

January 20, 2017

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

**Re: California Independent System Operator Corporation  
Docket: ER15-2526-\_\_\_\_\_  
Independent Assessment by the Department of Market Monitoring  
October 2016 Energy Imbalance Market Transition Period Report  
– Arizona Public Service**

Dear Secretary Bose:

The Department of Market Monitoring (DMM) hereby submits its independent assessment on the transition period of Arizona Public Service during its first six months of participation in the Energy Imbalance Market (EIM) for October 2016. Arizona Public Service entered the EIM on October 1, 2016.

Please contact the undersigned directly with any questions or concerns regarding the foregoing.

Respectfully submitted,

**By: /s/ Eric Hildebrandt**

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## California ISO

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# Report on energy imbalance market issues and performance: Arizona Public Service

January 20, 2017

Prepared by: Department of Market Monitoring



## Executive summary

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Pursuant to the Commission's October 29, 2015 Order on the ISO's Energy Imbalance Market (EIM), the ISO filed a report on January 17, 2017 covering the period from October 1 through October 31, 2016 (October 2016 Report) for the Arizona Public Service area in the energy imbalance market.<sup>1</sup> This report provides a review by the Department of Market Monitoring (DMM) of energy imbalance market performance in the Arizona Public Service area during the period covered in the ISO's October report. Key findings in this report include the following:

- Overall energy imbalance market performance went very well during the first month of implementation in the Arizona Public Service area. The addition of Arizona Public Service into the energy imbalance market on October 1 added significant transfer capacity between the EIM areas and the ISO. With the new and existing transfer capacity, little congestion occurred between Arizona Public Service, NV Energy, PacifiCorp East, and the ISO. As a result, real-time prices have been fairly uniform between the ISO and these energy imbalance market areas.
- Arizona Public Service market prices tracked closely with Southern California Edison area prices within the ISO. The average price used for load settlement, which combines 15-minute and 5-minute prices, in the Arizona Public Service area was about \$32/MWh for the month and about \$34/MWh in the Southern California Edison area for the same period.
- The percentage of intervals when the energy power balance constraint was relaxed to allow the market software to balance modeled supply and demand was very low (less than 0.3 percent) in the 15-minute and 5-minute markets in October. Because of the low number of power balance constraint relaxations, the price discovery feature, which prevents prices from being set by the \$1,000/MWh penalty price during power balance shortages, had minimal impact on market prices.
- Without special price discovery provisions in place, the load bias limiter feature would not have been triggered in the 15-minute market and would have been triggered in just one interval when the power balance constraint was relaxed in the 5-minute market in October for Arizona Public Service. Resulting market prices would have changed by less than 1 percent during the month, had the load bias limiter been in place and not price discovery.<sup>2</sup>
- DMM reviewed the results and conclusions in the ISO's October report and found that they are largely consistent with the results we report in this document.

Section 1 of this report provides a description of prices in the market and impacts from the power balance constraint, section 2 provides details on the impact of the load bias limiter, and section 3 provides details and results from the flexible ramping sufficiency test.

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<sup>1</sup> The ISO's October 2016 Report was filed at FERC on January 17, 2017 and posted in the ISO website on January 18, 2017: [http://www.caiso.com/Documents/Jan17\\_2017\\_EIM\\_InformationalReport\\_TransitionPeriod\\_APS\\_Oct2016\\_ER15-2565.pdf](http://www.caiso.com/Documents/Jan17_2017_EIM_InformationalReport_TransitionPeriod_APS_Oct2016_ER15-2565.pdf).

<sup>2</sup> The load bias limiter, also referred to as the load conformance limiter, is a market mechanism that sets power balance constraint penalty prices at the last economic bid dispatched, rather than the power balance constraint penalty parameter if the load adjustment is larger than the power balance constraint relaxation. In the event of a power balance constraint shortage, this causes prices to be set by the last economic instead of the \$1,000/MWh penalty parameter. The outcomes from this mechanism do not impact the market because of the price discovery feature, which is in place for the first six months of new energy imbalance market operation, and sets the price for all power balance constraint relaxations to the last price bid into the market by a unit.



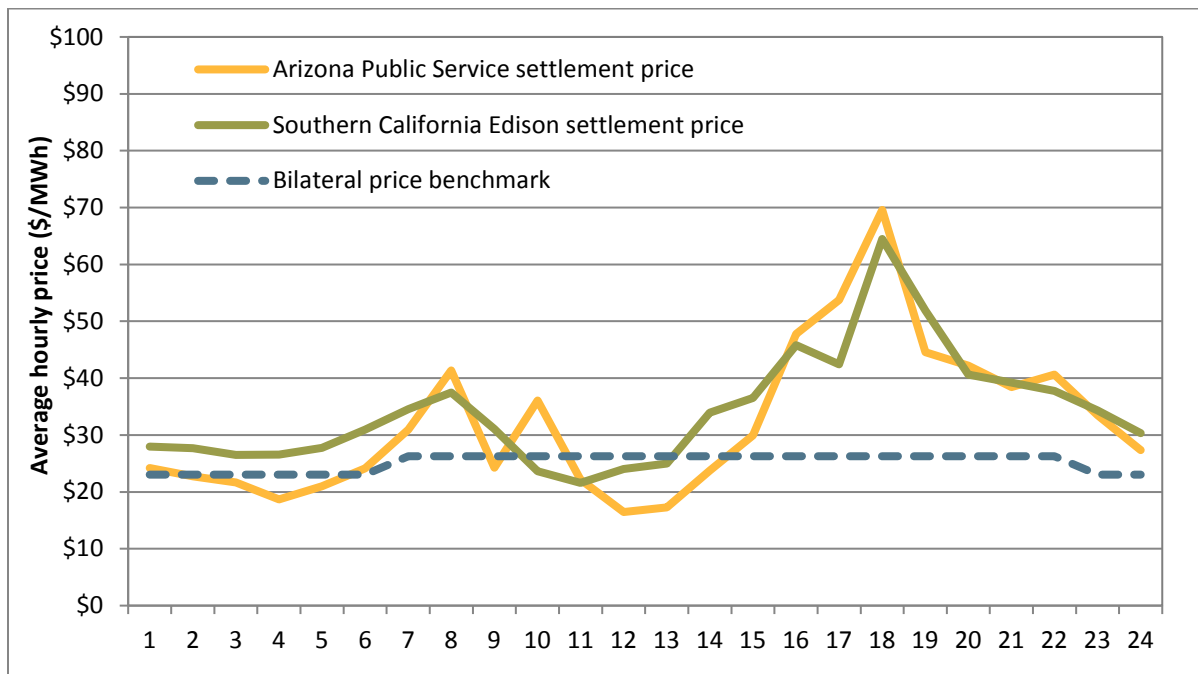
## 1 Energy imbalance market prices

The load settlement price is an average of 15-minute and 5-minute prices, weighted by the amount of estimated load imbalance in each of those markets.<sup>3</sup> For the energy imbalance market, 15-minute prices are weighted by the imbalance between base load and forecasted load in the 15-minute market, while 5-minute prices are weighted by the imbalance between forecasted load in the 15-minute market and forecast load in the 5-minute market.

Figure 1.1 shows hourly average settlement prices during October in the Arizona Public Service and Southern California Edison areas, as well as the bilateral prices DMM uses as an additional benchmark for energy imbalance market prices.

The bilateral price benchmark is an average of peak and off-peak prices at various trading hubs using day-ahead ICE indices that are representative of an EIM entity’s pricing for settling imbalance prior to EIM implementation. For Arizona Public Service, the bilateral price benchmark reflects an average of prices at three major western trading hubs (Mead, Palo Verde and Four Corners).

**Figure 1.1 Settlement prices and bilateral price benchmark – Arizona Public Service**



Large transfer capabilities and little congestion between the ISO and Arizona Public Service caused average settlement prices in Arizona Public Service during the quarter to reflect market outcomes in the ISO, which are depicted by the Southern California Edison prices. Settlement prices averaged about

<sup>3</sup> Business Practice Manual Configuration Guide: Real-Time Price Pre-calculation, Settlements and Billing, October 29, 2015: [https://bpmcm.caiso.com/BPM%20Document%20Library/Settlements%20and%20Billing/Configuration%20Guides/Pre-Calcs/BPM%20-%20CG%20PC%20Real%20Time%20Price\\_5.13.doc](https://bpmcm.caiso.com/BPM%20Document%20Library/Settlements%20and%20Billing/Configuration%20Guides/Pre-Calcs/BPM%20-%20CG%20PC%20Real%20Time%20Price_5.13.doc).

\$32/MWh in Arizona Public Service and \$34/MWh in the Southern California Edison load aggregation area during October.

Figure 1.2 through Figure 1.3 show the average daily frequency of constraint relaxations in the 15-minute and 5-minute markets in Arizona Public Service by week during October.<sup>4</sup> These figures also show the average weekly prices *with* and *without* the special price discovery mechanism applied to mitigate prices in the area.<sup>5</sup> These figures also include the average bilateral price benchmark for comparison to EIM market prices, depicted by the dashed blue lines. For these figures, the SCE load aggregation area price is also included as a comparison as prices generally moved in the same direction and relative magnitude.

These figures show that the percentage of intervals when the energy power balance constraint was relaxed was very low in both real-time markets in October. In the 15-minute market and 5-minute market, the power balance constraint was relaxed in less than 0.3 percent of intervals in Arizona Public Service. As a result, prices with and without price discovery were mostly converged in both real-time markets.

The most significant separation between prices with and without price discovery occurred on October 11 in Arizona Public Service in the 15-minute and 5-minute markets. On October 11, multiple infeasibilities for Arizona Public Service in both real-time markets were driven by a significant reduction in biddable capacity during the morning when bids were not entered in time for the window to submit real-time bids.

The average weekly 15-minute and 5-minute prices for Arizona Public Service were slightly above the bilateral price benchmark and tracked near to Southern California Edison prices because of the high transfer capacity available between Arizona Public Service and the ISO.

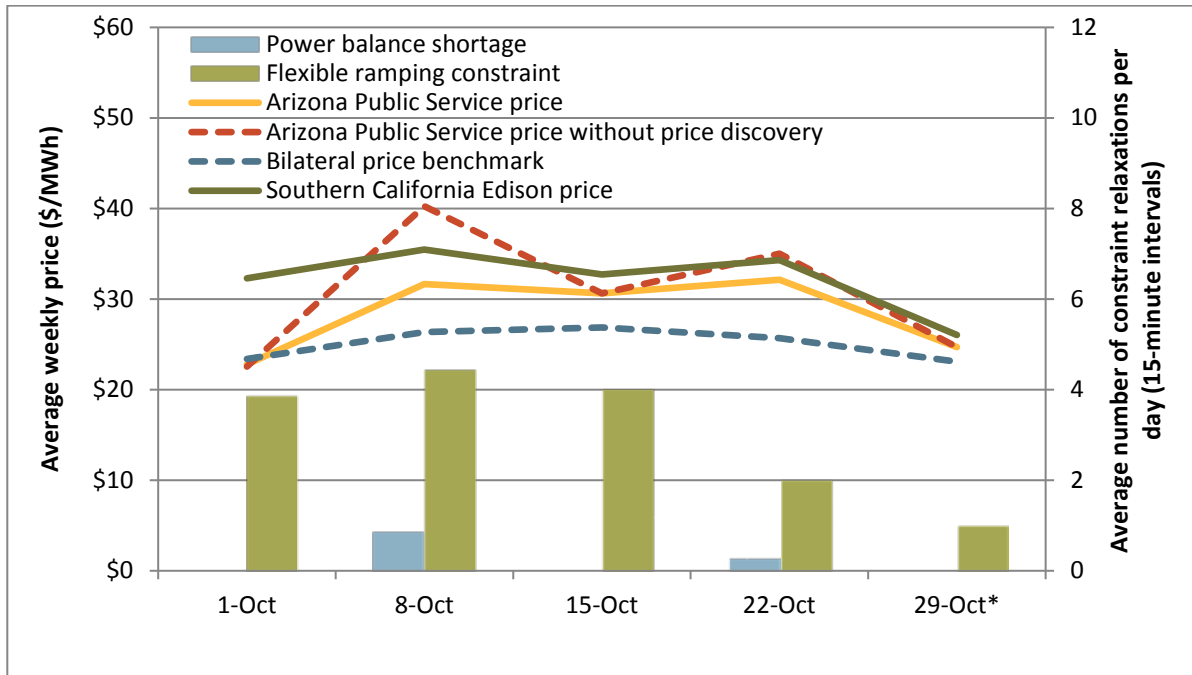
As shown in these figures, the price discovery mechanism, approved under the Commission's October 29, 2015 Order, had little impact on market prices in the Arizona Public Service areas in October 2016. This was because of the very low number of power balance relaxations during the month.

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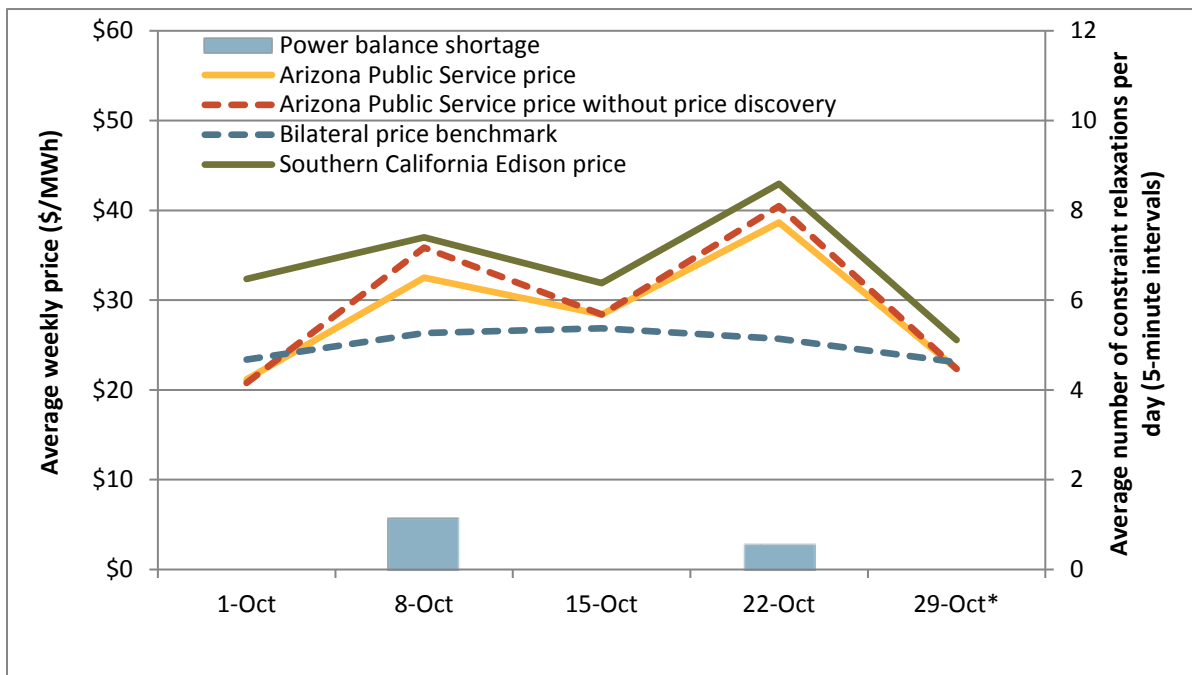
<sup>4</sup> All figures contain a partial week for the last week shown. The week starting October 29 contains three days.

<sup>5</sup> A detailed description of the methodology used to calculate these counterfactual prices that would result without price discovery was provided on p. 6 of the April 2, 2015 report on the Energy Imbalance Market from DMM (link below). When estimating prices without price discovery, it is assumed that when the load bias limiter would have been triggered, the resulting price would have been equal to the actual price that resulted with price discovery in effect. DMM has also adjusted its analysis to be consistent with the data in the ISO report.  
[http://www.caiso.com/Documents/Apr2\\_2015\\_DMM\\_AssessmentPerformance\\_EIM-Feb13-Mar16\\_2015\\_ER15-402.pdf](http://www.caiso.com/Documents/Apr2_2015_DMM_AssessmentPerformance_EIM-Feb13-Mar16_2015_ER15-402.pdf).

**Figure 1.2 Frequency of constraint relaxation and average prices by week  
Arizona Public Service (15-minute market)**



**Figure 1.3 Frequency of constraint relaxation and average prices by week  
Arizona Public Service (5-minute market)**







## 2 Load Bias Limiter

When triggered, the load bias limiter would have the same effect as the price discovery feature and cause prices to be set by the last economic bid dispatched rather than the \$1,000/MWh penalty price for energy power balance shortages. A more detailed description of the load bias limiter is included in DMM’s April 2015 report.<sup>6</sup> The ISO also included a discussion of the load bias limiter in its answer to comments regarding available balancing capacity on November 24, 2015.<sup>7</sup>

The frequency of intervals in which the power balance constraint was relaxed was very low during October for Arizona Public Service in both real-time markets. Without special price discovery provisions in effect, the load bias limiter feature would have been triggered in just one interval when the power balance constraint was relaxed in the 5-minute market in October for Arizona Public Service only. This implies that hypothetical market prices with the load bias limiter in place would have been almost the same as prices without the load bias limiter or price discovery during the month (see Table 2.1). The load bias limiter would not have been triggered during any 15-minute market interval and would therefore not have any impact on those prices in Arizona Public Service.

**Table 2.1 Impact of load bias limiter on Arizona Public Service prices (October 2016)**

	Average proxy price	Average EIM price	EIM price without price discovery	EIM price without price discovery or load bias limiter	Potential impact of load bias limiter	
					Dollars	Percent
<i>Arizona Public Service</i>						
15-minute market (FMM)	\$25.19	\$28.85	\$31.39	\$31.39	\$0.00	0%
5-minute market (RTD)	\$25.19	\$29.43	\$30.61	\$30.70	-\$0.09	-0.30%

<sup>6</sup> Report on Energy Imbalance Market Issues and Performance, Department of Market Monitoring, April 2, 2015, pp.34-35: [http://www.caiso.com/Documents/Apr2\\_2015\\_DMM\\_AssessmentPerformance\\_EIM-Feb13-Mar16\\_2015\\_ER15-402.pdf](http://www.caiso.com/Documents/Apr2_2015_DMM_AssessmentPerformance_EIM-Feb13-Mar16_2015_ER15-402.pdf).

<sup>7</sup> Answer of the California Independent systems Operator Corporation to Comments, November 24, 2015, pp. 13-21: [http://www.caiso.com/Documents/Nov24\\_2015\\_Answer\\_Comments\\_AvailableBalancingCapacity\\_ER15-861-006.pdf](http://www.caiso.com/Documents/Nov24_2015_Answer_Comments_AvailableBalancingCapacity_ER15-861-006.pdf).



### 3 Flexible ramping sufficiency test

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The flexible ramping sufficiency test ensures that each balancing area has enough ramping resources over an hour to meet expected ramping needs. The test is designed to ensure each EIM entity has sufficient ramping capacity to meet real-time market requirements without relying on transfers from other EIM balancing areas. This test is performed prior to each operating hour. If an EIM area fails the test, EIM transfers into that area cannot be increased.<sup>8</sup> The area will also fail the flexible ramping sufficiency test for any hour when the capacity test fails. The capacity test is a test designed to ensure that there is sufficient resource capacity available to meet forecasts and net exports for any given hour.<sup>9</sup>

Prior to June 2015, the ISO calculated the flexible ramping sufficiency test requirement as the cumulative sum of the flexible ramping requirement for each of the 15-minute intervals during each operating hour. The ISO recognized this method significantly overestimated the ramping requirements for an EIM entity because the total flexible ramping requirements for the 15-minute intervals within each operating hour are not additive. Therefore, in June 2015 the ISO modified the test to eliminate this cumulative summation so that it instead was based directly on the requirement for each 15-minute interval.

Figure 3.1 shows the percent of intervals in which Arizona Public Service failed the sufficiency test or relaxed the power balance constraint in the 15-minute and 5-minute markets. As shown in Figure 3.1, Arizona Public Service failed the sufficiency test relatively infrequently, during less than 10 total hours. When an EIM area fails the sufficiency test, the effect on EIM transfers into the area can impact the feasibility of the solution. During October, the percent of intervals in which both the sufficiency test failed and the power balance constraint was relaxed was very low, occurring in less than 0.3 percent of 15-minute and 5-minute intervals during the month.

In November, the ISO implemented the flexible ramping product, which replaced the flexible ramping constraint, as a new mechanism to ensure that there is sufficient upward and downward ramping capability available to account for forecasted net load changes and forecast uncertainty. In addition, the ISO introduced a downward ramping sufficiency test to address real-time leaning due to over-supply in EIM. DMM will provide more details on market results from the flexible ramping product in the upcoming monthly report for November.

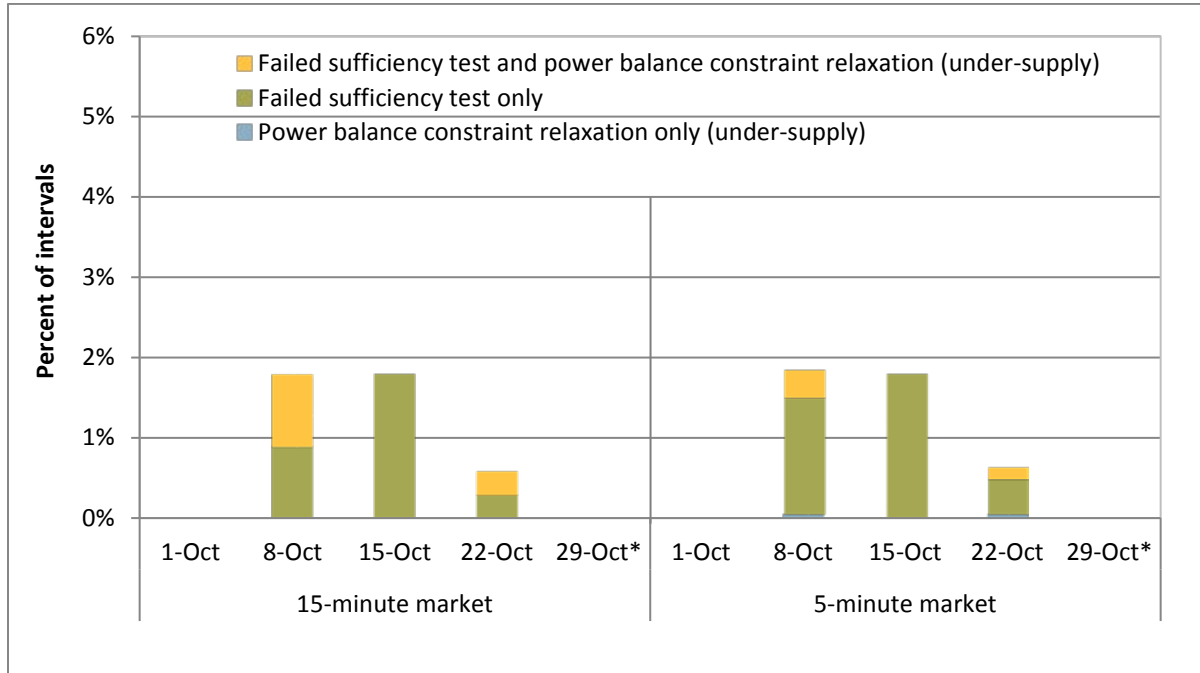
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<sup>8</sup> Business Practice Manual for the Energy Imbalance Market, August 30, 2016, p. 45-52:

[https://bpmcm.caiso.com/BPM%20Document%20Library/Energy%20Imbalance%20Market/BPM\\_for\\_Energy%20Imbalance%20Market\\_V6\\_clean.docx](https://bpmcm.caiso.com/BPM%20Document%20Library/Energy%20Imbalance%20Market/BPM_for_Energy%20Imbalance%20Market_V6_clean.docx).

<sup>9</sup> Business Practice Manual for the Energy Imbalance Market, August 30, 2016, p. 45.

**Figure 3.1 Arizona Public Service flexible ramping sufficiency test results**



## CERTIFICATE OF SERVICE

I certify that I have served the foregoing document upon the parties listed on the official service list in the captioned proceedings, 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, California this 20<sup>th</sup> day of January, 2017.

*/s/ Grace Clark*  
Grace Clark