

December 2, 2014

The Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

**Re: California Independent System Operator Corporation
Docket No. ER15____-000;
Tariff Amendment – Minimum Performance Threshold for Regulation
Up and Regulation Down**

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) requests authority to implement revisions to its minimum performance threshold for resources providing regulation.¹ The CAISO incorporated this minimum performance threshold into its Order 755 market design under which the CAISO not only compensates regulation resources for their capacity but also compensates them based on how accurately they respond to the CAISO's regulation control signal. The minimum performance threshold requires regulation resources to achieve a monthly accuracy score of at least 50 percent based on a simple average of accuracy measurements taken in each 15 minute interval in which the resource is providing regulation.

In this filing, the CAISO proposes the following tariff changes to its Order 755 market design:

- (1) Modify the monthly accuracy calculation for regulation resources from a simple average to a weighted average of 15 minute accuracy measurements using instructed mileage as the weight; and
- (2) Reduce the minimum performance threshold from 50 percent to 25 percent.

¹ The CAISO submits this filing pursuant to section 205 of the Federal Power Act, 16 U.S.C. § 824d (2012). Capitalized terms not otherwise defined herein have the meanings set forth in the CAISO tariff, and references to specific sections, articles, and appendices are references to sections, articles, and appendices in the current CAISO tariff and revised or proposed in this filing, unless otherwise indicated.

The Commission should accept these tariff revisions because they recognize the value of greater movement to balance the system between each 5 minute dispatch and also mitigate the administrative burden and potential market disruption that could occur if a large number of resources needed to recertify their regulation capacity or face disqualification as a result of failing the 50 percent minimum performance threshold.

The CAISO requests that these tariff revisions take effect on January 1, 2015. This effective date coincides with the expiration of a waiver granted by the Commission permitting the CAISO not to enforce the minimum performance threshold under its Order 755 market design. This request is appropriate to provide market participants with certainty that the CAISO will not impose one minimum performance threshold in January 2015 but a different minimum performance threshold in later months. The CAISO, therefore, requests that the Commission waive the requirement of 18 C.F.R. § 35.3 that a rate schedule be filed not less than 60 days from the effective date.

I. Background

The CAISO uses regulation (regulation up and regulation down) for several purposes, including frequency response and to meet system imbalances that occur within 5 minute dispatch intervals. In October 2011, FERC issued Order 755, which adopted a final rule for compensation of frequency regulation in organized wholesale power markets.² In response to the final rule, the CAISO developed a two-part bid structure to establish capacity and mileage clearing prices for bid-in and self-provided regulation. Under the market design, the CAISO compensates resources providing regulation for their capacity and also compensates these resources with a mileage payment based on how accurately they respond to the CAISO's regulation control signal.³ While not required by Order 755, the CAISO also proposed to adopt a minimum performance threshold for resources providing regulation. The Commission accepted this proposal.

As part of its approval of the CAISO's Order 755 market design, the Commission directed the CAISO to conduct an operational review of its Order 755 market design based on one year of experience and submit an informational

² *Frequency Regulation Compensation in the Organized Wholesale Power Markets*, FERC Stats. & Regs. ¶ 31,324 (2011) (Order 755), *rehearing denied*, 138 FERC ¶ 61,123 (2012) (Order 755-A).

³ *Cal. Indep. Sys. Operator Corp.*, 140 FERC ¶ 61,206 (2012); *Cal. Indep. Sys. Operator Corp.* 142 FERC ¶ 61,233 (2013). The Commission originally accepted the market design effective January 1, 2013, but subsequently the Commission granted successive motions for extension of time filed by the CAISO to implement the market design effective May 1, 2013 and then effective June 1, 2013. *Cal. Indep. Sys. Operator Corp.*, 141 FERC ¶ 61,184 (2012); Notice of Extension of Time, Docket Nos. ER12-1630-000, et al. (Apr. 30, 2013).

report within 14 months of the effective date of its tariff revisions.⁴ The CAISO also committed to monitor its market design and propose software or market rule changes as appropriate.⁵

Prior to completing this operational review, the CAISO discovered that many resources certified to provide regulation in the CAISO's market had not met the 50 percent minimum performance threshold. On January 10, 2014, the CAISO requested a limited waiver of these tariff provisions to avoid the market disruption that might occur if it required all resources that did not meet the minimum performance threshold to recertify to provide regulation service or face disqualification. The CAISO also requested the waiver to allow it sufficient time to assess the design of the minimum performance threshold and develop any modifications, if necessary. The Commission granted the CAISO's waiver.⁶

After collecting one year of operational data, the CAISO initiated a stakeholder process in September 2014 to examine potential changes to its Order 755 market design.⁷ The CAISO did not propose to undertake a significant redesign of its Order 755 market design, but instead proposed to refine the minimum performance threshold. The CAISO Board of Governors approved these refinements at its November 13, 2014 business meeting.⁸

A. The Minimum Performance Threshold

As part of its market design, the CAISO includes a minimum performance threshold for resources providing regulation.⁹ Under this threshold, the CAISO calculates whether resources have maintained at least a 50 percent accuracy measurement in response to control signals over a calendar month. The CAISO considers under-response and over-response equally in assessing the accuracy of the resource's response to the regulation signal over each 15 minute operating interval. The CAISO calculates accuracy as the sum of instructed mileage over

⁴ The CAISO filed this informational report on August 1, 2014 in Commission dockets ER12-1630 and ER14-971. A copy of this informational report is available at the following link: <http://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=13606136>

⁵ *Cal. Indep. Sys. Operator Corp.*, 140 FERC ¶ 61,206 (2012) at P 75.

⁶ *Cal. Indep. Sys. Operator Corp.*, 147 FERC ¶ 61,132 (2014).

⁷ A copy of the CAISO's issue paper and straw proposal is available at the following website: http://www.aiso.com/Documents/IssuePaper-StrawProposal_PayForPerformanceRegulation-YearOneDesignChanges.pdf

⁸ Copies of materials presented to the CAISO Board of Governors and a record of their vote are attached to this filing as Attachment C.

⁹ CAISO tariff at section 8.2.3.1.1.

each 15 minute interval less the 15 minute sum of deviations from the regulation signal, and then divides that amount by the sum of the instructed mileage. This percentage value is the accuracy of the resource's performance as compared to regulation signals. The CAISO then uses this percentage to calculate a monthly average to evaluate the performance of resources.¹⁰ To calculate the monthly average, the CAISO currently takes the simple average of all 15 minute accuracy calculations for all intervals the resource provided regulation service over the calendar month.

If a resource fails to meet the minimum performance threshold over a calendar month, the tariff requires the resource to re-certify to offer regulation within 90 days after the date the CAISO provides notice of the resource's failure to meet the minimum performance threshold. If the resource does not recertify, the CAISO will disqualify the resource from providing regulation up or regulation down, respectively. The CAISO calculates separate accuracy measurements for regulation up and regulation down. As a result, a resource may face disqualification from one or both services.

B. Performance of Resources under the Minimum Performance Threshold

Based on its review and assessment of one year of operational data from June 1, 2013 through May 31, 2014, the CAISO found that resources providing regulation performed below the 50 percent minimum performance threshold in multiple calendar months during the first year of the Order 755 market design. The CAISO tracked regulation performance by the following resource types: combined cycle, generator turbine, hydro pump turbine, hydro turbine, limited energy storage resource and steam turbine. Each category of resource performed below the 50 percent minimum performance threshold for either regulation up or regulation down during at least one calendar month between June 1, 2013 and May 31, 2014. In fact, based on a review of the more than 90 resources providing regulation during the first year of operation, every resource failed the minimum performance threshold for regulation up or regulation down in at least one calendar month.

The CAISO measures accuracy against a resource's response to a four second control signal. As part of its review, the CAISO discovered that resources control and communication systems face challenges to accurately respond in each 4 second interval. During the first quarter of 2014, the CAISO requested information from various scheduling coordinators providing regulation in the CAISO markets concerning the physical or operational constraints that prevent their resources from meeting the minimum performance threshold and

¹⁰ The CAISO also applies this percentage to reduce any performance payment for the 15 minute interval. In this filing, the CAISO is not proposing to change this formula for purposes of adjusting any performance payments.

the steps, if any, that they can take to improve the accuracy of their resources' response to CAISO control signals. Some scheduling coordinators reported physical and control limitations designed for safety that can cause a delay in responding to a CAISO control signal. Other scheduling coordinators identified that the time between the communication of the control signal and the resource's response may not in all cases match the four second requirement of the CAISO's accuracy measurement. For example, the CAISO's four second control signal may request a resource providing regulation to move to a new dispatch operating target, but the resource may require several four second intervals to reach that target. As a result, even though the resource responds to the CAISO's control signal and reaches the dispatch operating target, the resource will have a low accuracy score in the earlier four second intervals.

Absent the waiver granted by the Commission earlier this year, the CAISO would have had to notify all resources providing regulation in the CAISO markets from June 2013 through May 2014 that they needed to recertify their capacity to provide regulation or face disqualification. The CAISO does not know which of these resources would have requested to recertify their capacity, especially given the fact that they might fail the minimum performance threshold again and face yet another recertification requirement.

II. Proposed Tariff Amendments

In this filing, the CAISO proposes to revise tariff section 8.2.3.1.1 to state that for purposes of the minimum performance threshold the CAISO will use a monthly accuracy measurement that reflects a weighted average of 15 minute accuracy measurements, using instructed mileage as the weight. The CAISO also proposes to change the minimum performance threshold in section 8.2.3.1.1 from 50 percent to 25 percent and to modify tariff section 8.4.1.1(h) to state that "Regulation capacity offered must meet or exceed the minimum performance threshold of twenty-five (25) percent measured accuracy as specified in Section 8.2.3.1.1." Finally, the CAISO proposes to modify certification requirements for resource providing regulation in Appendix K of the CAISO tariff to state: "the resource's measured accuracy in responding to the CAISO's EMS signal must meet or exceed twenty-five (25) percent."¹¹

A. Use of a Weighted Average Reflects the Importance of Instructed Mileage in Balancing the System Between 5 Minute Dispatches

Based on its assessment of the original market design to implement Order 755, the CAISO believes use of a weighted average of 15 minute accuracy measurements is more appropriate for a minimum performance threshold. Using

¹¹ CAISO tariff, Appendix K, Part 1.1.5.

a simple average assumes the same potential reliability service for performance in intervals with lower instructed mileage as performance in intervals with higher instructed mileage. However, the fact that higher instructed mileage occurs in a 15 minute interval may evidence a greater reliability need because the CAISO is asking the resource to move a greater distance and likely more frequently from the initial regulation set point. This movement reflects an increased need to balance the system within each five minute dispatch and, therefore, a greater reliance on regulation to manage the system until the next 5 minute dispatch.

For resources that have limitations in responding to each four second control signal, large movements in a sustained direction over multiple four second intervals may increase their accuracy score. Use of a weighted average recognizes this fact, more appropriately accounts for their contribution to and performance in maintaining reliability, and will allow resources that respond accurately in intervals with higher instructed mileage to meet the minimum performance threshold.¹² The CAISO has examined the effect of this change in measuring accuracy on a representative sample of resources providing regulation between June 1, 2013 and May 31, 2014. The change would have resulted in a range of 6-8 percent improvement for the sampled resources providing regulation during this time. These results reflect that resources are responding more accurately to the ISO's control signals across intervals in which there is an increased need for regulation services. The ISO, therefore, believes use of a weighted average of 15 minute accuracy measurements instead of a simple average of these measurement is a just and reasonable change to the minimum performance threshold.

B. Reducing the Minimum Performance Threshold to 25 percent Acknowledges the Aggressive Nature of the CAISO's Accuracy Measurement

The CAISO measures the ability of regulation resources to respond to a control signal sent every four seconds. This measurement is extremely aggressive and presents challenges for some resources to meet their dispatch operating target in each four second interval. The CAISO believes that maintaining the 50 percent threshold is not necessary to ensure reliable operations because balancing authorities do not need to instantaneously correct

¹² The CAISO also calculates a rolling 30 day accuracy measurement for individual resources known as the Historic Regulation Performance Accuracy. The CAISO uses this measurement and a resources' certified ramp capability to determine a resource-specific expected mileage for purposes of awarding Regulation Up and Regulation Down capacity. See CAISO tariff, sections 8.2.3.1.1, 27.1.3 and Appendix K. The CAISO is not proposing to use a weighted average for purposes of a resource's rolling 30 day Historic Regulation Performance Accuracy as part of this filing. The CAISO will consider possible changes to that calculation through the normal course of its stakeholder initiative catalog.

Area Control Error in each four second interval.¹³ Instead, the CAISO monitors Area Control Error over multiple regulation intervals and each 5 minute dispatch interval to keep the value within certain limits to support frequency of the interconnection. It is a resource's performance over these multiple intervals – not its performance in an individual four second interval – that matters most for purpose of maintaining reliability.

Reducing the minimum performance threshold from 50 percent to 25 percent is appropriate and necessary given that most, if not all, resources currently certified to provide regulation have failed, and likely will continue to fail a minimum performance threshold with a 50 percent accuracy. However, this does not mean that these resources are failing to provide the regulation services needed by the CAISO to reliably operate the grid. As explained, the CAISO is not experiencing reliability issues as a result of the current performance of the regulation fleet. Lowering the minimum performance threshold will not modify the fleet's performance, but only establish the threshold at which resources would need to undertake a recertification of their regulation capacity.

At this time, however, the CAISO does not believe it should change its accuracy measurement. As emerging technologies develop and participate as resources on the CAISO grid, the ability to respond to a four second control signal will allow these resources to distinguish themselves from other resources in the CAISO's regulation market. However, by reducing the minimum performance threshold from 50 percent to 25 percent, the CAISO can avoid a potential market disruption if the entire regulation fleet is forced to recertify their capacity (at a 50 percent accuracy measurement). Based on historical performance, the majority of resources offering regulation capacity into the CAISO market will not need to recertify at the 25 percent accuracy measurement. This will ensure sufficient regulation capacity remains available while emerging technologies enter the CAISO's market. As the regulation fleet changes over time, it may be appropriate to raise the minimum performance threshold because emerging resources providing regulation, such as energy storage, could address the reliability concerns that exist today.

C. The Proposed Tariff Revisions Avoid the Potential for Market Disruption.

As explained above, the CAISO's review of historical performance under its Order 755 market design reflects that the majority of resources providing regulation will not need to recertify their capacity at a twenty-five (25) percent

¹³ Area Control Error is "the instantaneous difference between a balancing authority's net actual and scheduled interchange, taking into account the effects of frequency bias and correction for meter error." See Glossary of Terms Used in NERC Reliability Standards. http://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf

accuracy measurement. If the CAISO had to re-certify a large number of resources to provide regulation, this effort could potentially disrupt the market for these services because resource operators may elect not to recertify their capacity to provide regulation, thereby narrowing the fleet of resources offering regulation capacity. Resource operators may elect not to recertify their capacity because of the business disruption that may occur from the possibility of having to recertify their capacity again if they subsequently fail the minimum performance threshold. Depending on the revenue opportunities these resource operators may earn from other ancillary services or energy, they may elect not to offer regulation services because of the need to recertify their capacity if they fail the minimum performance threshold in any calendar month.

Under Order 755, the Commission directed that organized markets reform their compensation mechanisms to incentivize better performance from regulation.¹⁴ Order 755 did not include a minimum performance threshold; so, reducing the minimum threshold from 50 percent to 25 percent is not inconsistent with, and will not undermine, the principles of Order No. 755. Instead, the CAISO included this feature in its market design as an additional means to encourage resources to respond accurately. However, based on one year of experience with this design, the CAISO believes this threshold is too stringent given the existing fleet's limits to respond accurately to each four second interval. Until more fast-responding technologies are participating in the CAISO's regulation market, the CAISO does not believe it is reasonable to implement a rule that may lead to the unnecessary disqualification of a large number of existing resources certified to provide regulation.

Again, the CAISO has not experienced a reliability problem resulting from resources failure to meet the minimum performance threshold. The CAISO does not believe that reducing the threshold from 50 percent to 25 percent will create reliability problems. Existing resources have performed sufficiently well to provide the CAISO with the quality of regulation services it needs to maintain reliable operations within each five minute dispatch of energy. The CAISO has no reason to believe this will change with a different minimum performance threshold. Resources should continue to respond to CAISO control signal as accurately as possible in order to receive mileage payments and ensure that the CAISO qualifies their capacity as capable of providing mileage in the market clearing process.

D. The Proposed Tariff Revisions Will Reduce the Burden on the CAISO to Undertake a Significant Number of Recertification Tests Each Calendar Quarter.

As explained, applying the existing minimum performance threshold would likely require all resources providing regulation to recertify their capacity. The

¹⁴ Order 755 at P 2.

CAISO measures performance each calendar month, so some resources may have to undertake this process multiple times each year if they do not meet the minimum performance threshold in subsequent months. This could make the CAISO's recertification program unduly burdensome. Part A of Appendix K of the CAISO tariff governs the certification process for regulation. As contemplated by these tariff provisions, the certification process involves the CAISO testing a resource's communication and control equipment to ensure that the communication and control system performs to meet the CAISO requirements. These tests include but are not limited to:

- (a) confirmation of control communication path performance;
- (b) confirmation of voice circuit for receipt of dispatch instructions;
- (c) confirmation of the resource's control performance; and
- (d) confirmation of the CAISO energy management system control to include changing the resource operating level over the range of regulation proposed at different set points, from minimum to maximum, and at different rates of change from the minimum to the maximum permitted by the design of the resource.¹⁵

While the CAISO can perform a test usually within a couple of hours, the process of scheduling the test, conducting pre-test activities, communicating the results and updating the CAISO Master File can easily involve work processes over a two week period.¹⁶ If, during each calendar quarter, the CAISO had to recertify the majority of capacity providing regulation on its system, this would create an undue burden on the CAISO because the CAISO would need to commit staff and resources to undertake a continual re-testing process for resources providing regulation up and regulation down service. The CAISO estimates this work would require at least the equivalent of one full-time employee to manage the actual testing program as well as significant amount of time from operations staff to undertake all of the recertification tests.

The CAISO reviewed information on the number of resources that would need to recertify at a 25 percent rather than 50 percent minimum performance

¹⁵ CAISO Tariff, Appendix K, Part A.10.

¹⁶ Operating Procedure 5330 <http://www.caiso.com/Documents/5330.pdf>.

threshold and believes it can manage that level of work with existing resources. For June 2014, 10 resources would have needed to recertify to provide regulation up and 4 resources would have needed to recertify to provide regulation down. In contrast, under a 50 percent minimum performance threshold, approximately 40 resources would have needed to recertify to provide regulation up and approximately 20 resources would have needed to recertify to provide regulation down for the same month.¹⁷ This workload could greatly increase if the CAISO has to perform this number of recertification tests for each calendar month.

III. Stakeholders Support the CAISO's Proposal.

Stakeholders broadly support changing the monthly accuracy calculation from a simple average to a weighted average based upon a resource's instructed mileage.¹⁸ With respect to additional Order 755 market design changes, stakeholders also generally support, on an annual basis, evaluating more comprehensive design changes through the CAISO stakeholder initiative catalog process. One stakeholder requested that the CAISO assess the minimum performance threshold percentage no later than three years from January 1, 2015. The CAISO commits to undertake this review. This time period will allow sufficient evaluation of the performance of new technologies that the CAISO expects to join its regulation fleet over the next few years.

IV. Effective Date and Request for Order

The CAISO requests that the Commission make the tariff revisions contained in this filing effective as of January 1, 2015, and therefore respectfully requests that the Commission waive the requirement of 18 C.F.R. § 35.3 that a rate schedule be filed not less than 60 days from the effective date. The CAISO does not believe any stakeholder opposes its request for a January 1, 2015 effective date. This effective date coincides with the expiration of a waiver granted by the Commission permitting the CAISO not to enforce the minimum performance threshold under its Order 755 market design. This request is appropriate to provide market participants with certainty that the CAISO will not

¹⁷ See page 7 of presentation on Pay for Performance Regulation Design Changes provided by Greg Cook, Director, Market and Infrastructure Policy to the CAISO Board of Governors on November 13, 2014.
<http://www.aiso.com/Documents/DecisionPayPerformanceRegulationProposal-Presentation-Nov2014.pdf> The CAISO has included a copy of this presentation as part of the materials in Attachment C to this filing.

¹⁸ More information on the CAISO's stakeholder processes is available on the following website:
<http://www.aiso.com/informed/Pages/StakeholderProcesses/PayforPerformanceRegulation.aspx>

impose one minimum performance threshold in January 2015 but a different minimum performance threshold in later months.

V. Communications

Communications regarding this filing should be addressed to the following individuals, whose names should be put on the official service list established by the Commission with respect to this submittal:

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* Individuals designated for service pursuant to Rule 203(b)(3).¹⁹

VI. Service

The CAISO has served copies of this transmittal letter, and all attachments, on the California Public Utilities Commission, the California Energy Commission, and parties with effective scheduling coordinator service agreements under the CAISO tariff. In addition, the CAISO is posting this transmittal letter and all attachments on the CAISO Web site.

VII. Attachments

The following attachments, in addition to this transmittal letter, support the instant filing:

Attachment A	Revised CAISO tariff sheets
Attachment B	Proposed changes to the CAISO tariff shown in black-line format
Attachment C	Materials presented to the CAISO's Board of Governors as well as a record of the Board of Governor's vote.

¹⁹ 18 C.F.R. § 385.203(b)(3).

VIII. Conclusion

The Commission should approve the CAISO's tariff revisions to use a weighted average of accuracy measurements from each 15 minute interval, using instructed mileage as the weight for purposes of its monthly minimum performance threshold for resources providing regulation up and regulation down. The Commission should also approve the CAISO's proposal to reduce this threshold from a monthly accuracy measurement of 50 percent to 25 percent. These revisions reflect the importance of instructed mileage in balancing the CAISO's system between each 5 minute dispatch and also acknowledge the aggressive nature of the CAISO's accuracy measurement based on resources' ability to respond to each four second control signal. The proposed tariff revisions will also help avoid the market disruption and undue burden that would result if all resources had to undertake repeated recertification of their regulation capacity because they did not meet the minimum performance threshold. The CAISO requests an order accepting this tariff amendment by March 2, 2015, but with a proposed effective date of January 1, 2015. As explained in this filing, this effective date coincides with the expiration of a waiver of the CAISO's existing minimum performance threshold currently in effect. This effective date will allow the CAISO to apply its new tariff provisions during the first calendar quarter of 2015.

Please contact the undersigned if you have any questions regarding this matter.

Respectfully submitted,

By: /s/ Andrew Ulmer

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Attachment A – Clean Tariff Records
Tariff Amendment - Minimum Performance Threshold for
Regulation Up and Regulation Down
California Independent System Operator Corporation

8.2.3.1.1 Regulation Performance

The CAISO will measure the accuracy of a resource's response to CAISO EMS signals. The CAISO will sum a resource's Automatic Generation Control set points for each four (4) second Regulation interval every fifteen (15) minutes and then sum the total deviations from the Automatic Generation Control set point for each four (4) second regulation interval during that fifteen (15) minute period. The CAISO will divide the sum of the resource's Automatic Generation Control set points less the sum of the resource's total deviations by the sum of the resource's Automatic Generation Control set points. The CAISO will apply the resulting percentage to a resource's Instructed Mileage to calculate the resource's Regulation performance payments. The CAISO will adjust a resource's Automatic Generation Control set point deviations when the CAISO EMS signal sent to a resource changes direction and the resource under-responds in the prior interval. The adjusted Automatic Generation Control set point will reflect the Automatic Generation Control set point to which the EMS signal directed the resource to move in the prior interval.

The CAISO will use a resource's Historic Regulation Performance Accuracy and certified ramp capability to determine a resource-specific expected Mileage for purposes of awarding Regulation Up and Regulation Down capacity. The CAISO will calculate a separate Historic Regulation Performance Accuracy for both Regulation Up and Regulation Down.

A minimum performance threshold of twenty-five (25) percent will apply for a resource to offer Regulation Up and Regulation Down capacity. If a resource's measured accuracy, based on a weighted average of fifteen (15) minute intervals during a calendar month using Instructed Mileage as the weight, is less than twenty-five (25) percent for Regulation Up or Regulation Down, the resource must re-certify to provide the respective service within ninety (90) days from the date the CAISO provides notice to the resource's Scheduling Coordinator of the resource's failure to meet the minimum performance threshold. In the event of lost accuracy data, the CAISO will not use data from these intervals to calculate the resource's Historic Regulation Performance Accuracy or to assess the minimum performance threshold.

* * *

8.4.1.1 Regulation

A resource offering Regulation must have the following operating characteristics and technical capabilities:

- (a) it must be capable of being controlled and monitored by the CAISO EMS by means of the installation and use of a standard CAISO direct communication and direct control system, a description of which and criteria for any temporary exemption from which, the CAISO shall publish on the CAISO Website;
- (b) it must be capable of achieving at least the Ramp Rates (increase and decrease in MW/minute) stated in its Bid for the full amount of Regulation capacity offered;
- (c) the Regulation capacity offered must not exceed the maximum Ramp Rate (MW/minute) of that resource times ten (10) minutes;
- (d) the resource to CAISO Control Center telemetry must, in a manner meeting CAISO standards, include indications of whether the resource is on or off CAISO EMS control at the resource terminal equipment;
- (e) the resource must be capable of the full range of movement within the amount of Regulation capability offered without manual resource operator intervention of any kind;
- (f) each Ancillary Service Provider must ensure that its CAISO EMS control and related SCADA equipment for its resource are operational throughout the time period during which Regulation is required to be provided;
- (g) Regulation capacity offered must be dispatchable on a continuous basis for at least sixty (60) minutes in the Day-Ahead Market and at least thirty (30) minutes in the Real-Time Market after issuance of the Dispatch Instruction. The CAISO will measure continuous Energy from the time a resource reaches its award capacity. Scheduling Coordinators for Non-

Generator Resources located within the CAISO Balancing Authority Area that require Energy from the Real-Time Market to offer their full capacity as Regulation may request the use of Regulation Energy Management as described in Section 8.4.1.2; and

- (h) Regulation capacity offered must meet or exceed the minimum performance threshold of twenty-five (25) percent measured accuracy as specified in Section 8.2.3.1.1.

* * *

Appendix K Ancillary Service Requirements Protocol (ASRP)

PART A **CERTIFICATION FOR REGULATION**

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- A 1.1.5** the resource's measured accuracy in responding to the CAISO's EMS signal must meet or exceed twenty-five (25) percent.

Attachment B – Marked Tariff Records
Tariff Amendment - Minimum Performance Threshold for
Regulation Up and Regulation Down
California Independent System Operator Corporation

8.2.3.1.1 Regulation Performance

The CAISO will measure the accuracy of a resource's response to CAISO EMS signals. The CAISO will sum a resource's Automatic Generation Control set points for each four (4) second Regulation interval every fifteen (15) minutes and then sum the total deviations from the Automatic Generation Control set point for each four (4) second regulation interval during that fifteen (15) minute period. The CAISO will divide the sum of the resource's Automatic Generation Control set points less the sum of the resource's total deviations by the sum of the resource's Automatic Generation Control set points. The CAISO will apply the resulting percentage to a resource's Instructed Mileage to calculate the resource's Regulation performance payments. The CAISO will adjust a resource's Automatic Generation Control set point deviations when the CAISO EMS signal sent to a resource changes direction and the resource under-responds in the prior interval. The adjusted Automatic Generation Control set point will reflect the Automatic Generation Control set point to which the EMS signal directed the resource to move in the prior interval.

The CAISO will use a resource's Historic Regulation Performance Accuracy and certified ramp capability to determine a resource-specific expected Mileage for purposes of awarding Regulation Up and Regulation Down capacity. The CAISO will calculate a separate Historic Regulation Performance Accuracy for both Regulation Up and Regulation Down.

A minimum performance threshold of ~~twenty-five~~ twenty-five (25) percent will apply for a resource to offer Regulation Up and Regulation Down capacity. If a resource's measured accuracy, based on a ~~weighted-simple~~ average of fifteen (15) minute intervals during a calendar month using Instructed Mileage as the weight, is less than ~~twenty-five~~ twenty-five (25) percent for Regulation Up or Regulation Down, the resource must re-certify to provide the respective service within ninety (90) days from the date the CAISO provides notice to the resource's Scheduling Coordinator of the resource's failure to meet the minimum performance threshold. In the event of lost accuracy data, the CAISO will not use data from these intervals to calculate the resource's Historic Regulation Performance Accuracy or to assess the minimum performance threshold.

* * *

8.4.1.1 Regulation

A resource offering Regulation must have the following operating characteristics and technical capabilities:

- (a) it must be capable of being controlled and monitored by the CAISO EMS by means of the installation and use of a standard CAISO direct communication and direct control system, a description of which and criteria for any temporary exemption from which, the CAISO shall publish on the CAISO Website;
- (b) it must be capable of achieving at least the Ramp Rates (increase and decrease in MW/minute) stated in its Bid for the full amount of Regulation capacity offered;
- (c) the Regulation capacity offered must not exceed the maximum Ramp Rate (MW/minute) of that resource times ten (10) minutes;
- (d) the resource to CAISO Control Center telemetry must, in a manner meeting CAISO standards, include indications of whether the resource is on or off CAISO EMS control at the resource terminal equipment;
- (e) the resource must be capable of the full range of movement within the amount of Regulation capability offered without manual resource operator intervention of any kind;
- (f) each Ancillary Service Provider must ensure that its CAISO EMS control and related SCADA equipment for its resource are operational throughout the time period during which Regulation is required to be provided;
- (g) Regulation capacity offered must be dispatchable on a continuous basis for at least sixty (60) minutes in the Day-Ahead Market and at least thirty (30) minutes in the Real-Time Market after issuance of the Dispatch Instruction. The CAISO will measure continuous Energy from the time a resource reaches its award capacity. Scheduling Coordinators for Non-

Generator Resources located within the CAISO Balancing Authority Area that require Energy from the Real-Time Market to offer their full capacity as Regulation may request the use of Regulation Energy Management as described in Section 8.4.1.2; and

- (h) Regulation capacity offered must meet or exceed the minimum performance threshold of twenty-five (25) percent measured accuracy as specified in Section 8.2.3.1.1 for responding to the CAISO's EMS control signal.

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Appendix K Ancillary Service Requirements Protocol (ASRP)

PART A **CERTIFICATION FOR REGULATION**

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A 1.1.5

the resource's measured accuracy in responding to the CAISO's EMS signal must meet or exceed twenty-five (25) percent, the minimum performance threshold for responding to the CAISO's EMS control signal.

Attachment C – Materials Presented to Board
Tariff Amendment - Minimum Performance Threshold for
Regulation Up and Regulation Down
California Independent System Operator Corporation

Memorandum

To: ISO Board of Governors

From: Keith Casey, Vice President, Market & Infrastructure Development

Date: November 6, 2014

Re: **Decision on Pay for Performance Regulation Year 1 Design Changes**

This memorandum requires Board action.

EXECUTIVE SUMMARY

In 2011 the Federal Energy Regulatory Commission adopted Order 755 to remedy what the Commission identified as undue discrimination in the procurement of frequency regulation in the organized wholesale electric markets. The final rule required ISOs to adopt a two part payment for frequency regulation: (1) a payment for regulation capacity and (2) a payment for performance of the resource in response to a regulation signal. In response to the final rule, the ISO developed and implemented a two-part bid structure to establish capacity and mileage clearing prices for bid-in and self-provided regulation. Under the market design that went into effect on June 1, 2013, in addition to a regulation capacity payment, compensation includes a payment based upon a resource's actual movement in response to the regulation signal. This payment is adjusted based upon the accuracy of the resource's response to the regulation signal.

The ISO's design includes a minimum performance threshold for resources providing regulation. The threshold was included to ensure that resources providing regulation service accurately followed ISO regulation signals. Under this threshold, the ISO calculates a simple average of how accurately resources respond to regulation control signals every 15 minutes over a calendar month. Resources must achieve a monthly accuracy score of at least 50 percent. Resources that do not meet this minimum requirement must be recertified to provide regulation service. The 50 percent threshold was expected to be reasonable to ensure a high performing regulation fleet that would include new resource technologies that could very accurately follow regulation signals. However the entrance of such new resources into the ISO's regulation market, although still expected, has yet to occur. A limited analysis that was conducted prior to implementation of the new design showed that the current regulation fleet was expected to meet the minimum threshold, however once the new design was implemented and the monthly accuracy metric was calculated, many of these resources fell below the minimum accuracy threshold. As a result, on January 10, 2014 the ISO requested a limited waiver of these tariff provisions from FERC to avoid the market disruption that might occur due to the recertification requirements. FERC approved the waiver through December 31, 2014.

To provide for additional time for higher performing resources to enter the market and more accurately account for resource performance, Management proposes two changes to its Order 755 market design: (1) modify the monthly accuracy calculation from a simple average to a weighted average which will better account for resource performance; and (2) reduce the minimum performance threshold from 50 to 25 percent accuracy to avoid the potentially frequent recertification of older resource technologies that are currently providing most of the ISO's regulation needs. Notably, these changes will not alter the performance incentives built into the pay for performance regulation for higher performing regulation resources to enter the market. Management is seeking to make these changes effective January 1, 2015, when the current tariff waiver expires. Management plans to revisit the minimum performance threshold in three years when it can evaluate the performance of new technologies that can provide regulation, such as energy storage, that will be added to the regulation fleet over the next few years.

Moved, that the ISO Board of Governors approves the pay for performance regulation market design proposal, as described in the memorandum dated November 6, 2014; and

Moved, that the ISO Board of Governors authorizes Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the proposed tariff change.

DISCUSSION AND ANALYSIS

The ISO uses frequency regulation for system balancing to manage the differences between resources' responses to dispatch instructions and actual load within a 5-minute period. The ISO procures regulation up and regulation down as separate products. Regulation up is used to balance the system when actual load is higher than the dispatch of resources. Regulation down balances the system when actual load is lower than the dispatch of resources.

As the ISO works to integrate increasing volumes of variable energy resources, regulation services are increasing in importance. The ISO has forecast a substantial increase in hourly regulation capacity requirements in some hours due to a more variable generation fleet.

Background

In October 2011, FERC issued Order 755, which adopted a final rule for compensation of frequency regulation in organized wholesale power markets. The Commission's final rule required organized markets to compensate regulation resources based on the actual service provided, including a capacity payment that reflects the marginal unit's opportunity costs and a performance payment that reflects the quantity of regulation service actually provided by a resource when the resource accurately follows a dispatch signal.

In response to the final rule, the ISO developed a market design that uses a two-part structure to establish capacity and mileage clearing prices for bid-in and self-provided regulation. As part of this structure, the ISO estimates the expected mileage from the capacity a resource bids-in or self-provides based on that resource's specific mileage multiplier. This expected mileage allows the ISO to optimize capacity offered to satisfy regulation requirements and to establish a market clearing price for performance payments as adjusted for accuracy. Under the ISO's market design, a resource responding to the ISO's control signal receives a performance payment based on the resource's actual movement in response to the control signal. In other words, the ISO adjusts a resource's performance payment based on how accurately it responds to the ISO's control signal.

As part of its design, the ISO also implemented a minimum performance threshold for resources providing regulation. In determining the minimum performance threshold, the ISO performed a high level analysis of a few resources over a limited number of hours. The analysis indicated that most resources currently providing regulation service could meet the 50% performance threshold. However, once the design was implemented and resource performance was measured over a monthly period, many resources certified to provide regulation in the ISO's market did not meet this minimum performance threshold. On January 10, 2014, the ISO requested a limited waiver from enforcing these tariff provisions until December 31, 2014. The ISO requested the waiver to avoid the market disruption that might occur if it required all resources that did not meet the minimum performance threshold to recertify to provide regulation service.

Management does not believe that a significant redesign of the regulation market design is necessary at this time. Management is not proposing any changes to the settlement of resources providing regulation or the market optimization rules to award regulation capacity and mileage. However, to address the potential market disruption from requiring broad recertification of existing regulation resources, Management proposes two changes: (1) modify the monthly accuracy calculation from a simple average to a weighted average; and (2) reduce the minimum performance threshold from 50 percent to 25 percent accuracy.

Recertification of resources based on monthly performance

As part of its market design, the ISO implemented a minimum performance threshold for resources providing regulation. The ISO set the threshold at 50 percent accuracy over a calendar month. For purposes of this threshold, the ISO measures a resource's accuracy in responding to a 4-second control signal based on a simple average of 15-minute intervals during a calendar month. If the resource fails to meet the minimum performance threshold over the month, the tariff requires the resource to recertify to offer regulation within 90 days. The resource will not be able to provide regulation unless it recertifies. The intent of the minimum performance threshold was not to disqualify a large portion of the existing regulation fleet, but rather as another mechanism to incentivize accuracy improvements.

Based on measured performance of resources providing regulation, the ISO would have had to disqualify a significant amount of its certified regulation capacity if it had applied the 50 percent minimum performance threshold. The performance of various resource types on average reflects that each category of resource offering regulation has experienced difficulty in meeting the minimum performance threshold. There is no evidence that more accurate resources would necessarily be available to supply the ISO's regulation requirements if the ISO required less accurate resources to complete a recertification process. If large numbers of resources cease to provide regulation, this outcome could lead to market and operational instability. In addition, even if resources that fail to meet the minimum performance threshold did recertify to provide regulation, a large number of these resources may immediately fail to meet the minimum performance threshold in the next calendar month. Undertaking a continual re-testing process for regulation when no apparent reliability concerns exist to justify re-testing is not a reasonable use of the ISO's or market participants' resources.

Calculation of the monthly performance accuracy metric

The ISO considers positive and negative deviations equally in assessing the accuracy of the resource's response to the regulation signal over each 15 minute operating interval. The ISO calculates accuracy as the sum of instructed mileage over each 15 minute interval less the 15 minute sum of deviations from the regulation signal, and then divides that amount by the sum of the instructed mileage. This percentage value is the accuracy of the resource's performance as compared to regulation signals. The ISO then applies this percentage to reduce any mileage payment for the 15 minute interval. Management is not proposing to change the compensation of resources.

The ISO also calculates a monthly average to evaluate the performance of resources to determine if the resource should be required to recertify. To calculate the monthly average, the ISO currently takes the simple average of all 15 minute accuracy calculations for all intervals the resource provided regulation service over the calendar month.

Management is proposing to change the calculation to use instructed mileage to calculate a weighted average of the 15 minute accuracy calculation over the calendar month. For example, assume the resource provided regulation for two intervals. In interval 1, the resource's total instructed mileage was 50 MW and its accuracy was 10%. In interval 2, the resource's instructed mileage was 250 MW and its accuracy was 80%. The simple average accuracy would be 45%; however, the weighted average accuracy would be 68%.

The weighted average is more appropriate because the simple average assumes the same potential reliability impact for performance in intervals with lower mileage as performance in intervals with higher mileage. However, when higher mileage occurs in a 15 minute interval there is a greater potential reliability impact since regulation resources are moved farther and more frequently from the initial regulation set point.

Minimum performance threshold percentage

Management also proposes to lower the minimum performance threshold from 50 to 25 percent. Based on historical performance, the majority of resources offering regulation capacity into the ISO market will not need to recertify at this level. As a result, the ISO will maintain sufficient regulation capacity to meet reliability. Management considered removing the minimum performance threshold entirely, but decided against this approach. As the regulation fleet changes over time, it may be appropriate to raise the minimum performance threshold because emerging resources providing regulation, such as energy storage, could address the reliability concerns that exist today.

The ISO currently provides market participants with data regarding the accuracy of resources providing regulation in the ISO's Market Performance and Planning Forum and will continue to do so. This information will allow market participants to observe changes in regulation performance as the regulation fleet changes over time as new resources, such as energy storage, begin providing regulation.

As with any market design, Management will continue to monitor the performance of the regulation market to determine if further design enhancements are needed. In addition, stakeholders can also request modifications through the annual stakeholder initiatives catalog process. This process allows all stakeholders to provide input on the priority of future stakeholder initiatives.

POSITIONS OF THE PARTIES

Stakeholders support the narrow market design changes necessary to address the minimum performance threshold. Stakeholders broadly support changing the monthly accuracy calculation from a simple average to a weighted average based upon a resource's instructed mileage. However, the California Energy Storage Alliance (CESA) has requested that the ISO assess the minimum performance threshold percentage no later than three years from January 1, 2015. CESA believes that this will allow sufficient time for the evaluation of the performance of new technologies that will be added to the regulation fleet over the next few years. Management supports CESA's request and commits to evaluating the appropriateness of the minimum performance threshold percentage as well as the potential need for more substantive changes to other market design elements prior to January 1, 2018.

CONCLUSION

Management requests Board approval for the changes to the pay for performance regulation market design. The proposed changes address a narrow issue with the need for recertification of the existing regulation fleet and will be reevaluated in three years as the regulation fleet changes with increased penetration of storage and other new technologies able to meet regulation needs.

Pay for Performance Regulation Design Changes

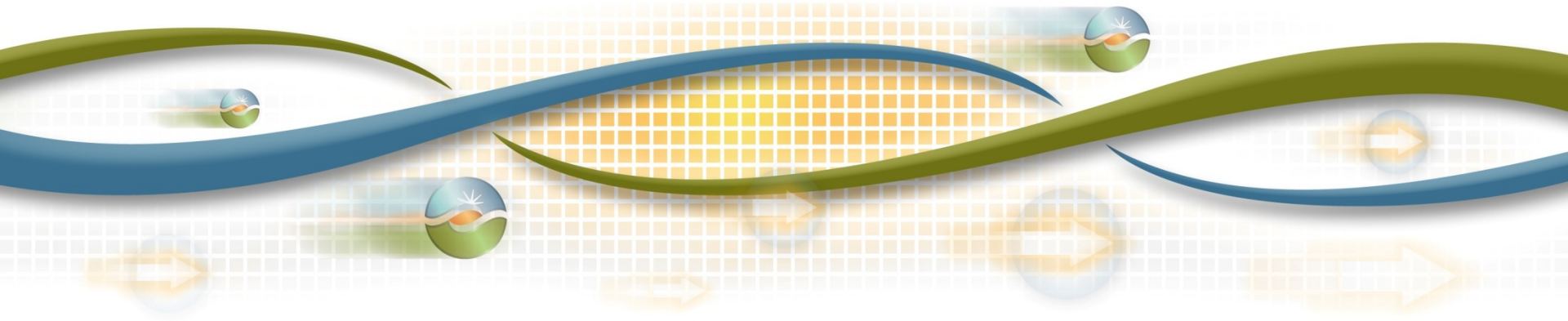
Greg Cook

Director, Market and Infrastructure Policy

Board of Governors Meeting

General Session

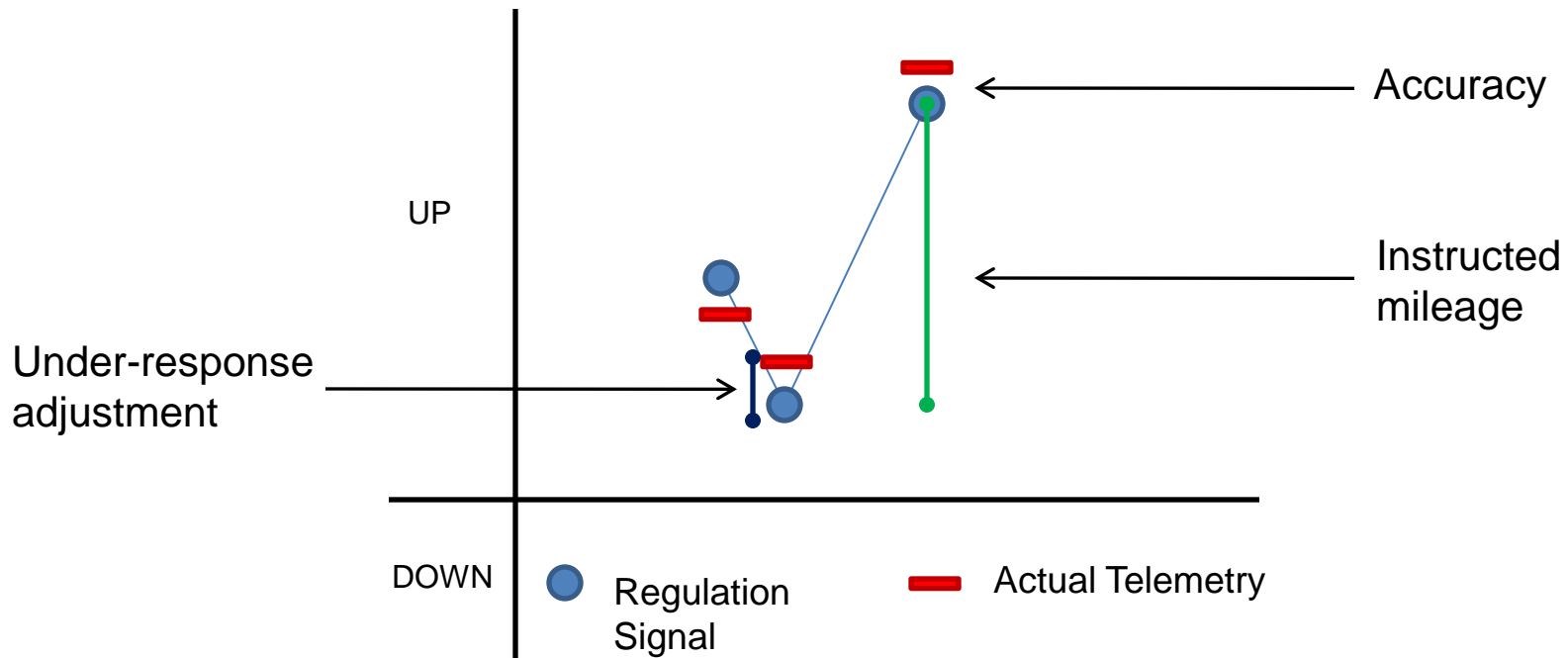
November 13, 2014



ISO implemented pay for performance regulation in June 2013 as required by FERC Order 755

- ISO uses frequency regulation to balance supply and load within 5-minute periods
- Pay for performance regulation includes two-part-payment for regulation:
 1. A payment for regulation capacity and
 2. A payment for performance of the resource in response to a regulation signal
- Intended to incent fast and accurate regulation resources

PFP regulation design pays resources for mileage with an adjustment for accuracy and includes a minimum performance threshold.



1. Under-response adjustment reduces mileage payment
2. Accuracy measured by actual telemetry versus regulation signal

Why are we evaluating the PFP regulation design?

- In original stakeholder process, we committed to a one-year review of the pay for performance regulation design.
- Large portion of current regulation fleet unable to meet minimum performance threshold.
 - In January 2014, FERC granted ISO's request for one-year waiver of the regulation pay for performance threshold.

FERC approved waiver of minimum performance threshold until December 31, 2014

- Performance of resources providing 78% of ISO's regulation

Regulation Up/Down total Quantities (MWh) May and June 2014	Regulation Down 12 Month Average Monthly Performance	Regulation Up 12 Month Average Monthly Performance	Resource Fuel Type
1,052,407	0.5300	0.4009	Hydro
346,741	0.4081	0.3343	Hydro
230,214	0.6341	0.5036	Hydro
171,916	0.5440	0.3701	Combined cycle
93,832	0.4078	0.3691	Hydro
50,583	0.5422	0.3352	Hydro

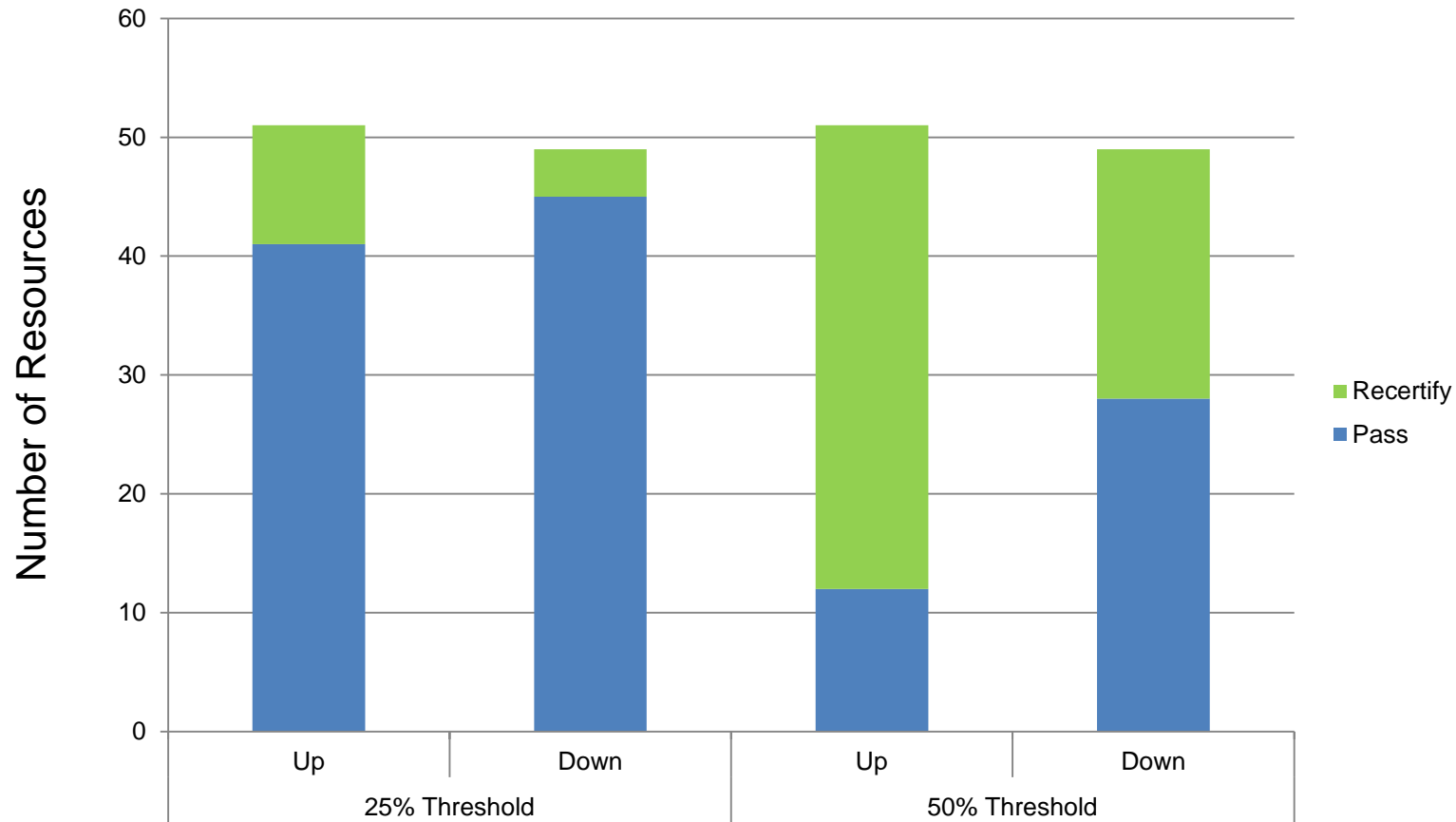
- Reliability concerns if significant portion of the regulation fleet would have to re-certify because monthly accuracy < 50%

ISO proposes two changes to minimum performance threshold

1. Change monthly performance calculation from simple average to weighted average based on mileage
2. Lower minimum performance threshold to 25% from 50% for next 3 years

25% monthly performance threshold results in manageable number resources subject to recertification

June 2014



Stakeholders support only making minor changes at this time

- Reliability concerns if ISO decertified majority of current regulation resources.
 - Very few resources currently meet the 50% performance threshold
- Appropriate to revisit when regulation fleet changes to resources that prioritize mileage payments over capacity payments, but no later than three years from today.

In summary, Management recommends approval of the PFP regulation design changes:

- Narrowly addresses reliability concern from broad decertification of existing resources providing regulation capacity.
- As new resources begin to provide regulation over next three years, evaluation of accuracy calculation can consider operational experience of new resources.



Board of Governors November 13, 2014 Decision on pay for performance regulation proposal

Motion

Moved, that the ISO Board of Governors approves the pay for performance regulation market design proposal, as described in the memorandum dated November 6, 2014; and

Moved, that the ISO Board of Governors authorizes Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the proposed tariff change.

Moved: Galiteva Second: Bhagwat

Board Action: Passed		Vote Count: 4-0-0
Bhagwat	Y	
Galiteva	Y	
Mullin	Y	
Olsen	Y	

Motion Number: 2014-11-G1