

35. Beacon Power argues that rather than include clarifying language in its tariff addressing how performance will be measured by the actual mileage the resource is dispatched to provide, PJM inappropriately proposes to eliminate this provision from its performance credit formula altogether, at Schedule 1, section 3.2.2(g). Beacon Power argues that while it is true that resources under PJM's proposed clearing and settlement mechanism will recover their performance bid cost, it is also true that the credit for performance would not be based on a uniform price per movement. Beacon Power adds that PJM's proposal to remove actual mileage from the settlement will mean that the only difference in payment between a resource following the fast signal and a resource following the slow signal, when the benefits factor is 1.0, is the accuracy score (a standard that makes no distinction between a resource following the fast signal and a resource following the slow signal).

36. Beacon Power concludes that PJM should be directed to: (i) re-include actual mileage in the credit for regulation performance, at Schedule 1, section 3.2.2(g); and (ii) convert the performance regulation market-clearing price from a \$/MW to a \$/ΔMW-movement, using the mileage of the resource that sets the performance regulation market-clearing price, so that there will be no double counting of mileage in the settlement.³⁸

³⁶ Beacon Power Answer at 2 (citing Order No. 755, FERC Stats. & Regs. ¶ 31,324 at PP 131 and 133).

³⁷ *Id.* at 3, n.3 (citing May 17 Order, 139 FERC ¶ 61,130 at P 72).

³⁸ Beacon Power notes that the re-inclusion of mileage in the regulation settlement does not present a case of double counting relative to PJM's proposed use of the marginal benefits factor in settlement process (an issue raised below, regarding PJM's section 205 proposals). Beacon Power states that the benefits factor represents the operational relationship, or rate of substitution, between the fast regulation signal and traditional regulation signal, whereas mileage represents the amount of movement (up or down) that the resource is requested to provide. Beacon Power asserts that PJM can avoid double counting for mileage if it converts the performance price from \$/MW to \$/ΔMW-movement.

4. Additional Answers

37. PJM, in its answer, states that it has fully and appropriately supported its proposed use of actual mileage in the market clearing prices combined with the proposed use of the unit-specific benefits factor, in the PJM tariff filing.

38. Specifically, PJM challenges Beacon Power's limited focus on PJM's proposed removal of mileage from the performance credit, in the second paragraph of section 3.2.2(g). PJM argues that Beacon Power's objection to this proposed revision fails to acknowledge, or account, for the corresponding revisions to this provision, which eliminate the need for an adjustment in the settlements process to convert the historical mileage to the actual "mileage." PJM explains that these corresponding revisions require PJM to calculate the actual amount of regulation dispatched and the actual ratio of control signals in determining the performance regulation market-clearing prices. PJM adds that since the performance regulation market-clearing price will be set based on actual amounts of regulation and the actual ratio of control signals calculated, it is no longer necessary, or appropriate, to include the amount of regulation performance, i.e., "mileage," in the performance credit calculation set forth in the second paragraph of section 3.2.2(g).

39. PJM also argues that Beacon Power, in its analysis of a two-part offer/two-part compensation structure under PJM's tariff, includes the performance and revenue, but fails to include the capability offers and lost opportunity cost. PJM adds that, under Beacon Power's preferred approach, traditional resources would lose money by providing regulation, when a fast-following resource has the highest performance offer. PJM further adds that this approach would require more make-whole payments to occur outside the market and would thus be inconsistent with Order No. 755.

40. PJM asserts that Beacon Power fails to recognize that the benefits factor creates an equivalent offer structure for all resources. In addition, PJM argues that Beacon Power's preferred approach deviates from the basic market construct, because it is based on the principle that the marginal resource should receive its bid-in offer plus any lost opportunity cost and all other infra-marginal resources should receive the profits associated with the uniform clearing prices being above their offers plus any lost opportunity cost. PJM argues that Beacon Power's "pay-as-bid" approach will lead to volatile and unpredictable market compensation results.

41. The IMM, in its answer, also disputes Beacon Power's claim that PJM's mileage proposal imposes a "pay-as-bid" approach that will discriminate against fast-responding resources. The IMM argues that, to the contrary, PJM's proposal reflects the use of actual mileage, correctly values fast and slow resources in directly comparable normalized units, and results in a uniform price for a normalized product. The IMM adds that with no meaningful connection of price to value, the regulation market results would be irrational, inefficient and discriminatory. The IMM concludes that Beacon Power's proposed changes would result in overpayment of fast resources, underpayment of slow resources, and non-transparent pricing in the regulation market. The IMM argues that Beacon Power's claim

that PJM's proposal is discriminatory is based on the false assumption that every mile covered by a fast-responding resource is equivalent to every mile covered by a traditional resource, in other words, to the false assumption that these resources follow the same signal.

42. The IMM further argues that Beacon Power's approach would overpay fast resources and underpay resources for equivalent miles. The IMM suggests that Beacon Power is arguing that PJM should include actual mileage in its regulation credit to give value for performance based on the actual amount of regulation performance a resource provides during the market hour, and should then convert the regulation market clearing price to prevent double counting of mileage in the settlement. The IMM responds that because PJM already includes expected miles, Beacon Power's approach would lead to double-counting of fast resource miles and the undercounting of slow resource miles. The IMM asserts that, as such, Beacon Power's approach would result in significant overpayment of fast resources, when slow resources are marginal, and significant underpayment of slow, when fast resources are marginal.

43. Finally, the IMM disputes Beacon Power's claim that it is more difficult and costly for fast resources to follow the fast-responding resource signal than it is for slow resources to follow the traditional resource signal, and that a resource following a fast signal versus a slow signal likely incurs more cost. The IMM responds that any qualifying resource can choose whether, on an hour-by-hour basis, to offer into the market as a fast or a slow resource.

44. Beacon Power argues that nothing in PJM's answer rebuts the central points raised in Beacon Power's answer, i.e., that actual mileage is no longer included in the settlement formula for performance and there is no uniform price for mileage. Beacon Power argues that, as such, under PJM's compliance proposal, there could be instances where a fast responding resource would receive the exact same payment for performance as a slow-responding resource, even though the fast resource is directed by PJM to follow a dispatch signal that requires significantly more up and down regulation movement. Beacon Power argues that such an allowance would be unduly discriminatory. Beacon Power adds that, in fact, PJM has admitted that Beacon Power's alternative proposal, to use a uniform clearing price for mileage movement, appears reasonable and would expect that Beacon Power's proposed methodology could result in under-compensation of traditional resources or price volatility. Beacon Power requests that the Commission direct PJM to revise their market design to ensure that resources are paid uniformly for performance, based on the measurement of performance, as required by Order No. 755, i.e., based on the absolute amount of regulation up and down it provides in response to the system operator's dispatch signal.

5. Commission Determination

45. We accept, subject to conditions, PJM's compliance proposal, given PJM's failure to comply with the May 17 Order's requirement that PJM define the term actual mileage; actual mileage is the absolute amount of regulation up and down a resource provides in

response to the system operator's dispatch signal. PJM's initial compliance filing, in this proceeding, proposed that a resource be credited for regulation performance based on the amount of regulation performance it provides during the market hour at Schedule 1, section 3.2.2(f) of its Operating Agreement. PJM further noted that conforming language, at Manual 28, section 4.2, would provide that performance be measured by the "actual mileage" the resource is dispatched to provide.³⁹ Specifically, PJM stated that it would send a dispatch signal to a 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, as described in proposed Manual 28, section 4.2.

46. In the May 17 Order, the Commission accepted PJM's proposal that regulation performance be measured by the actual mileage the resource is dispatched to provide (a requirement that PJM proposed to include in its manuals), but required PJM to include this requirement in its tariff.⁴⁰ PJM proposes a substantive change in performance compensation relative to what we accepted in the May 17 Order. Specifically, PJM in response proposes to eliminate actual mileage from the performance payment settlement, as supported by PJM's tariff filing discussed in section III, below, a proposal to apply a benefits factor to the settlement process. PJM's August compliance filing before us here, however, fails to comply with the May 17 Order. PJM states that its use of the ratio of control signals in the adjustment of performance offers and hence, in the clearing process, ensures that all resources will have their actual mileage reflected in the clearing price, and thus in settlement. Beacon Power objects to PJM's compliance filing and argues that, under PJM's proposal, performance payments will not be made on a uniform basis relative to the amount of movement a resource provides in response to the system operator's dispatch signal, contrary to the requirements of Order No. 755 and the May 17 Order. First, we find that PJM has failed to provide sufficient evidence that the ratio of control signals is an accurate measure of a resource's later-dispatched mileage or performance. Second, this ratio of control signals is signal-type specific. Therefore, the Regulation Market Performance Clearing Price is affected by only the estimated mileage of the marginal resource, and any deviation by the resource in real-time would require a true-up, absent in PJM's proposal. Finally, we find that the regulatory text adopted by Order No. 755 is clear: "Each Commission-approved independent system operator or regional transmission organization that has a tariff that provides for the compensation for frequency regulation service must provide such compensation based on the actual service provided, including ... a payment for performance that reflects the quantity of frequency regulation service provided by a resource

³⁹ See *supra* note 31 (describing the provisions of Manual 28, section 4.2).

⁴⁰ May 17 Order, 139 FERC ¶ 61,130 at P 72.

when the resource is accurately following the dispatch signal.”⁴¹ By failing to include actual mileage in the settlement equation, PJM appears to be inconsistent with Order No. 755.

47. Accordingly, we direct PJM to either explain why its proposal provides a reasonable basis for paying for resources based on the actual service provided or to submit an additional compliance filing that proposes a reasonable method for paying resources based on mileage within 60 days of the date of the order.⁴²

G. Market Power Mitigation

48. The IMM, in its comments, identifies a formula error that it claims PJM has acknowledged. Specifically, the IMM notes that PJM’s tariff filing includes tariff language in which PJM made an inadvertent error regarding the calculation of its historic accuracy score. The IMM asserts that PJM incorrectly defines the term “Effective MW” (the product of offered regulation capability MW multiplied by historic performance) as the offered MW *divided* by historic performance. The IMM proposes to replace “divided” with “multiplied” to correct the problem. PJM acknowledges its error. Accordingly, we require PJM to include in its compliance filing, OATT and Operating Agreement language replacing “divided” with “multiplied.”⁴³

III. PJM’s Section 205 Filing

A. PJM’s Proposal

49. In its August 2, 2012 filing, in Docket No. ER12-2391-000, PJM proposes to revise Schedule 1 of the PJM Operating Agreement and the Attachment K – Appendix of the PJM OATT to: (i) provide *ex post* make-whole payments based on individual regulation resource’s opportunity costs, such that a regulation resource will be compensated if the resource’s offer, plus opportunity costs, is higher than the total regulation market clearing price; (ii) apply the marginal benefits factor to the settlement process;⁴⁴ and (iii) apply PJM’s accuracy score (i.e., the weighted average of a delay score, correlation score and

⁴¹ Order No. 755, FERC Stats. & Regs. § 35.28.

⁴² We discuss in section III, below, PJM’s section 205 proposals with respect to the use of the benefits factor in settlement and for lost opportunity costs.

⁴³ See section 3.2.2A.1(b) (i) of the PJM OATT and the parallel provision in its Operating Agreement.

⁴⁴ For a definition of marginal benefits factor, see *supra* note 28.

energy score for each ten second interval) to adjust each regulation resource's lost opportunity costs in the regulation market clearing process, capability payment, and three-pivotal supplier test.⁴⁵

50. With respect to make-whole payments, PJM notes that to comply with the Order No. 755 requirement that all cleared regulation resources be paid a uniform clearing price that includes the marginal resource's opportunity costs, PJM proposed to eliminate after-the-fact make-whole payments to regulation resources – even though these provisions are the only currently-effective provisions that can guarantee that a regulation resource will be compensated for opportunity costs that are incurred outside the hour or estimated at the time of clearing and setting price.⁴⁶ PJM states that, however, to ensure that each regulation resource will be compensated for all lost opportunity costs, it is appropriate that an after-the-fact review be done. PJM therefore proposes to revise the PJM Operating Agreement, at Schedule 1, section 3.2.2, to provide for a make-whole payment where the resource's offer plus opportunity costs is higher than the total regulation market clearing price.⁴⁷

51. PJM states that, in addition to adjusting each capability and performance offer by a unit-specific benefits factor, in committing a regulation resource and determining price (as proposed by PJM in its initial filing in this proceeding), it is also appropriate to adjust a unit's lost opportunity costs by the unit-specific benefits factor, and then multiply each resource's performance payment and capability payment by the marginal resource's unit-specific benefits factors for the applicable dispatch signal type.

52. PJM states that it will translate each fast-following regulation resource's offered MWs into traditional MWs by adjusting a regulation resource's total incremental cost by the

⁴⁵ The three pivotal supplier test is used by PJM to determine whether structural market power exists in the regulation market. *See* PJM Operating Agreement at Schedule 1, section 3.2.2A.

⁴⁶ PJM further notes that in an answer it submitted, in the PJM Order No. 755 Compliance Proceeding, PJM clarified that its proposed revisions should result in clearing prices that are sufficiently high to compensate regulation resources for their opportunity costs.

⁴⁷ Specifically, PJM proposes to revise section 3.2.2(b) to provide regulation resources the higher of: (i) the regulation market-clearing price; or (ii) the sum of the applicable regulation offers for a regulation resource determined pursuant to section 3.2.2A.1 and unit-specific opportunity costs, inclusive of unit-specific shoulder-hour opportunity costs and unit-specific inter-temporal opportunity costs. PJM further proposes a new provision, section 3.2.2(e), specifying the calculation methodology applicable to make-whole payments.

unit-specific benefits factor, thereby decreasing the cost of a regulation resource in the commitment and pricing process when the benefits factor is above one. PJM states that this payment methodology will compensate the marginal resource for its total cost to provide frequency regulation and will exceed the total costs for any infra-marginal regulation resource.⁴⁸

53. PJM also proposes to add to the “payment for performance” provisions it adopted in its tariff, in compliance with Order No. 755, with new provisions that would adjust each regulation resource’s lost opportunity costs in the clearing process by the resource’s historic accuracy score.⁴⁹ PJM also proposes to adjust each regulation resource’s capability payment by the resource’s accuracy.⁵⁰ PJM asserts that, under its proposed revisions, PJM will multiply both the capability and performance clearing prices by each resource’s accuracy score within the market hour for settlement. PJM states that, as such, compensation will be tied, for each market hour, to the resource’s ability to provide system control. PJM adds that using an hourly accuracy score for each component in the settlement process will ensure that the resulting market clearing prices appropriately compensate each resource by reflecting a merit order ranking based on accuracy.

⁴⁸ PJM states that to implement the marginal benefits factor, it proposes to revise the PJM Operating Agreement, at Schedule, section 3.2.2, to apply the unit-specific benefits factor to all aspects of the clearing processes and the marginal benefits factor to the settlement process. Specifically, PJM proposes to revise: (i) section 3.2.2(a) and (g) to apply the marginal benefits factor to the performance payment, (ii) section 3.2.2(g) to clarify that the performance offer will be adjusted by the unit-specific benefits factor to determine the performance regulation market clearing price; (iii) section 3.2.2(h) to multiply the capability payment by the marginal benefits factor and clarify that the capability offer will be adjusted by the unit-specific benefits factor (as opposed to the marginal benefits factor) to determine the capability regulation market clearing price; and (iv) section 3.2.2(j) to specify how PJM will calculate the marginal benefits factor.

⁴⁹ *See* proposed PJM Operating Agreement, at Schedule 1, section 3.2.2(c). In the PJM Order No. 755 Compliance Proceeding, PJM proposed to pay a Performance Regulation Market Clearing Price based on the highest adjusted performance offer of the resources that cleared the market, and calculate the performance payment based on the requested MW movement and the relevant resource’s response to the regulation control signal. The May 17 Order found that PJM’s performance payment proposal satisfied the requirements of Order No. 755, subject to a tariff revision detailing each component of the accuracy score and how each component scalar in the accuracy score calculation would be determined. *See* May 17 Order, 139 FERC ¶ 61,130 at P 71.

⁵⁰ *See* proposed PJM Operating Agreement, at Schedule 1, section 3.2.2(h).

B. Notice of Filing and Responsive Pleadings

54. Notice of PJM's compliance filing was published in the *Federal Register*, 77 Fed. Reg. 48,137 (2012), with interventions and protests due on or before August 23, 2012. Timely-filed motions to intervene were submitted by The Dayton Power and Light Company (Dayton); Exelon Corporation; IMM; AES Energy Storage, LLC; American Electric Power Service Corporation (AEP); American Municipal Power, Inc.; ESA; Beacon Power; North Carolina Electric Membership Corporation; Dominion Resources Services, Inc.; Duke Energy Corporation (Duke); and PSEG. Comments were submitted by the IMM, ESA, Beacon Power, and jointly by AEP, Dayton, and Duke (AEP, *et al.*). A protest was submitted by PSEG.

55. ESA and Beacon Power argue that PJM's proposed tariff changes are necessary for the implementation of a two-part compensation methodology, as envisioned by Order No. 755, and should be accepted without revision.

56. PSEG and AEP, *et al.* object to PJM's proposed make-whole payments provisions.⁵¹ PSEG argues that making shoulder-hour payments an after-the-fact make-whole payment should be rejected, given that: (i) the inclusion of these costs in the regulation service price has not been shown by PJM to be infeasible; (ii) failing to compensate traditional resources opportunity costs as part of the regulation service could result in a reduction in the number of participants volunteering to provide regulation service during times of peak demand and thus threaten reliability; and (iii) PJM's after-the-fact payment is inconsistent with Order No. 755's requirement that opportunity costs be included in the regulation service price.⁵²

57. AEP, *et al.* agree that shoulder-hour opportunity costs should be incorporated into the regulation market clearing price, in order to make these costs visible to the marketplace. AEP, *et al.* argue that by not including these costs into the actual calculation of the regulation market clearing price, PJM will likely be artificially lowering the true cost of regulation service and could be setting the regulation market clearing price based off an incorrect marginal resource.

58. PSEG objects to PJM's proposed extension of its benefits factor to apply to both the clearing process and to the settlement process. PSEG argues that PJM's proposed extension of the benefits factor should be rejected, because it: (i) has not been shown to be necessary

⁵¹ Intervenors' arguments essentially mirror PSEG's arguments, as summarized in section II, above, regarding PJM's compliance obligation to explain when it is not feasible to include shoulder-hour lost opportunity costs in the regulation service price.

⁵² See PSEG Protest at 7 (citing Order No. 755, FERC Stats. & Regs. ¶ 31,324 at P 72).

to incentivize additional participation by fast-responding resources;⁵³ (ii) would reduce, if not eliminate, the savings intended to be realized by decreasing the quantity of regulation service obtained;⁵⁴ (iii) may create incentives for fast-responding resource providers to game their bids (i.e., they may be able to bid higher than their actual costs and still clear in the market due to the effect of the benefits factor); (iv) bestow redundant benefits vis-à-vis the adjustments made for accuracy and performance; (v) would violate incentive rate-making principles, absent a showing that the incentive provided is no more than that needed

⁵³ PSEG notes the KEMA Study's finding that the addition of fast following resources to an existing portfolio of regulation service resources that consist almost entirely of slow following resources results in efficiency gains that will benefit consumers. PSEG counters, however, that this finding ignores the fact that there was never any demonstration that the benefits factor was needed to achieve the desired efficient outcome. PSEG argues that, in fact, the mileage and accuracy adjustments included as part of the rate design will provide a higher level of payments to the fast following resources, based on their operating characteristics. PSEG adds that because these fast following resources can react much more quickly to the regulation dispatch signal, they will have very high accuracy scores and will travel more miles than conventional regulation resources.

⁵⁴ PSEG posits the following example, assuming: (i) 1,000 MWs of total system requirements for regulation service; (ii) offer prices of \$1 and \$1.49, respectively, for traditional (RegA) resources and fast-responding resources; (iii) a total system-wide payment of \$1,000 for the "No RegD" case; and (iv) a marginal benefits factor of approximately 1.5 for fast-responding resources, as set at a 30 percent penetration level. PSEG states that with 300 MWs of fast-responding resources and a 1.5 marginal benefits factor, a total of 150 MWs of RegA will be displaced, reducing the system requirement for nominal regulation service MWs to 850 MWs, even though 1,000 MWs of Effective MWs for regulation service would still be available. PSEG argues that if the benefits factor is only applied for clearing, the effective rate for the fast-responding resources in the clearing process will be about \$0.99 per MW, while the rate for RegA resources would be 1.00 per MW. PSEG states that, accordingly, the total system payments would be about \$847; the resulting cost savings over the rate base would be 15.3 percent. PSEG argues, however, that under PJM's proposal, if the benefits factor is applied to both the clearing and settlement process for fast-responding resources, the total system payment would be \$997, only a 0.3 percent savings over the base case.

for the purpose and is correlated to a resulting benefit;⁵⁵ and (vi) violate Order No. 755's requirement that resources be treated on a neutral basis.⁵⁶

59. PSEG also objects to PJM's proposed accuracy score revisions. PSEG argues that PJM should be required to provide a basis to exclude a resource's poor performance from its performance score, where the performance at issue is caused by the action of a third party that is beyond the resource's control. PSEG notes, for example, that while PJM proposes a process to suspend a regulation event, where the resource at issue is required to respond to a system emergency, PJM only provides the regulation resource two minutes before and after the event to respond. PSEG also argues that if PJM is late in requiring a traditional resource to ramp up to a required service level, the resource may not be able to reach that level in time and would be considered inaccurate.

60. Finally, the IMM, as noted above in section II, asserts that PJM made an inadvertent error in its formulation of the historic accuracy score, as it will apply to the Three Pivotal Supplier Test.⁵⁷ Specifically, the IMM asserts that the term "Effective MW" should be defined as the offered MW *multiplied* by the historic performance, not the offered MW *divided* by historic performance.

C. Answers

61. Answers were filed by PJM, on August 29, 2012, September 7, 2012 and October 25, 2012,⁵⁸ by ESA, on September 10, 2012, and by Beacon Power, on September 10, 2012.⁵⁹

⁵⁵ See PSEG Protest at 14 (citing *City of Detroit v. FPC*, 230 F.2d 810, 817 (D.C. Cir. 1955) and *Incentive Ratemaking for Interstate Natural Gas Pipelines, Oil Pipelines, and Electric Utilities*, 61 FERC ¶ 61,168, at 61,594 (1992) (Incentive Rate Policy Statement)).

⁵⁶ *Id.* at 8, (citing Order No. 755, FERC Stats. & Regs. ¶ 31,324 at PP 198-199).

⁵⁷ See PJM filing at proposed Schedule 1, section 3.2.2A.1(b)(i) of the PJM Operating Agreement.

⁵⁸ PJM's September 25, 2012 Answer, which was also filed in Docket No ER12-1204-001, is summarized in section II, above.

⁵⁹ Beacon Power's September 10, 2012 Answer was superseded by its October 9, 2012 Answer, as summarized in section II, above. In its September 10, 2012 answer, Beacon Power responds to PSEG's protest regarding the purpose and use of the benefits factor and disputes whether the benefits factors, as applied to the settlement process, (i) provides double credit to fast resources; (ii) reduces the benefits to consumers; and (iii) encourages fast resources to game their bids. Beacon Power's answer, however, was

(continued...)

62. PJM proposes to correct the definition of an Effective MW in a subsequent compliance filing directed by the Commission.

63. PJM, in its September 7, 2012 answer, responds to PSEG's and AEP, et al.'s assertions that shoulder-hour payments, under the Commission's directives, must be incorporated into the regulation market clearing price, not made on an after-the-fact basis. PJM argues that, under its proposal, it will calculate real-time regulation market clearing prices using real-time opportunity costs, thus satisfying the requirements of the May 17 Order and Order No. 755, and that in the rare event that a regulation resource's opportunity costs, plus offer, exceed the regulation market clearing price, PJM's proposed make-whole payment will appropriately capture these shoulder-hour opportunity costs. PJM adds that, in the May 17 Order, the Commission both allowed for make-whole payments *and* required PJM to specify how it will include opportunity costs in each regulation resource's offer.⁶⁰

64. PJM also responds to PSEG's argument that PJM's make-whole payments proposal fails to provide significant economic incentives to participate in the regulation market and fails to adequately compensate traditional resources for their opportunity costs. PJM argues that its proposal ensures that all regulation resources will be compensated for their opportunity costs, with only a limited portion of these payments made on an after-the-fact basis.

65. PJM and ESA also respond to PSEG's objections to PJM's proposed revisions to PJM's benefits factor. PJM disputes PSEG's assertion that PJM's proposed revision is redundant and unnecessary, given the existing benefits bestowed on fast-responding resources relative to their accuracy and performance. PJM argues that to ensure that each regulation resource is cleared, priced, and compensated on an equal basis, PJM is required to translate, via its benefits factor, the benefits from the resources following the fast regulation signal into the benefits of a resource following the traditional regulation signal, with a conversion-back translation made during the settlement process. PJM argues that this

superseded by its later-filed answer in Docket Nos. ER12-1204-001 and ER12-2391-000, which was based on Beacon Power's claim that "it became clear [to Beacon Power, based on the record in these proceedings] that PJM's removal of actual mileage from the settlement (as proposed in its August 15th compliance filing) does not result in compensating resources appropriately based on the amount of regulation up and down the system operator is requesting of the resources." *See* Beacon Power October 9, 2012 Answer at 9.

⁶⁰ PJM Answer at 6 (citing May 17 Order, 139 FERC ¶ 61,130 at PP 41 and 74).

conversion process does not result in a redundancy, or double credit, vis-à-vis PJM's accuracy and performance scores.⁶¹

66. PJM, ESA and Beacon Power also respond to PSEG's argument that using a benefits factor adjustment in the settlement process could eliminate, or reduce, the benefits to consumers, and could promote gaming. ESA challenges the example relied upon by PSEG. Specifically, ESA argues that PSEG's example mischaracterizes the way in which the benefits factor is typically used.⁶²

67. PJM argues that failing to include the benefits factor in the settlement process would result in PJM under-compensating fast-following resources, thus deterring these resources from participating and decreasing consumer benefits. PJM further argues that fast-following resources will not be able to game their bids by bidding higher than actual costs and still clearing in the market due to their benefits factor. PJM argues that the only way that a fast-following resource can bid its true cost and still be compensated for that cost is through the use of the benefits factor in the settlement process. PJM adds that failing to apply the benefits factor to the settlement process would likely lead to fast-following resources submitting offers into the market that are *higher* than their true cost in order to receive appropriate compensation.

68. PJM, ESA and Beacon Power also reject PSEG's claim that PJM's proposal to apply its benefits factor to the settlement process inconsistent with the Commission's incentive rate-making principles. PJM responds that these rate-making principles do not apply to

⁶¹ PJM notes that to ensure that fast-following resources do not receive a double credit, PJM normalized the benefits factor for accuracy by isolating the benefit of following the fast signal without the influence of the accuracy. PJM asserts that, as such, the benefits calculation is based on similar expected accuracy for the traditional and fast-responding resources, and there is no redundancy to using the benefits factor and the adjustments for accuracy and performance.

⁶² ESA argues that in PSEG's example, the MW Effective value is calculated erroneously, based on the marginal benefits factor, while in PJM's proposal it is the unit-specific benefits factor that is used to make this calculation. ESA asserts that PSEG's example would only be accurate in the case of a single fast-following resource providing all 300 MW of fast-following resources. ESA adds that a more illustrative example of the case of 30 percent fast-following resources and a 1,000 MW Effective requirement, using PSEG's assumptions of \$1/MW bid by traditional resources and \$1.49 bid by fast resources, would be market clearance of 514 MW of traditional resources and 221 MW of fast-following resources. ESA notes that the average benefits factor of the multiple fast-following resources would be about 2.2, such that the resource requirement would be met at a price level of \$846.

competitive markets.⁶³ ESA asserts that the benefits factor is not designed as an extra incentive to fast-following resources, but instead as a substitution factor between traditional and fast-following resources such that they can be compared on an apples-to-apples basis and so that the most cost-efficient mix of resources can be procured in the market. ESA adds that to ensure that fast-following resources that clear the market receive compensation at least equal to their bids, it is necessary that a resource's compensation in the settlements process also be adjusted by the benefits factor of the marginal fast-following resource.

69. PJM, ESA and Beacon Power also dispute PSEG's assertion that PJM's benefits factor provides double credit to fast-following resources. ESA argues that, in fact, the use of the benefits factor in the settlement calculation is the only way that regulation resources are compensated based on the amount of work or benefit they provide, as required by Order No. 755. ESA adds that were the Commission to accept PJM's August compliance filing, but reject PJM's tariff filing, applying the benefits factor to the settlement process, there would be no way for fast-following resources to be compensated for the actual amount of work they provide on a real-time basis.

70. PJM responds to PSEG's claim that PJM's proposal fails to appropriately address the circumstances presented when a resource fails to meet the accuracy requirement due to the action of a third party event beyond its control (for example, in the case of a reserve event, when PJM would impose a two minute window to respond, before and after the event). PJM argues that it must have a regulation resource respond within the stated window during a synchronized reserve event, based on PJM's operational experience. PJM adds that if a resource cannot respond to a synchronized reserve event and then regain control for regulation, it should either not volunteer to respond to the event, or should not be compensated for regulation if it does respond. In response to PSEG's second example, PJM notes that resources may provide an operational setpoint to PJM for use in the scoring calculation that can account for operational limitations, such as time necessary for a regulation resource to response. PJM states that it will consider these operational limitations when selecting resources to provide regulation service.

D. Request for Additional Information

71. On September 12, 2012, Commission Staff requested additional information from PJM. PJM submitted a response on September 18, 2012, as summarized below. In addition, PJM sought a waiver of the Commission's 60-day notice requirement for the purpose of allowing PJM's proposed tariff revisions to become effective, as originally requested, on October 1, 2012.

⁶³ PJM Answer at 11 (citing Incentive Rate Policy Statement, 61 FERC ¶ 61,168 at 61,587).

1. PJM's Response

72. In its response, PJM explains that if two fast-responding resources submit identical offers and both resources could be marginal, PJM would select the resource with the higher qualification test score as the marginal unit.⁶⁴ In addition, PJM contends that the marginal benefits factor will begin to decrease below one if resources following the fast-responding resource signal provide less benefit to system control than resources following the traditional regulation signal. PJM states given that the operational characteristics of the traditional regulation signal and fast-responding regulation signal complement one another, a blend of fast-responding and traditional regulation resources provides the best control because the most beneficial aspects of each type of resource can be used for system control. PJM states that while the first MW of fast-following regulation provides more benefit than the second MW, the benefit decreases incrementally as more fast-following regulation resources are utilized. PJM states that, as such, at a certain point a MW of fast-following regulation and a MW of traditional regulation have the equivalent impact on system control and, therefore, dispatching fast-following regulation has no greater benefit than using traditional regulation.⁶⁵

73. PJM adds that after that point, resources following the fast-responding resource signal provide less benefit to system control than resources following the traditional regulation signal and, therefore, the marginal benefits factor for fast-responding resources begins to decrease below one. PJM states that, under its proposed calculation, that point is when 42 percent of PJM's regulation requirements are provided by fast-following regulation.

74. PJM also provides a numerical example demonstrating that, under its proposal, the marginal benefits factor for resources following the fast-responding regulation signal can

⁶⁴ PJM states that, under PJM Manual 12, section 4.5, each regulation resource is required to participate in an initial performance test to ensure that the resource meets certain performance standards necessary to participate in PJM's regulation market. PJM adds that the higher a resource's qualification test score, the better its performance in following the regulation signal.

⁶⁵ PJM states that if fast-responding regulation resources are providing between 1 percent and approximately 42 percent of PJM's regulation requirement, the benefits factor for resources following the fast-responding regulation signal can range from 2.9 to 1. PJM states that the benefits factor for resources following the fast-responding regulation signal can range from 1 to .0001 if fast-responding regulation resources are providing between approximately 42 percent and 62 percent of PJM's regulation requirement. The benefits factor can range from .0001 to .00001 if fast-responding regulation resources are providing between approximately 60 percent and 100 percent of PJM's regulation requirement.

fall below one, but will be appropriately compensated when they do so. PJM clarifies that, under certain scenarios, a fast-responding resource may appropriately receive less compensation than a traditional resource, where the benefits factor indicates that it provides less benefit to system control than resources following the traditional regulation signal (e.g., where 1 MW of the fast-responding resource provides the equivalent of 0.5 MW of the traditional resource). PJM adds, however, that all resources will receive payments at least equal to their total cost to provide the service, with the marginal resource receiving exactly its total cost.

75. Finally, PJM provides examples to demonstrate how make-whole payment will be calculated for resources, when a regulation resource's offer price, plus its opportunity costs from outside the operating hour, exceed the frequency regulation market-clearing price. PJM also clarifies that only a small percentage of resources would be likely to have any opportunity costs accumulated outside the operating hour for any given clearing interval and that shoulder-hour opportunity costs will typically only apply to traditional resources, given that no resource eligible for shoulder-hour opportunity costs have qualified, or even attempted to qualify, to provide regulation service under the fast-responding resource signal.

2. Notice of Filing and Responsive Pleadings

76. Notice of PJM's response to Commission Staff's Request for Additional Information was published in the *Federal Register*, 77 Fed. Reg. 58,984 (2012), with interventions and protests due on or before October 9, 2012. Timely-filed motions to intervene and comments were submitted by AES and the IMM.

77. AES asserts that PJM has appropriately supported a benefits factor with a declining curve, given that its declining curve reflects the diminishing returns associated with the provision of frequency regulation service by a fast-responding resource. AES argues that a benefits factor curve represents a substitution factor, as between fast-responding resources and traditional resources, based on these resources' respective signals as they are designed today. AES adds that while the benefits factor is unlikely to drop below 1.0, the measurement of any such decline is necessary in order to reflect the relative value, as between a fast-responding resource and a traditional resource. AES adds that, regardless, a regulation resource can be bid into the regulation market as both a fast-responding resource and a traditional resource, in which case the lowest cost will be selected. AES notes that, as such, the benefits factor will be effectively set at a floor of 1.0.

78. AES also supports PJM's explanation that, under its proposal, it multiplies the unadjusted payment for each resource by the unit-specific benefits factor of the marginal unit for the applicable dispatch signal, to reflect the benefits that each resource provides to system control, such that all resources will receive payments at least equal to their total cost to provide the service, with the marginal resource receiving exactly its total cost to provide the service. AES supports this approach based on its claim that if settlements are not

multiplied by the benefits factor, and absent the adoption of a secondary make-whole structure, resources may not receive their total cost.

79. The IMM supports PJM's proposed application of the marginal benefits factor to the settlement process and agrees that PJM's approach is the only correct way to clear the market that would produce a uniform price in a common unit of measure (slow resource MW and price per MW of slow) that reflects the marginal value of the resource used. Nonetheless, the IMM notes that the benefits factor should be allowed to fall below zero.

E. Procedural Matters

80. Pursuant to Rule 214 of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.214 (2012), the timely, unopposed motions to intervene serve to make the entities that filed them parties to this proceeding. Rule 213(a)(2) of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.213(a)(2) (2012), prohibits an answer to a protest unless otherwise ordered by the decisional authority. We will accept the answers filed by PJM and ESA, because they have provided information that assisted us in our decision-making process.

F. Commission Determination

81. For the reasons discussed below, we accept PJM's filing, subject to conditions and the submission of a compliance filing within 60 days of the date of this order.

1. Make-Whole Payments

82. We accept PJM's proposed tariff revisions providing for make-whole payments in those circumstances where a regulation resource's offer, plus opportunity costs, is higher than the total regulation market clearing price. We agree with PJM that when a regulation resource's opportunity costs plus offer is higher than the regulation market clearing prices, it is appropriate to provide make-whole payments to regulation resources to ensure that each regulation resource receives payment for its shoulder-hour lost opportunity costs.

83. We reject PSEG's and AEP, et al. argument that PJM's proposed revisions fail to include a frequency regulation resource's shoulder-hour opportunity cost in a resource's offer. As PJM explains, PJM will continue to include each regulation resource's estimated shoulder-hour opportunity costs in the offer when committing resources in the hour prior to the operating hour.⁶⁶ As PJM further explains, incorporating shoulder-hour opportunity costs into the regulation five-minute clearing price would be problematic because, by definition, the real-time (i.e., actual) opportunity costs used to calculate real-time prices for

⁶⁶ See PJM Filing at 7-8.

a particular five-minute interval do not include the opportunity costs incurred outside of the regulating hour. For example, PJM states that including costs from outside of the five-minute interval would result in an inaccurate calculation of the incremental costs calculated by the software optimization.⁶⁷ As stated above, we find reasonable PJM's proposal to continue to commit resources one hour in advance of the operating hour using estimated opportunity costs, including shoulder-hour opportunity costs, and to provide make-whole payments for opportunity costs are incurred outside of the hour or estimated at the time of clearing and setting price.

84. We also reject PSEG's and AEP, et al.'s argument that real-time prices will not adequately cover each regulation resource's shoulder-hour opportunity costs. In the event that a regulation resource's opportunity costs, plus offer, is higher than the regulation market clearing prices, PJM will provide a make-whole payment.⁶⁸ As such, regulation resource's providing service at the direction of PJM will be appropriately compensated.

2. Benefits Factor in Settlement

85. We reject PJM's proposal to include a "marginal benefits factor" in settlement as unjust and unreasonable, unduly discriminatory and a violation of Order No. 755.⁶⁹ In Order No. 755, the Commission required that resources that are asked to, and do, provide the same regulation service be paid the same, and that resources that are asked to, and do, perform different amounts of service be paid differently. Contrary to this fundamental principle.

86. PJM's proposal to use a benefits factor in settlement allows resources to perform the same amount of work and receive different levels of compensation. For example, assuming the same capability, performance, and accuracy score, a fast-responding resource with a

⁶⁷ In PJM's compliance filing, as discussed in section II, above, PJM notes that including costs from outside the five-minute interval would result in an inaccurate calculation of the incremental costs calculated by the software optimization, and that only a portion of the shoulder-hour costs are known during the regulating hour, given that the costs incurred for the shoulder-hour occurring after the regulating hour cannot be determined within the hour. PJM further notes that once regulation resources provide regulation for multiple hours, PJM has no mechanism by which to spread the opportunity costs incurred over the duration of the regulation service. *See* PJM compliance filing, in Docket No. ER12-1204-001 at 5-6.

⁶⁸ *See* sections 3.2.2(b), 3.2.2A.1 and 3.2.2(e) of Attachment K-Appendix of the PJM OATT and the parallel provision in Schedule 1 of the Operating Agreement.

⁶⁹ The term "marginal benefits factor" is defined *supra* at note 28.

marginal benefits factor of two would receive twice the performance payment as a traditional signal resource. While we understand that PJM wants to avoid introducing make-whole payments into its settlement, and using the benefits factor in the settlement formula mitigates this, we do not find that this is sufficient to overcome the discriminatory payments in violation of Order No. 755. While Order No. 755 did use the example of make-whole payments and the associated impact on the uniformity of prices (*vis-à-vis* ex post opportunity cost payments), Order No. 755 did not seek to eliminate, or reduce make-whole payments. One of Order No. 755's important goals was to ensure that compensation is not unduly discriminatory.

87. Additionally, PJM has not demonstrated that the benefits factor is a substitute for including actual mileage in the settlement process. Therefore, we are not persuaded by arguments suggesting that the benefits factor must be included in the settlement process or that the benefits factor should displace the use of actual mileage in the settlement process.

88. Similarly, we reject the application of the benefits factor in settlement of the capability credit. We acknowledge PJM's and commenters' explanations that the benefits factor represents a measure of the substitutability of fast-response resources for traditional resources, and thus the use of the benefits factor to settle capability payments is justified as a payment for Effective MWs of regulation capability. We also acknowledge, as we do with respect to performance payment, the desire to avoid make-whole payments. However, PJM's justification for the use of the benefits factor in settlement is based on the joint use in settling capability and performance. Given that compensation for capability and performance are intrinsically tied together, we reject PJM's proposal.

3. Accuracy Score Revisions

89. We accept, subject to conditions, PJM's proposal to apply an accuracy score, that is, a resource's historic performance score reflecting its accuracy in providing regulation service over a rolling 100 hours, to adjust each regulation resource's lost opportunity costs in the regulation market clearing process, capability payment, and three-pivotal supplier test. We agree with PJM that, with these revisions, PJM's market clearing prices will appropriately compensate a regulation resource by reflecting a merit order ranking based on accuracy.

90. We reject PSEG's arguments that PJM's proposed methodology for calculating accuracy scores two minutes before and after a synchronized reserve event is flawed.⁷⁰

⁷⁰ PJM Manual 28, section 6.1 at 35-36 (Synchronized Reserve Accounting Overview) provides that resources that are assigned regulation when a synchronized reserve event is initiated will be compensated based on the amount of response provided beyond their regulation commitment, as well as for any response in excess of their regulation high

Under PJM's proposal, PJM will multiply both the capability and performance clearing prices by each resource's historic accuracy score within the market hour for market settlement. As a result, the compensation aligns with the effectiveness of that resource providing system control each market hour. In addition, PJM proposes to incorporate the historic accuracy score into the three pivotal supplier test.⁷¹

91. We find persuasive PJM's argument that continued suspension of performance scoring beyond the two-minute window would result in compensation to resources that are unable to follow the regulation control signal down during an important time for system control. In Order No. 755, the Commission stated that a resource's performance in following the AGC signal of the RTO or ISO should be taken into consideration when compensating that resource for providing frequency regulation service. We also find that if a resource is unable to respond to a regulation control signal, it may be unable to provide the frequency regulation capacity the balancing authority needs to procure in order to maintain reliability. Furthermore, and as noted by PJM, resources are not required to respond to a synchronized reserve event. Regulation resources that believe they are not able to return to regulation control within the two-minute window may simply choose not to participate without any negative impacts on their performance score. We also find convincing PJM's argument that allowing resources to provide an operational setpoint that is considered when selecting regulation resources will prevent PJM from requiring resources to ramp to a level that they are incapable of reaching within the required time interval.

92. With regard to the proposed Tariff and Operating Agreement language that apply the marginal benefits to the settlement process such as revisions in subsection 3.2.2(a) and (g) and 3.2.2(h) that multiplies the capability payment by the marginal benefits factor, we direct PJM to revise these subsections to remove the use of the benefits factor in the settlement process and make any other conforming changes within 60 days of the date of this order.

The Commission orders:

(A) PJM's compliance filing is hereby accepted, subject to conditions and the submission of an additional filing within 60 days of the date of this order, as discussed in the body to this order.

limit or economic maximum (whichever is lower). *See also* PJM Manual 11, section 4.2.11 (Settlement) at 80-81.

⁷¹ *See* sections 3.2.2(c), 3.2.2(h), 3.2.2A.1(b)(i) of Attachment K-Appendix of the PJM OATT and the parallel provision in Schedule 1 of the Operating Agreement.

(B) PJM's proposed tariff revisions are hereby accepted, in part, and rejected, in part, subject to conditions and the submission of a compliance filing within 60 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.