

June 30, 2016

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

**Re: Informational Report of the California Independent System
Operator Corporation**

Dear Secretary Bose:

Consistent with the Commission's directive, the California Independent System Operator Corporation (CAISO) submits this informational report regarding the performance of resources providing regulation service.¹

Respectfully submitted,

By: /s/ Andrew Ulmer

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¹ *Cal. Indep. Sys. Operator Corp*, 150 FERC ¶ 61,056 (2015) at P 16.

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

California Independent System) Docket Nos. ER15-554
Operator Corporation)

**Report on Performance of Resources
Under the CAISO's Order 755 Market Design**

The CAISO has prepared this informational report based on operational data from January 1, 2015 up to and including March 31, 2016 concerning the performance of resources providing regulation up and regulation down under the CAISO's Order 755 market design.² Based on the data in this report, the CAISO concludes that the current minimum performance threshold that is part of its Order 755 market design does not create a significant risk to reliability. Most resources are meeting the minimum performance threshold and should not need to repeat multiple recertification tests to provide regulation up or regulation down. The CAISO will confer with market participants through its stakeholder initiative catalog process on whether any changes to its Order 755 market design, including changes to its minimum performance threshold, are appropriate.³

I. Background and Scope of Report

Under the CAISO's Commission-approved tariff, regulation up and regulation down are separate ancillary services provided by resources certified to respond automatically to control signals in an upward or downward direction to balance

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 More information about the CAISO's stakeholder initiative catalog process is available at the following website:
<http://www.caiso.com/informed/Pages/StakeholderProcesses/StakeholderInitiativesCatalogProcess.aspx>

demand and supply in real-time. The CAISO market systems procure regulation up and regulation down for many reasons to balance supply and demand within 5-minute intervals, that occur because of demand forecast inaccuracies and supply deviations, and to provide frequency response.

In October 2011, the Commission issued Order 755, which adopted a final rule for compensation of frequency regulation in organized wholesale power markets. The Commission determined that the then-effective compensation methods for regulation service in organized markets failed to acknowledge the inherently greater amount of regulation service provided by faster-ramping resources and that certain practices result in economically inefficient dispatch of resources providing regulation service. To remedy these issues, 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. Order 755 required the use of a market-based price rather than an administrative price on which to base performance payments.⁴

In response to the final rule, the CAISO developed a market design, which the Commission accepted effective June 1, 2013.⁵ The design 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 CAISO estimates the expected mileage from

⁴ Order 755 at P 128.

⁵ *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).

the capacity a resource bids-in or self-provides based on that resource's specific mileage multiplier. This expected mileage allows the CAISO to optimize capacity offered to satisfy regulation requirements and to establish a market clearing price for performance payments as adjusted for accuracy. Under the CAISO's market design, a resource responding to the CAISO's control signal receives a performance payment based on the resource's actual movement in response to the control signal. In other words, the CAISO adjusts a resource's performance payment based on how accurately it responds to the CAISO's control signal.

Additionally, the CAISO proposed that resources meet a minimum performance threshold of 50 percent accuracy over a calendar month.⁶ If a resource fails to meet the minimum performance threshold over the month, the tariff requires the resource to recertify to offer regulation up or regulation down within 90 days from the date the CAISO provides notice of the resource's failure to meet the minimum performance threshold.⁷

As part of its approval of the CAISO's 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 report within 14 months of the effective date of its tariff revisions.⁸ Based on that review and subsequent stakeholder discussions, the CAISO requested a change to its market

⁶ CAISO Tariff section 8.2.3.1.1.

⁷ When it implemented the Order 755 market design, the CAISO informed market participants that it would not issue notices regarding a resource's failure to meet the minimum performance threshold for regulation up or regulation down until after the CAISO had compiled a calendar quarter of performance data.

⁸ *Cal. Indep. Sys. Operator Corp.*, 140 FERC ¶ 61,206 (2012) at P 75.

design to reduce its monthly minimum performance threshold for resources providing regulation up and regulation down from 50 percent accuracy to 25 percent accuracy.

The Commission authorized this change, effective January 1, 2015, but directed the CAISO to file two informational reports to review the minimum performance threshold, with the first due no later than 18 months from January 1, 2015.⁹ For purposes of this first informational report, the Commission asked the CAISO to evaluate the appropriateness of the minimum performance threshold, considering the accuracy of resources providing regulation capacity based on historical data.¹⁰ The Commission directed the CAISO to include a study of how resources' accuracy measurements changed as the minimum performance threshold reduced from 50 percent to 25 percent, while also taking into consideration the level of recertification that would be needed at various threshold percentage levels, and any other analysis CAISO deems appropriate.¹¹

II. Most resources are meeting the CAISO's minimum performance threshold for regulation up and regulation down

Under its current Order 755 market design, resources providing regulation up or regulation down must meet a minimum performance threshold of 25 percent accuracy.¹² For purposes of this threshold, the CAISO measures a resource's accuracy in responding to a four second control signal. The CAISO sums a

⁹ *Cal. Indep. Sys. Operator Corp*, 150 FERC ¶ 61,056 (2015) at P 16.

¹⁰ *Id.* at P 16.

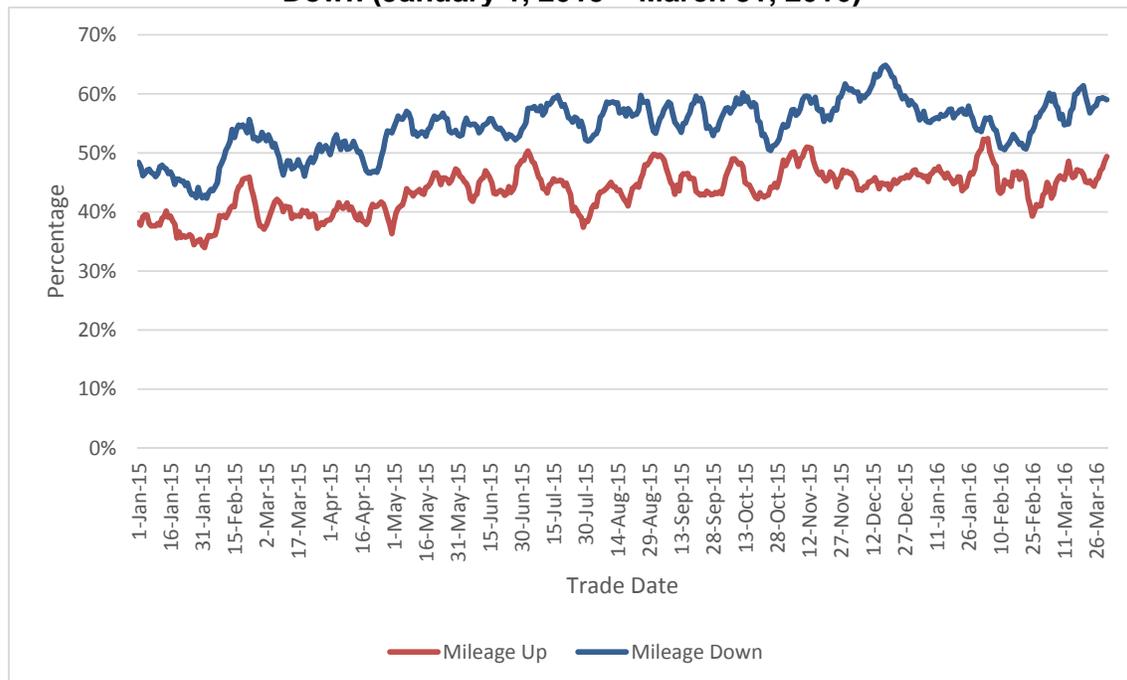
¹¹ The Commission recognized that data collected for this initial informational report may not be ripe in considering the performance of emerging technologies. Accordingly, the Commission directed the CAISO to file a second, subsequent informational report no later than 36 months from January 1, 2015. As part of this second information report, the CAISO plans to include an analysis of how the entrance of new and faster-responding technologies may have influenced overall resource accuracy measurements in CAISO's regulation up and regulation down market.

¹² CAISO tariff sections 8.2.3.1.1 and 8.4.1.1(h); CAISO tariff appendix K, section A 1.1.5.

resource’s automatic generation control set points for each four second regulation interval every fifteen (15) minutes and then sums the total deviations from the automatic generation control set point for each four second regulation interval during that fifteen (15) minute period. The CAISO then divides 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.¹³ The CAISO then calculates the resource’s monthly performance by taking a simple average of 15-minute intervals during a calendar month.

Based on a review of 2015 and Q1 2016 operational data, resources providing both regulation up and regulation down have generally met the minimum performance threshold. Figure 1 reflects the average performance of resources each day across the CAISO system providing regulation up and regulation down during the relevant time period.

Figure 1- Performance of CAISO System for Regulation Up and Regulation Down (January 1, 2015 – March 31, 2016)



¹³ CAISO tariff section 8.2.3.1.1.

This data reflects that system-wide resources have performed at a level that exceeds the minimum performance threshold of 25 percent accuracy for both regulation up and regulation down. System-wide performance for regulation down is consistently more accurate than system wide performance for regulation up.

The CAISO has also tracked regulation up and regulation down performance by resource types, including gas turbine, steam turbine, hydro, combined cycle and limited energy storage resource. Tables A and B provide data on the performance of resources by resource type for the period of January 2015 through the end of March 2016. This data reflects that each category of resource type has been able to meet an average performance that exceeds the 25 percent accuracy measurement, as a group, in most months for both regulation up and regulation down. The data also reflects an improvement in the performance of each resource type over the last year.

**Table A – Performance by Resource Type for Regulation Up
(January 1, 2015 – March 31, 2016)**

MONTH	Combined Cycle	Gas Turbine	Hydro	Limited Energy Storage Resource	Pump Turbine	Steam Turbine
Jan-15	35.46%	66.49%	37.25%		25.95%	21.38%
Feb-15	48.44%	72.49%	38.58%	42.57%	44.09%	16.30%
Mar-15	36.02%	59.76%	37.04%	50.14%	28.54%	26.47%
Apr-15	45.57%	61.28%	41.61%	14.45%	20.22%	28.68%
May-15	40.01%	53.91%	50.12%	74.62%	48.00%	37.57%
Jun-15	44.27%	65.97%	50.95%	74.85%	49.54%	37.86%
Jul-15	43.98%	62.83%	49.31%	72.92%	34.33%	36.63%
Aug-15	59.81%	56.35%	56.08%	67.32%	40.82%	49.42%
Sep-15	48.13%	64.43%	50.31%	77.63%	49.57%	49.05%
Oct-15	43.78%	52.55%	49.10%		51.37%	46.93%
Nov-15	50.98%	72.90%	50.36%		36.02%	45.09%
Dec-15	51.26%	53.10%	45.72%	66.76%	58.65%	45.64%
Jan-16	46.96%	61.90%	46.66%	51.57%	59.06%	49.67%
Feb-16	52.15%	63.21%	47.80%	58.02%	49.37%	35.53%
Mar-16	51.13%	74.91%	49.78%	63.70%	58.59%	45.12%
Total	46.88%	63.08%	46.67%	61.35%	45.31%	40.00%

**Table B – Performance by Resource Type for Regulation Down
(January 1, 2015 – March 31, 2016)**

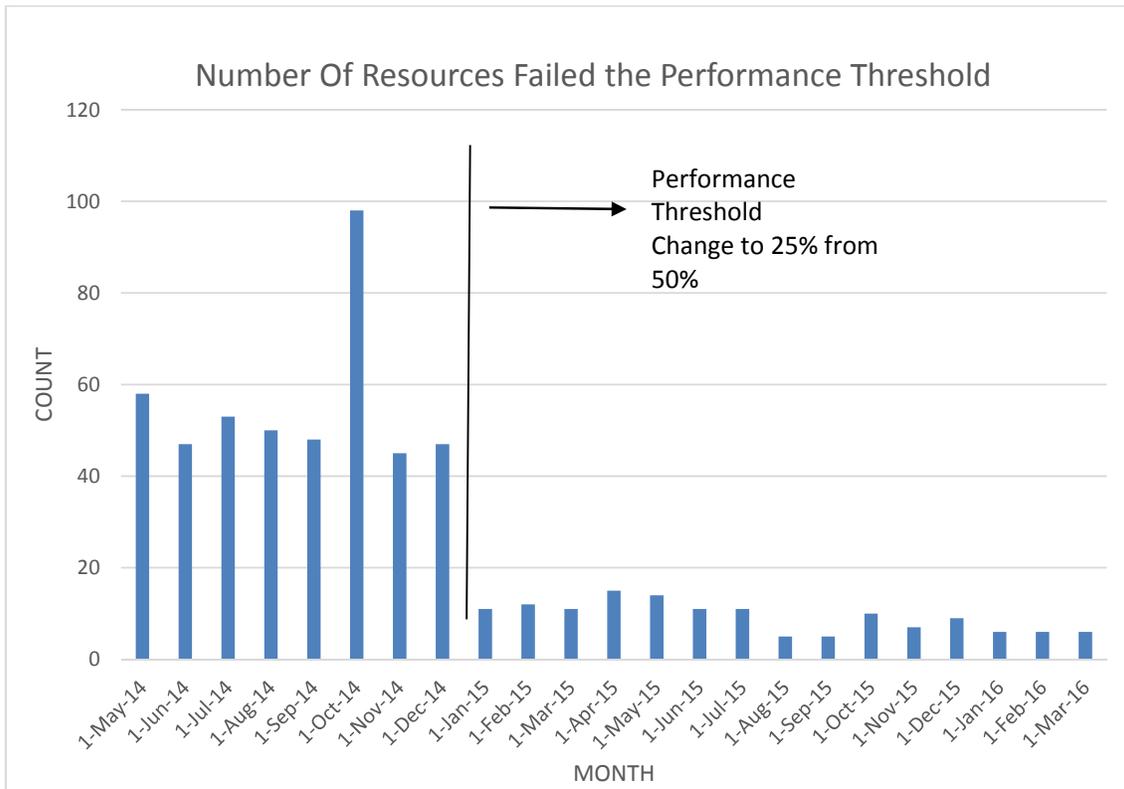
MONTH	Combined Cycle	Gas Turbine	Hydro	Limited Energy Storage Resource	Pump Turbine	Steam Turbine
Jan-15	44.68%	56.08%	50.52%		45.09%	25.40%
Feb-15	65.42%	72.45%	48.15%	50.36%	52.82%	30.16%
Mar-15	55.46%	72.07%	53.07%	49.77%		48.01%
Apr-15	56.64%	61.31%	54.74%	37.56%	4.39%	47.83%
May-15	48.82%	68.36%	58.94%	66.36%		54.92%
Jun-15	51.00%	61.49%	58.04%	76.54%	43.44%	50.83%
Jul-15	63.37%	73.17%	57.45%	69.79%	1.09%	56.30%
Aug-15	59.74%	76.85%	56.99%	70.42%	2.18%	55.23%
Sep-15	67.91%	68.62%	57.24%	76.54%		56.51%
Oct-15	53.14%	72.53%	58.21%		27.66%	48.66%
Nov-15	53.84%	73.03%	61.35%		42.89%	66.11%
Dec-15	56.39%	67.30%	57.81%	68.97%	35.95%	64.88%
Jan-16	50.10%	65.21%	53.34%	72.67%	48.77%	56.57%
Feb-16	52.80%	69.85%	56.37%	57.27%	56.98%	51.81%
Mar-16	58.12%	80.11%	60.02%	67.95%	55.50%	48.77%
Total	55.40%	68.70%	55.86%	64.51%	41.85%	52.40%

III. The CAISO’s new minimum performance threshold has alleviated concerns about the need to continuously recertify a large number of resources for regulation service

The CAISO requested authority to change its minimum performance threshold for regulation resource from 50 percent to 25 percent accuracy because of concerns that many resources would not meet the threshold. Based on market performance results under the CAISO’s Order 755 design, the CAISO had concerns that resources might need to undertake a continuous process of re-certifying their regulation capacity at a 50 percent accuracy metric and might elect not to recertify that capacity. Shifting to a 25 percent accuracy threshold has alleviated that concern.

Figure 2 depicts the decrease in the number of resources required to undertake recertification tests as a result of not meeting the minimum performance threshold since the CAISO reduced that threshold to 25 percent accuracy.

**Figure 2 – Number of recertification tests
(Change in minimum performance threshold from 50 to 25 percent accuracy)**



The CAISO also has examined the number of resources that would be required to undertake recertification tests as a result of not meeting the minimum performance threshold if the CAISO had modified its minimum performance threshold to 30 percent accuracy or 40 percent accuracy as of January 1, 2015. Figures 3 and 4 depict these numbers. At a 30 percent accuracy threshold, there is not a significant additional number of resources facing recertification tests when compared to a 25 percent accuracy threshold. At a 40 percent accuracy threshold, the number of recertification tests increases in comparison to a 25 percent accuracy threshold and exceeds 20 resources in multiple months.

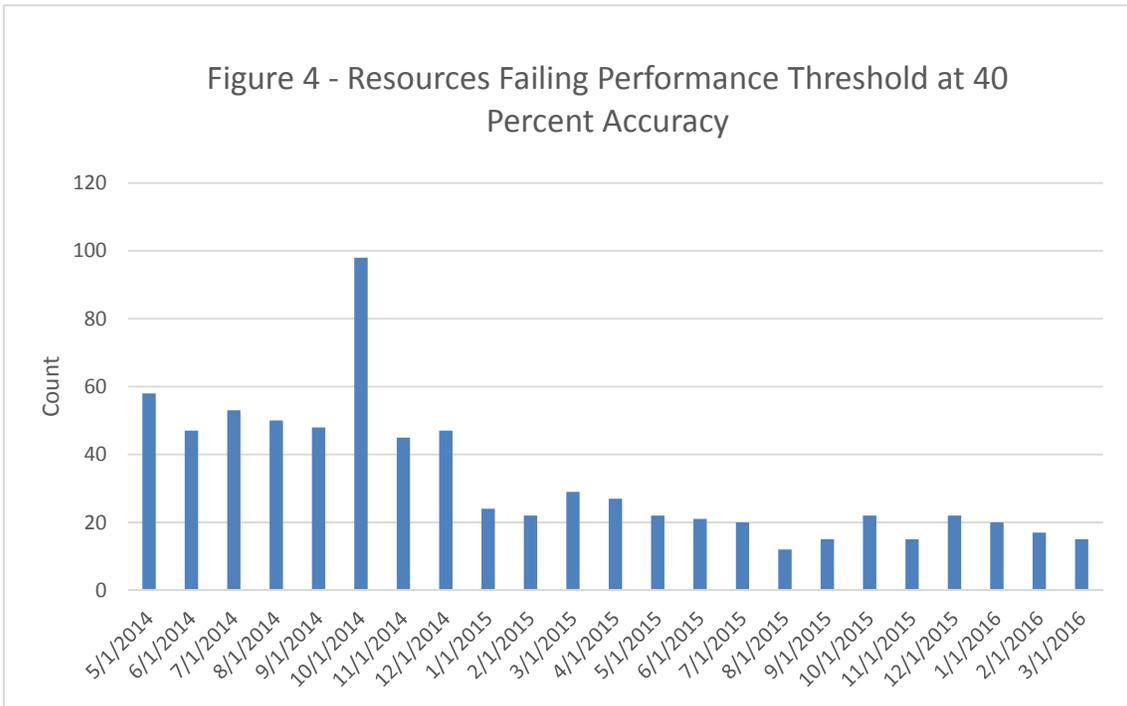
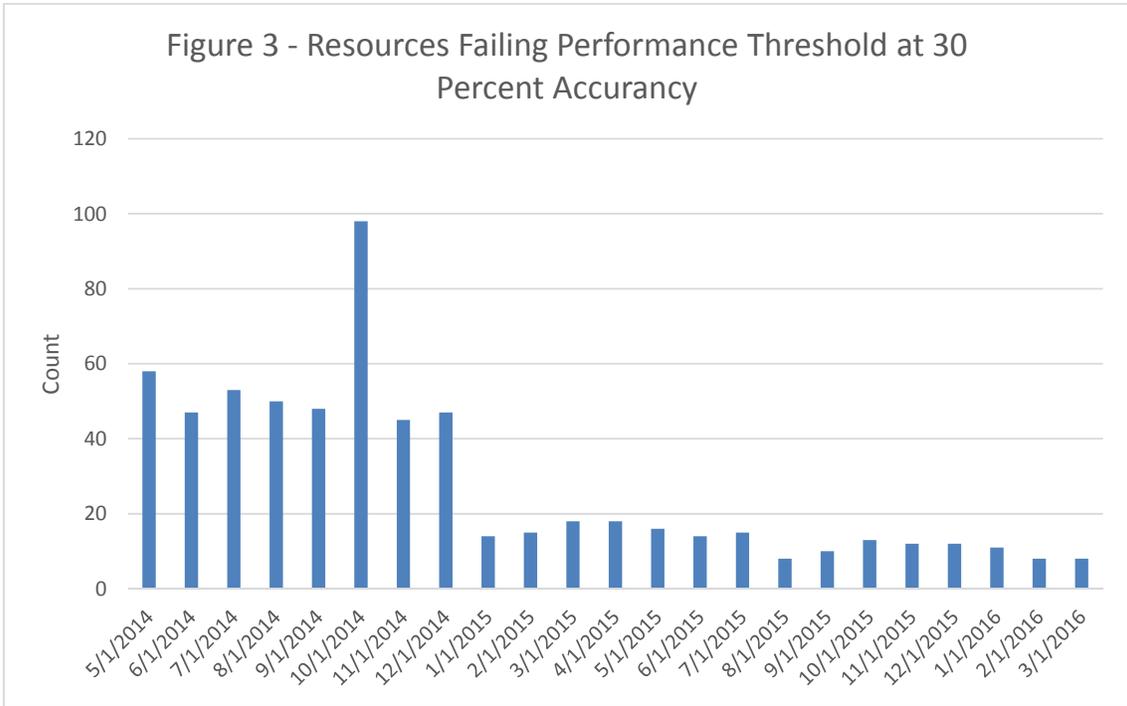
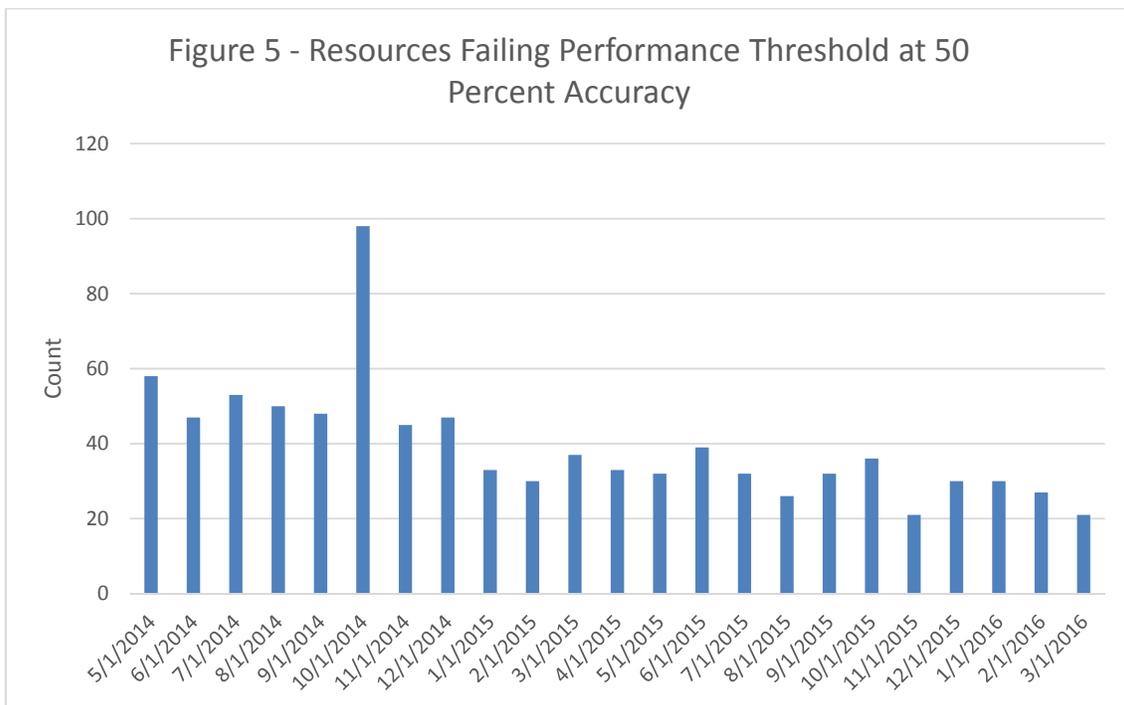


Figure 5 depicts the number of resources that would have required recertification tests had the CAISO not modified its minimum performance threshold from 50 percent accuracy as of January 1, 2015. At a 50 percent accuracy

threshold, more than 20 resources a month would face a requirement to recertify their regulation up or regulation down capacity. This volume of testing may cause some resource owners/operators to elect not to provide regulation service. While Figure 5 indicates improved resource performance since January 2015, the CAISO believes that using a 50 percent accuracy threshold may still create an unnecessary risk that resources may elect not to recertify to provide regulation up and regulation down when faced with the requirement to undertake multiple recertification tests.



IV. Conclusion and Next Steps

The CAISO's acknowledges that responding accurately in all intervals to a four second control signal is an aggressive metric. On the other hand, the CAISO expects and needs regulation resources to respond accurately to its control signal. The current minimum performance threshold of 25 percent accuracy for resources providing regulation up and regulation down does not appear to create a significant risk that large number of resources will face recertification tests or possible

decertification. At the same time, the threshold imposes a floor in terms of required accuracy for resources to respond to the CAISO's control signal. The CAISO plans to continue to monitor the performance of regulation resources and discuss system wide performance and regulation market design issues with stakeholders at its market performance and planning forum and in the context of its stakeholder initiative catalog. The CAISO will undertake an assessment of emerging technologies providing regulation and their impact on the market for regulation up and regulation down as part of its next Order 755 informational report that it will submit in December 2017.

CERTIFICATE OF SERVICE

I hereby certify that I have served the foregoing document upon the parties listed on the official service list in the captioned proceeding, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Folsom, CA this 30th day of June, 2016.

Anna Pascuzzo
Anna Pascuzzo