

February 29, 2016

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. ER15-402____
Independent Assessment – Department of Market Monitoring
Report on Energy Imbalance Market Issues and Performance**

Dear Secretary Bose:

The Department of Market Monitoring hereby submits its independent assessment on the causes and solutions identified by the California Independent System Operator Corporation in its report on the performance of the Energy Imbalance Market for December 1, 2015 through December 31, 2015.¹

Please contact the undersigned with any questions.

Respectfully submitted,

By: /s/ Anna A. McKenna

Roger E. Collanton

General Counsel

Anna A. McKenna

Assistant General Counsel

John C. Anders

Lead Counsel

California Independent System

Operator Corporation

250 Outcropping Way

Folsom, CA 95630

Tel: (916) 608-7182

Fax: (916) 608-7222

amckenna@caiso.com

¹ The CAISO submits this report pursuant to *California Independent System Operator Corp.*, 149 FERC ¶ 61,194 (2014).

California ISO

Report on energy imbalance market issues and performance

February 29, 2016

Prepared by: Department of Market Monitoring

Executive summary

Pursuant to the Commission's March 16, 2015 Order on the ISO's Energy Imbalance Market (EIM), the ISO filed a report on February 17, 2016 covering the period from December 1 through December 31, 2015 for the PacifiCorp balancing areas (December Report).¹ The redline portion of the ISO's December report shows that it contains updated graphs and figures from the ISO's November report.

This report provides a review by the Department of Market Monitoring (DMM) of EIM performance during the period covered in the ISO's December report. Key findings of DMM's review of EIM performance in the PacifiCorp balancing areas during December 2015 include the following:

- EIM performance in the PacifiCorp East balancing area improved significantly with the addition of the additional transmission capacity and supply that resulted from addition of the NV Energy area in December. In PacifiCorp East, the percentage of intervals when the flexible ramping constraint and energy power balance constraint were relaxed to allow the market software to balance modeled supply and demand dropped notably in December.
- In PacifiCorp West, the frequency of power balance constraint relaxations rose notably to higher levels, reaching 1.4 percent of intervals in the 15-minute market and 2.4 percent of intervals in the 5-minute market. The ISO's December report indicated that many of these constraint relaxations resulted from unexpected deviations in output from renewable resources.
- Prices in both PacifiCorp areas continued to be mitigated by special price discovery provisions that prevent prices from being set by the \$1,000/MWh penalty price for energy power balance shortages that would otherwise be utilized to set final market prices. Without the price discovery mechanism, prices in PacifiCorp East would have been about 20 percent higher in the 15-minute market and about 15 percent higher in the 5-minute market. In PacifiCorp West, 15-minute prices would have been about 37 percent higher and 5-minute prices would have been almost twice as high if price discovery had not been in effect.
- The average settlement price for PacifiCorp East was just over \$21/MWh during December, while prices in PacifiCorp West averaged about \$21.50/MWh. The load settlement price is calculated as an average of prices in the 15-minute market and the 5-minute market, weighted by load imbalance in each respective market. Settlement prices in both areas were within the range of representative bilateral trading hub prices, and were significantly below the average PG&E area settlement price from the ISO during December. PG&E prices may be used as a benchmark for competitiveness of the PacifiCorp areas, as this is the region where much of the energy transfer between PacifiCorp and the ISO occurs.
- In PacifiCorp East, the percentage of intervals when the flexible ramping constraint was relaxed in the 15-minute market – but price discovery provisions were not triggered due to relaxation of the energy power balance constraint – dropped sharply during December to relatively low levels. This reverses a trend of several consecutive months of increases in the percentage of intervals where the flexible ramping constraint bound. During intervals when the flexible ramping constraint binds, the

¹ The ISO's November Report was filed at FERC on February 17 and posted in the ISO website the same day, http://www.caiso.com/Documents/Feb17_2016_December2015EIMPriceWaiverReport_ER15-402.pdf.

energy price in the 15-minute market is increased by the \$60/MWh penalty price for relaxation of the flexible ramping constraint.²

- In the 15-minute market in PacifiCorp East, the flexible ramping constraint needed to be relaxed during less than 1 percent of intervals, and had an impact on prices of less than \$0.50/MWh. In comparison, during November in the same market the constraint bound during almost 18 percent of intervals and had an overall impact of close to \$10/MWh on area prices. In the 15-minute PacifiCorp West market, intervals where the flexible constraint bound increased prices by less than \$1.50/MWh during December. This is consistent with impacts during other recent prior months in PacifiCorp West.
- DMM worked with the ISO and PacifiCorp to mitigate flexible ramping constraint issues and a noticeable decrease in these relaxations began in late November and continued through December. The decrease in flexible ramping constraint relaxations in PacifiCorp East beginning in late November coincided with the return of a significant amount of generating capacity from outages in that area. This reduction continued in December and was likely driven in part by the addition of NV Energy to the EIM beginning in December.
- If price discovery provisions had not been in place in December, the load bias limiter feature would have been triggered during a small percentage of intervals when the power balance constraint was relaxed and would have resulted in a relatively small reduction in prices. The small price impact is partly attributable to the low number of power balance constraint relaxations in PacifiCorp East during December. During prior months the load bias limiter would have been triggered during a higher percentage of intervals while the power balance constraint was relaxed. In December, the load bias limiter would have reduced overall prices by less than 12 percent in each PacifiCorp market.
- When triggered, the load bias limiter would have the same effect as the price discovery feature triggered by power balance constraint shortages, and would cause prices to be set by the last economic bid dispatched rather than the \$1,000/MWh penalty price for energy power balance shortages.

This report is organized as follows. This summary section highlights key findings and trends occurring in December 2015. Sections 1 through 3 provide updated charts, tables, and analysis which have been included in prior reports. Section 1 includes a new chart and analysis on weighted 15-minute and 5-minute settlement prices in the EIM.

² When price discovery provisions are triggered by relaxation of the energy power balance constraint, the penalty price for the flexible ramping constraint of \$60/MWh is replaced by \$0/MWh in the pricing run, so that the shadow price of this constraint is always \$0/MWh when the power balance constraint binds.

1 Energy imbalance market prices

Figure 1.1 shows weekly average prices used for settlement of loads in PacifiCorp East, PacifiCorp West, and the Pacific Gas & Electric (PG&E) area (northern zone of the ISO) prices, along with the range of bilateral trading hub prices DMM uses as an additional benchmark for EIM prices.

Figure 1.1 shows that load settlement prices in both PacifiCorp areas tracked very closely with the representative bilateral trading hub price range and were below the PG&E settlement prices during December. The average settlement price for PacifiCorp East was just over \$21/MWh during December, while the same price for PacifiCorp West was about \$21.50/MWh. Both figures fell within the range of bilateral trading hub prices for the month.

Figure 1.1 also shows that prices in both PacifiCorp areas tended to track bilateral trading hub prices during November, while the settlement price in PacifiCorp East was roughly 5 to 20 percent above the bilateral price range. Prices during November in both PacifiCorp areas were also significantly below the PG&E load area settlement price.

The load settlement price in Figure 1.1 is an average of prices in the 15-minute market and the 5-minute market, weighted by load imbalance in each respective market.³ Prices in the 15-minute market are weighted by the imbalance between base loads and load scheduled in the 15-minute market. The 5-minute prices are weighted by the difference between load scheduled in the 15-minute market and load scheduled in the 5-minute market. These load settlement prices track most closely with 15-minute market prices since load settlement prices are weighted more heavily on prices in the 15-minute market and less heavily on prices in the 5-minute market. Data in Figure 1.1 begins in November, since this represents a period after the ISO made some corrections to their methodology for calculating EIM load settlement prices.

The bilateral trading hub price range in Figure 1.1 is calculated as the range between prices from the ICE and Powerdex indices. For each index, prices are calculated using weighted daily averages of four major western trading hubs (California Oregon Border, Mid-Columbia, Palo Verde, and Four Corners) and include both peak and off-peak prices.⁴ The PG&E area represents an appropriate area to compare with both PacifiCorp regions because much of the energy transfer between PacifiCorp and the ISO occurs via tie points in Northern California.

³ Business Process 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_5.9.doc

⁴ Prior to EIM implementation, DMM identified this to stakeholders and regulators as a benchmark DMM would use to assess the competitiveness and overall performance of EIM.

Figure 1.1 Settlement and bilateral trading hub prices – PacifiCorp East and West

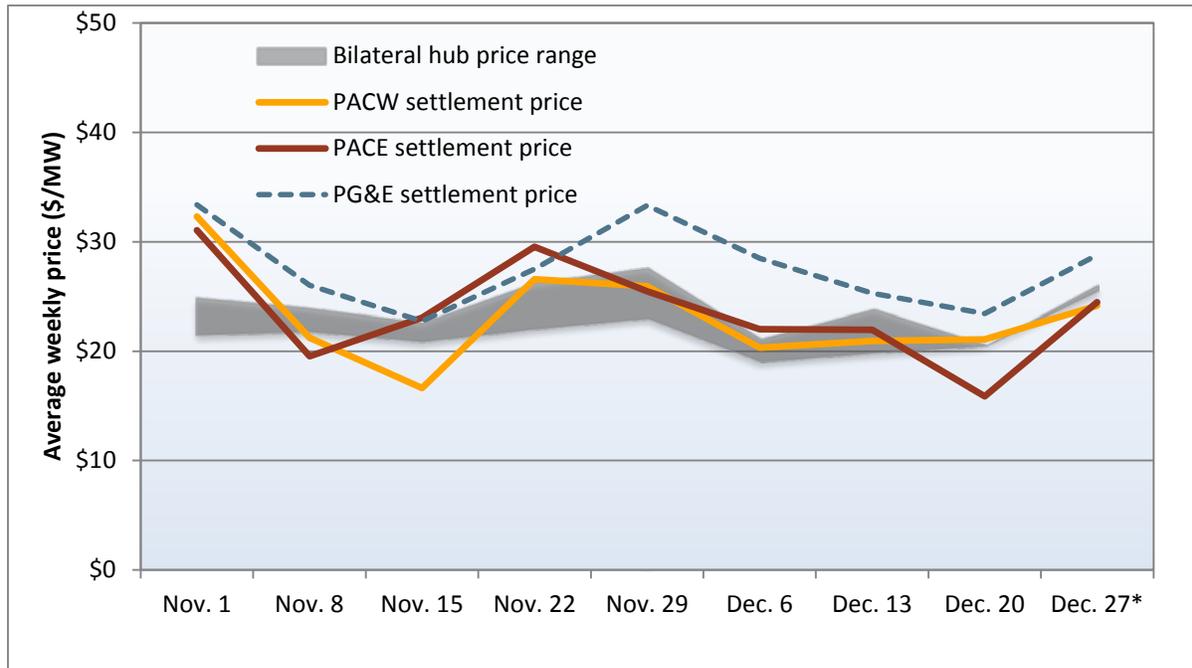


Figure 1.2 and Figure 1.4 show the average daily frequency of constraint relaxations in the 15-minute market by month in PacifiCorp East and PacifiCorp West, respectively. Figure 1.6 and Figure 1.8 provide a similar summary for the 5-minute market in these two areas. A detailed description of various types of constraint relaxation in these figures has been provided in prior reports.⁵

Figure 1.3 and Figure 1.5 show average monthly prices in the 15-minute market *with* and *without* the special price discovery mechanism being applied to mitigate prices in PacifiCorp East and PacifiCorp West, respectively. Figure 1.7 and Figure 1.9 provide the same monthly price summary for the 5-minute market. All four figures also include monthly averages of firm bilateral trading hub market prices for comparison to EIM market prices.

Figure 1.3 shows a significant decrease in the frequency of flexible ramping constraint relaxations from November to December in PacifiCorp East. This drove market prices in December down to within the bilateral trading hub range in the 15-minute PacifiCorp East market, as shown in Figure 1.3. This reverses a three month trend in this market of increasing price exceedances above the range of trading hub prices.

For comparison, the 15-minute market prices in PacifiCorp East were roughly 30 to 50 percent above the bilateral trading hub price range during November. Figure 1.4 also shows that 15-minute PacifiCorp

⁵ Report on Energy Imbalance Market Issues and Performance, Department of Market Monitoring, April 2, 2015, p.5. http://www.caiso.com/Documents/Apr2_2015_DMM_AssessmentPerformance_EIM-Feb13-Mar16_2015_ER15-402.pdf.

West market prices were just 1 to 9 percent above the bilateral trading price hub range. Prices in both 5-minute markets were below the bilateral trading price hub range.⁶

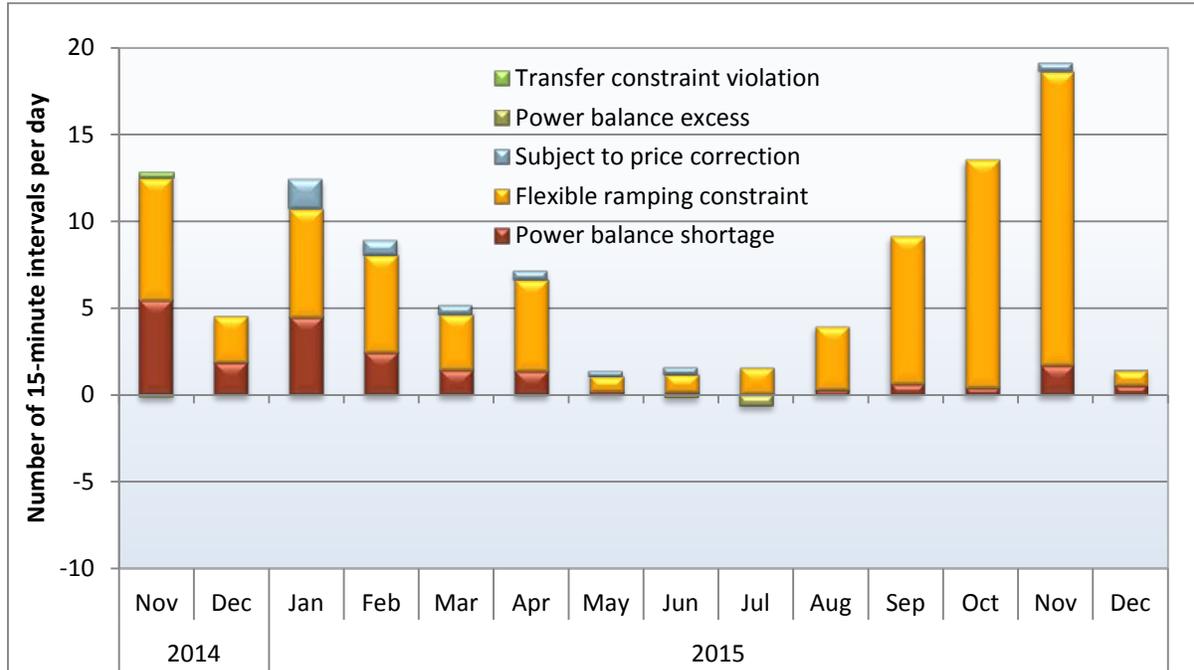
As shown in these figures, the price discovery mechanism approved under the Commission’s December 1, 2014 Order had a significant impact in terms of mitigating the impact of power balance constraint relaxation on market prices in December 2015. Without the price discovery mechanism prices in PacifiCorp East would have been about 20 percent higher in the 15-minute market and about 15 percent higher in the 5-minute market. In PacifiCorp West, 15-minute prices would have been about 37 percent higher and 5-minute prices would have been almost twice as high if price discovery had not been in effect.

Table 1.1 Average prices in EIM and bilateral markets (December 2015)

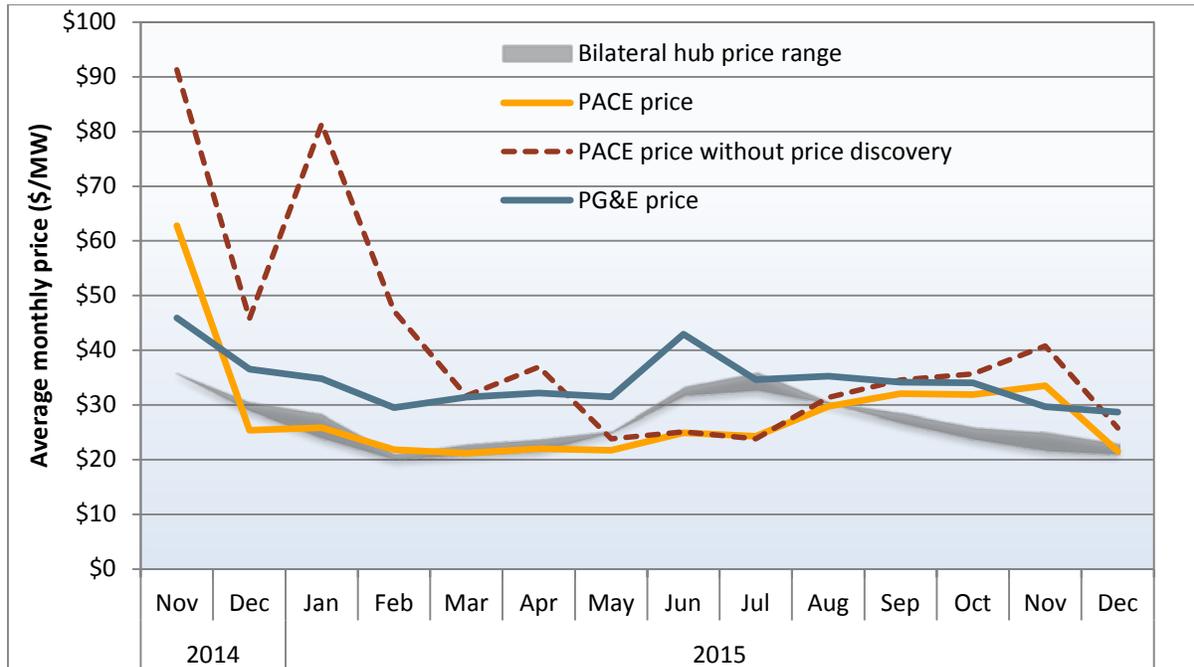
	Representative Bilateral trading hub price (ICE)	Representative Bilateral trading hub price (Powerdex)	Average EIM price	EIM price without price discovery
<i>PacifiCorp East</i>				
15-minute market (FMM)	\$21.18	\$22.99	\$21.53	\$25.78
5-minute market (RTD)	\$21.18	\$22.99	\$17.59	\$20.24
<i>PacifiCorp West</i>				
15-minute market (FMM)	\$21.18	\$22.99	\$23.14	\$31.69
5-minute market (RTD)	\$21.18	\$22.99	\$17.77	\$35.16

⁶ 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 report from DMM (link below). The ISO’s June 3 Report notes that the ISO implemented the load bias limiter feature for EIM on March 20, so that data in the ISO’s report now excludes intervals since March 20 when the power balance constraint was relaxed in the scheduling run, but this software feature would have been triggered if price discovery was not in effect. Also, when estimating prices without price discovery, it is assumed that when the load bias limited 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.

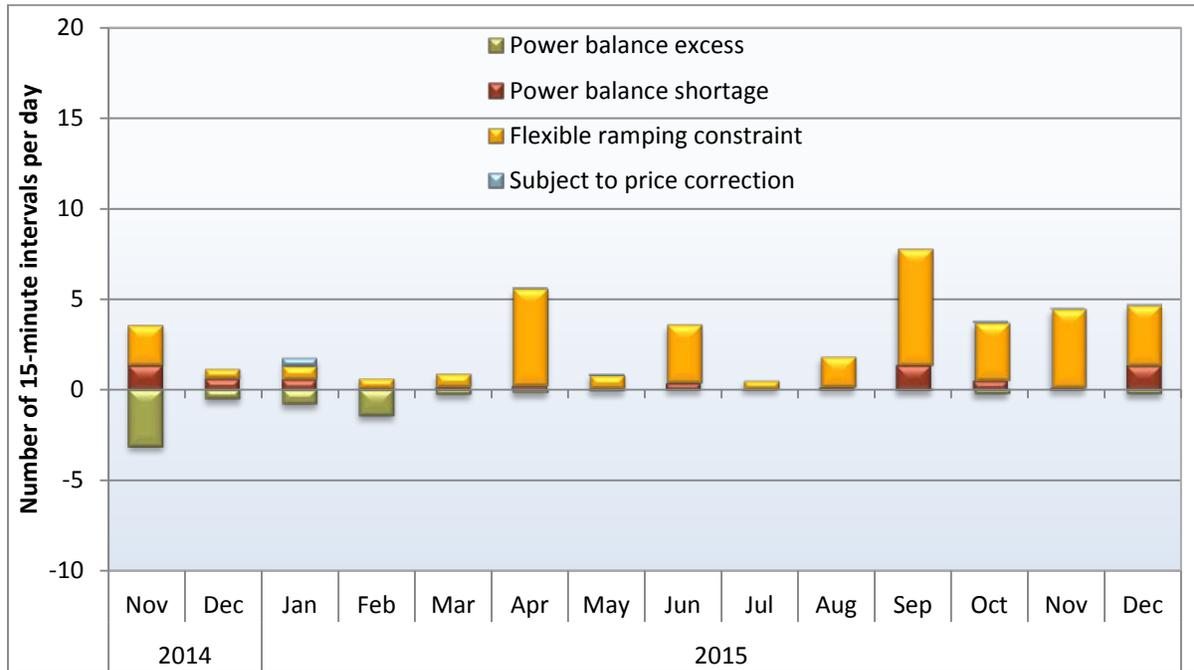
**Figure 1.2 Frequency of constraint relaxation
PacifiCorp East – 15-minute market**



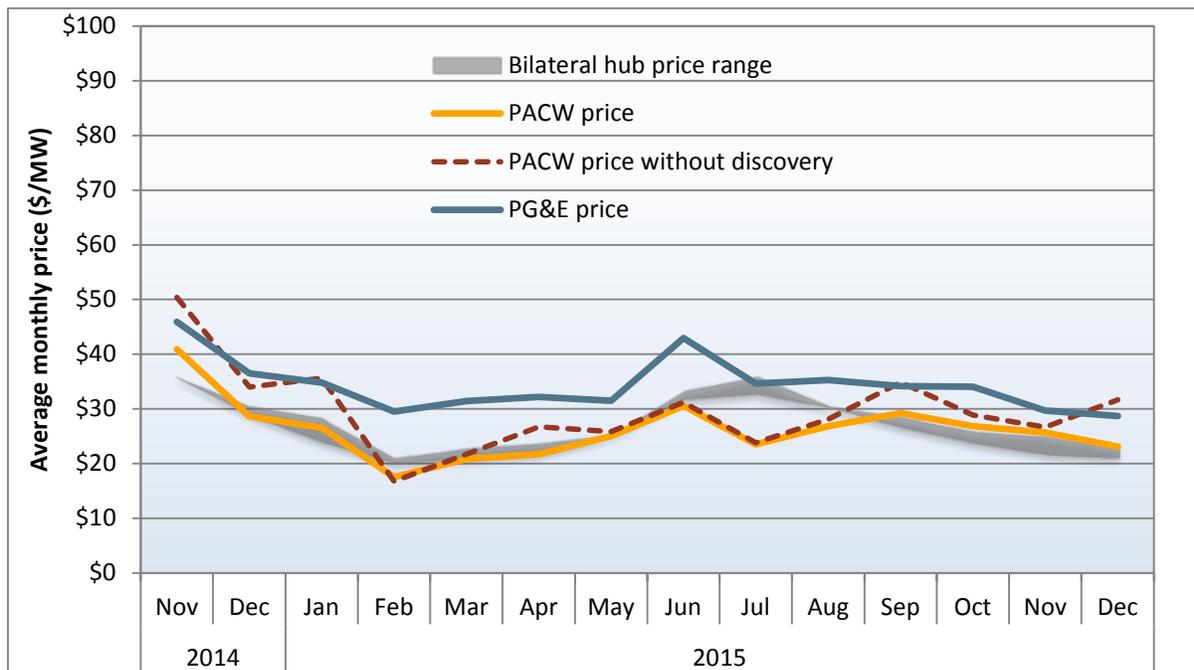
**Figure 1.3 Average monthly prices with and without price discovery
PacifiCorp East – 15-minute market**



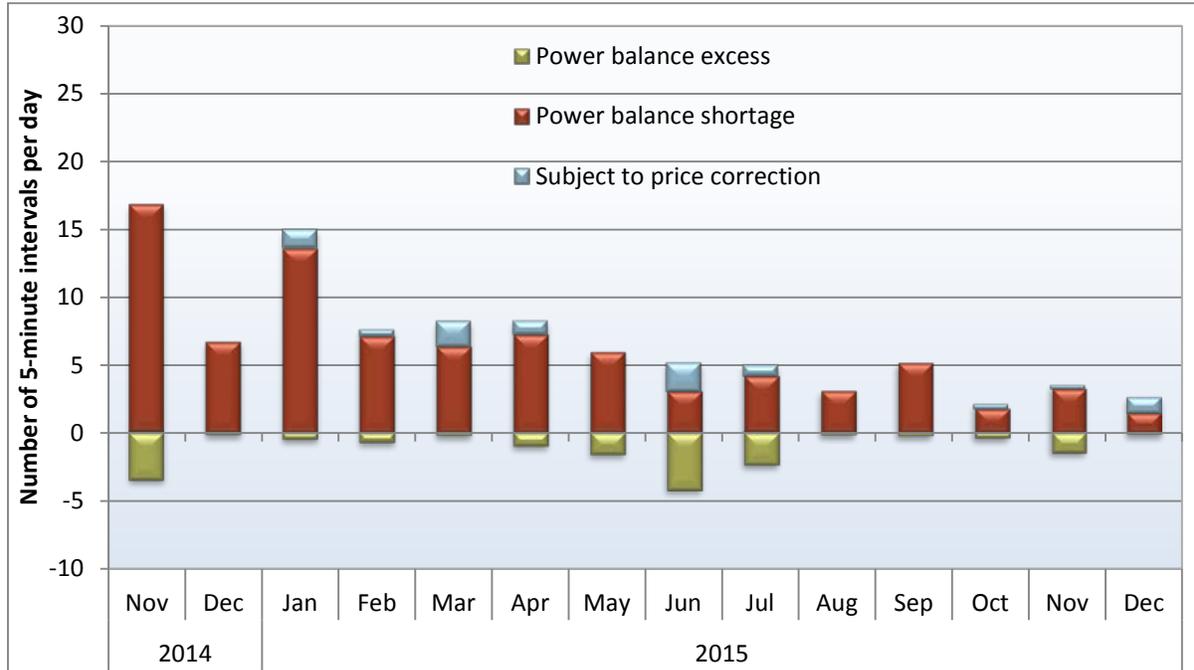
**Figure 1.4 Frequency of constraint relaxation
PacifiCorp West – 15-minute market**



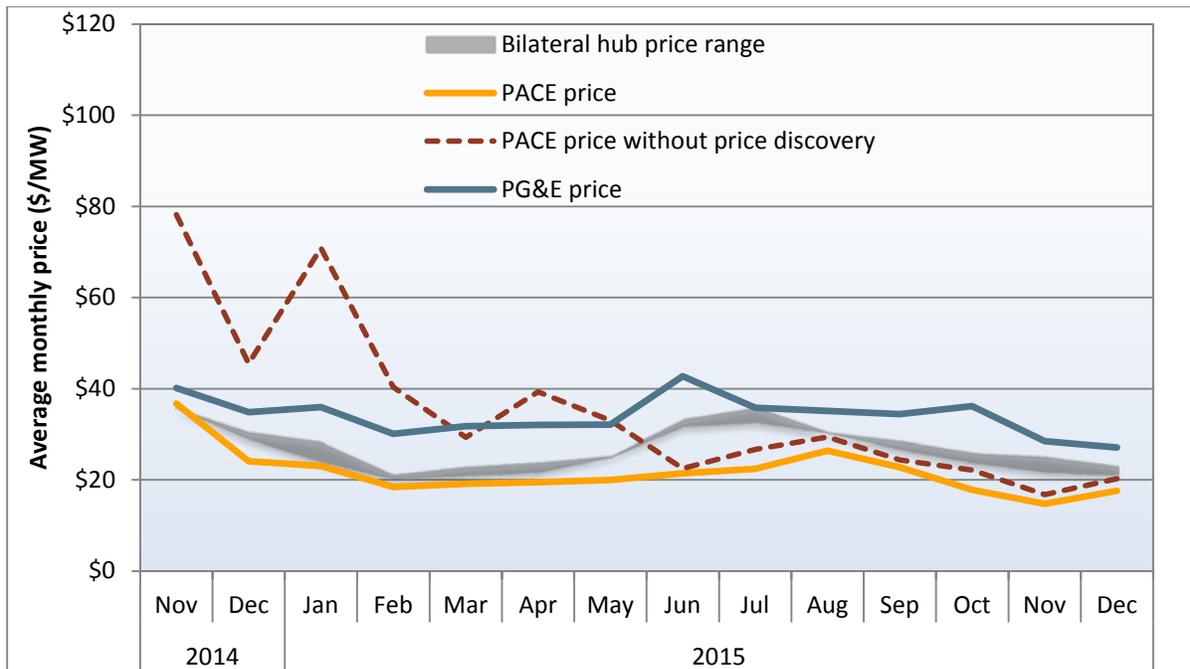
**Figure 1.5 Average monthly prices with and without price discovery
PacifiCorp West – 15-minute market**



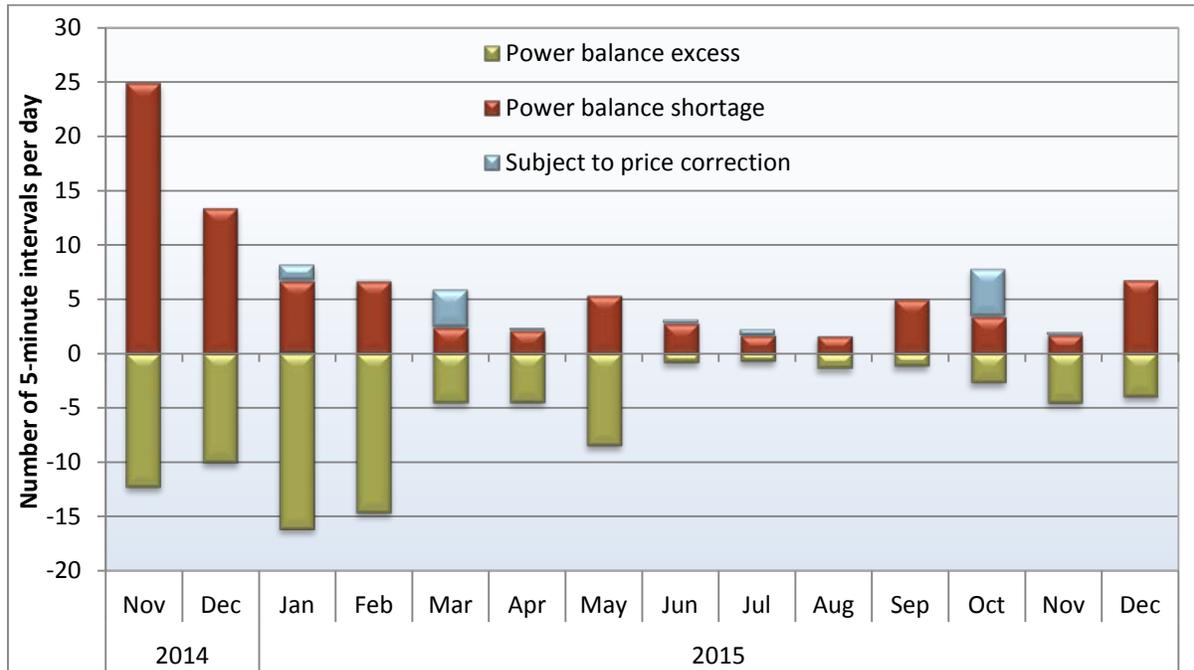
**Figure 1.6 Frequency of constraint relaxation
PacifiCorp East – 5-minute market**



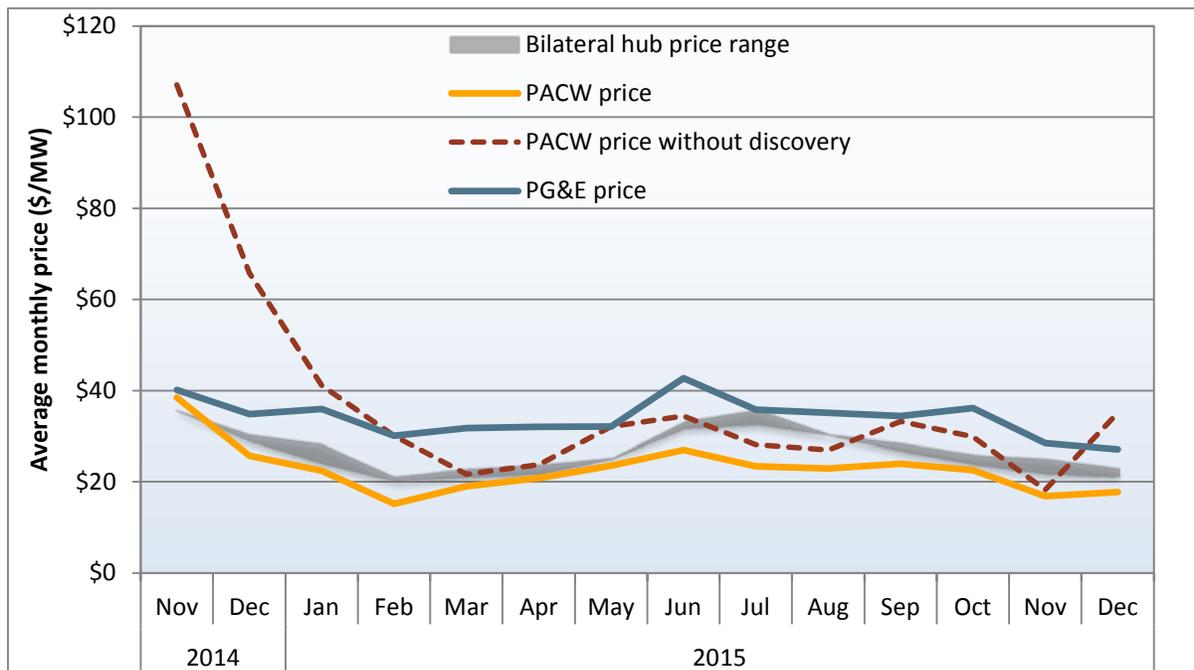
**Figure 1.7 Average monthly prices with and without price discovery
PacifiCorp East – 5-minute market**



**Figure 1.8 Frequency of constraint relaxation
PacifiCorp West – 5-minute market**



**Figure 1.9 Average monthly prices with and without price discovery
PacifiCorp West – 5-minute market**



2 Market software constraint relaxation

EIM performance has been driven primarily by the need to periodically relax several key constraints in the EIM market model. This section provides summary information on the frequency of the constraint violations in the EIM by calendar month for each market. Figure 2.1 and Figure 2.2 summarize the percent of intervals in which the power balance and flexible ramping constraints have been relaxed, by month, in the 15-minute markets in PacifiCorp East and PacifiCorp West, respectively. Figure 2.2 and Figure 2.4 summarize the percent of intervals in which the power balance constraint has been relaxed, by month, in the 5-minute markets in PacifiCorp East and PacifiCorp West, respectively.

Figure 2.1 shows that the total number of flexible ramping constraint relaxations declined dramatically from November to December in the 15-minute PacifiCorp East market. In this market during November, the flexible ramping constraint was relaxed during almost 18 percent of intervals, compared to less than 1 percent of intervals in December. When the flexible ramping constraint is relaxed a \$60/MWh penalty price is imposed, which leads to significant price increases in the 15-minute market. This impacted the PacifiCorp East 15-minute market beginning during September and continued through November. The frequency of flexible ramping constraint relaxations in PacifiCorp East dropped significantly beginning in late November. This decline coincided with the return of a significant amount of generating capacity from outages in PacifiCorp East.

This trend of low flexible constraint relaxations during December is likely to have also been driven, in part, by the addition of NV Energy to the EIM at that time. This addition provides a significant increase in the amount of additional energy scheduled in the 15-minute market, particularly into the PacifiCorp East area. Although flexible ramping capacity cannot be directly imported from other EIM areas, additional energy imports can allow more ramping capacity from resources within an EIM area to remain unloaded and available to meet flexible ramping constraint requirements.

Figure 2.1 and Figure 2.3 show that the frequency of intervals when the power balance constraint was relaxed to allow the market software to balance modeled supply and demand remained at low levels during December in both PacifiCorp East markets.

Figure 2.2 and Figure 2.4 show that the rate of power balance constraint relaxations for energy shortages increased in both the 15-minute and 5-minute markets in PacifiCorp West. In the 15-minute market this constraint was relaxed 1.4 percent of intervals, while in the 5-minute market the constraint was relaxed 2.4 percent of intervals in PacifiCorp West. The increase in power balance relaxations contributed to the increase in divergence between the prices with and without price discovery, discussed above. The ISO's December report indicated that many of these constraint relaxations resulted from unexpected deviations in output from renewable resources.

Figure 2.1 Frequency of constraint relaxation in 15-minute market – PacifiCorp East

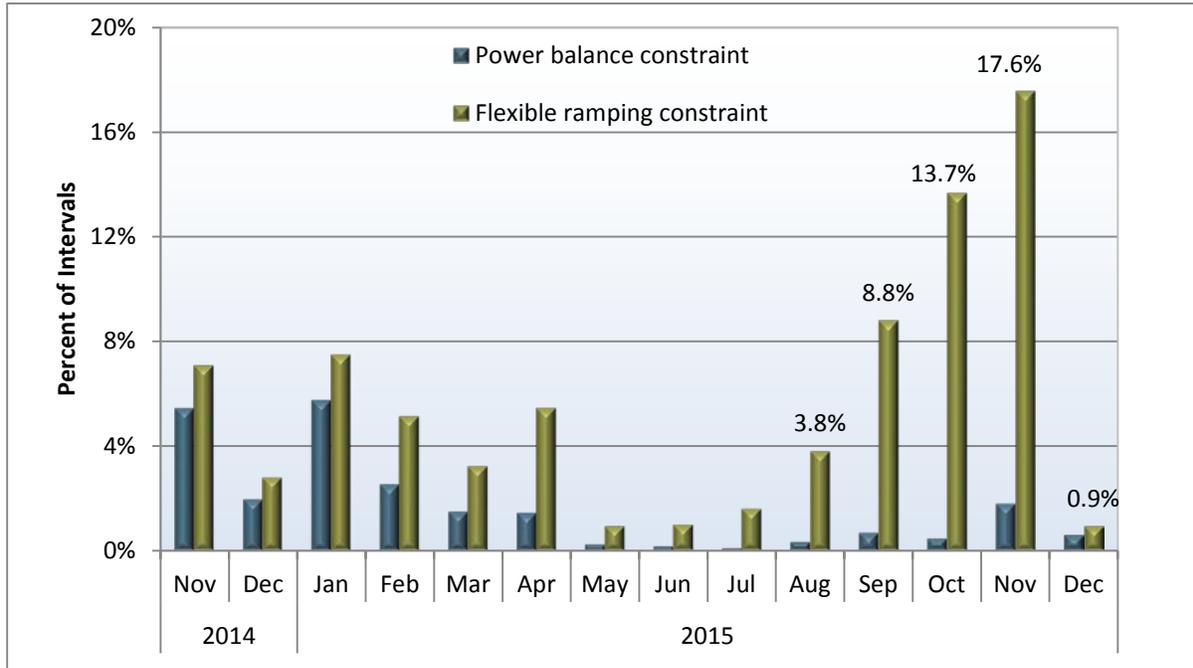


Figure 2.2 Frequency of constraint relaxation in 15-minute market – PacifiCorp West

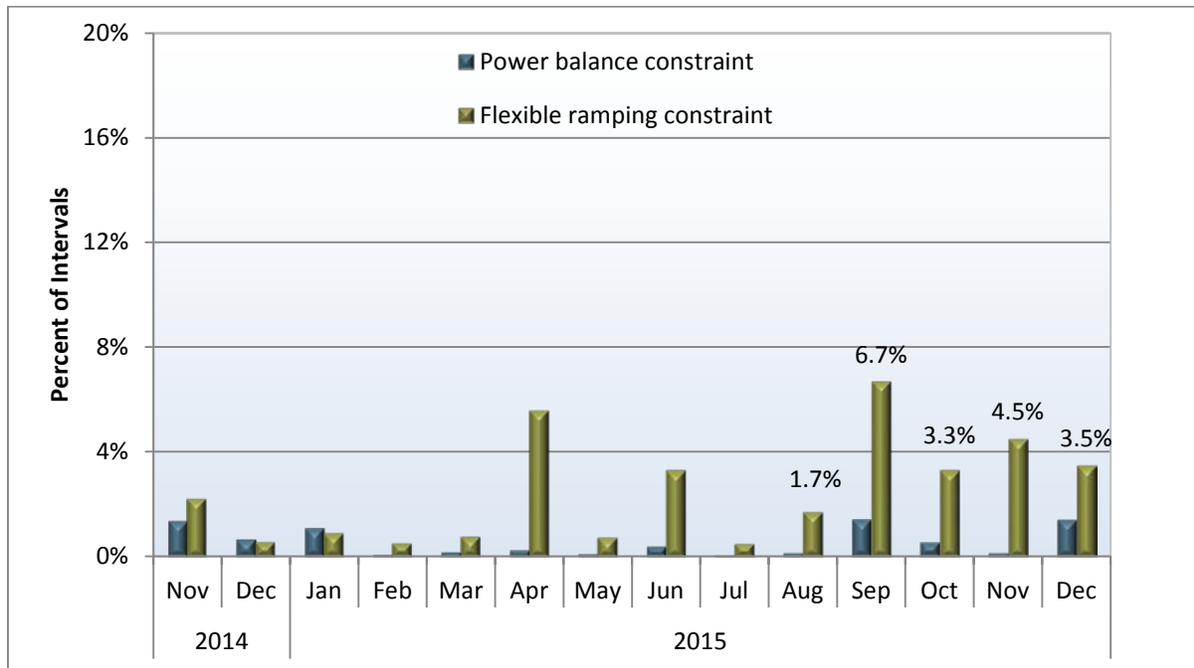


Figure 2.3 Frequency of constraint relaxation in 5-minute market – PacifiCorp East

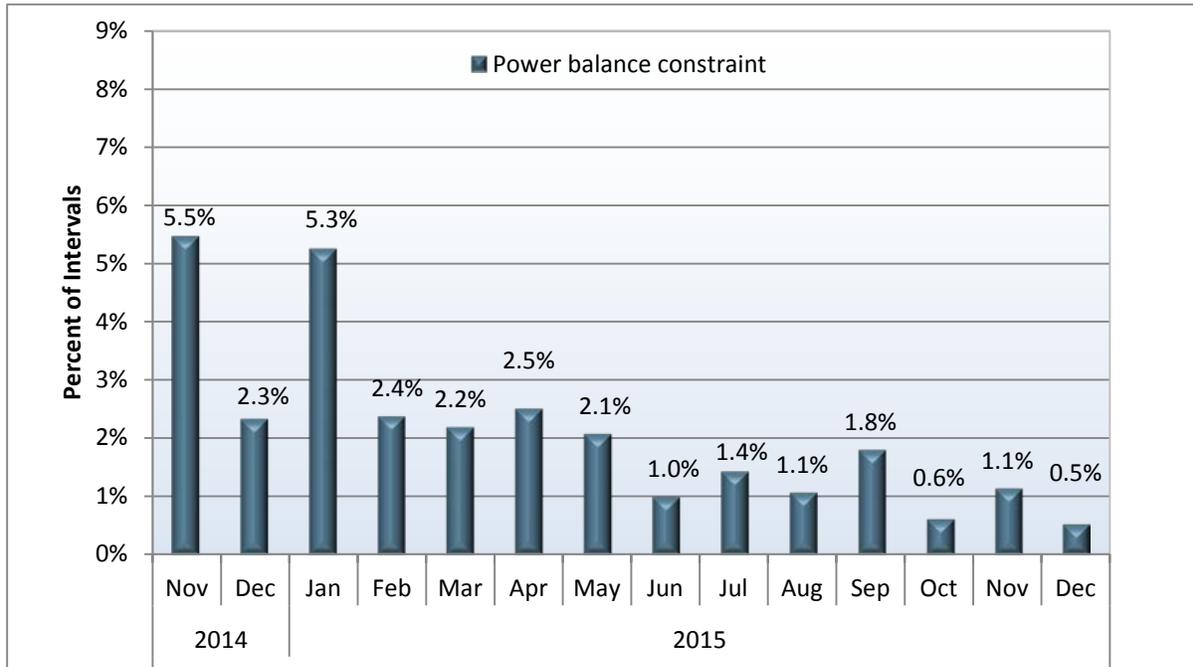
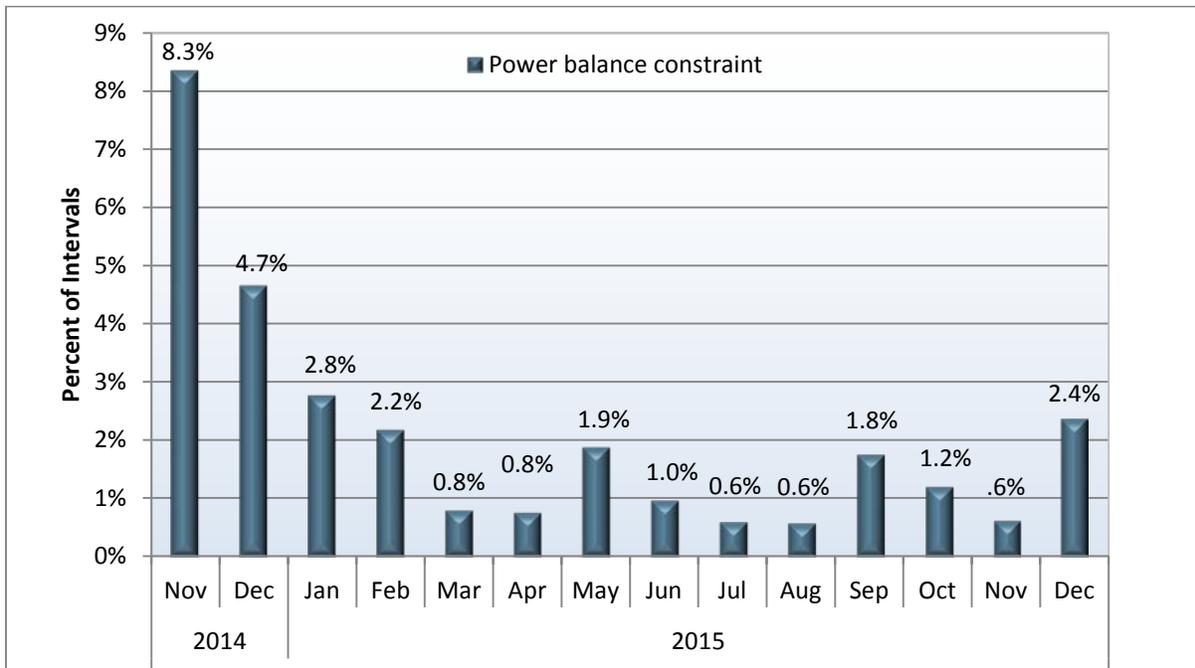


Figure 2.4 Frequency of constraint relaxation in 5-minute – PacifiCorp West



Flexible ramping capacity constraint

A detailed description of the flexible ramping constraint and a description of how the constraint impacts the market was provided in prior DMM reports on EIM market performance. In these reports DMM also discussed the relationship between the flexible ramping constraint and the flexible ramping sufficiency test. The most comprehensive discussion can be found in the EIM report covering November 2015.⁷

Table 2.1 shows that as the requirement for flexible ramping capacity in the 15-minute market increased, starting in June, and at the same time the portion of 15-minute intervals when the flexible ramping constraint bound or was relaxed also increased significantly. When the flexible ramping constraint cannot be met and must be relaxed, during intervals in which price discovery is not triggered by a relaxation of the power balance constraint, energy prices across the balancing area increase by the \$60/MWh shadow price that results for this constraint.

Table 2.1 also shows that in December the percent of intervals where the flexible ramping constraint bound but was not relaxed declined in PacifiCorp West, but remained at around 40 percent of intervals. The percent of intervals the flexible ramping constraint bound but was not relaxed increased in PacifiCorp East to over 50 percent of intervals. This table also shows a deep decline in the percentage of intervals that the flexible ramping constraint was relaxed in PacifiCorp East from November to December, which was noted above.⁸

Figure 2.5 and Figure 2.6 show the incremental impact from shortages of flexible ramping capacity on average prices in the 15-minute market, as well as the percentage of intervals that the flexible ramping constraint binds and is in shortage in PacifiCorp East and PacifiCorp West, respectively. As discussed earlier, the number of intervals where the flexible ramping constraint was relaxed greatly decreased at the end of November and remained low through December in PacifiCorp East. This reduction in relaxations caused the market price to collapse to nearly the 15-minute market price without flexible ramping shortages. For comparison, flexible ramping constraint shortages resulted in a more than \$9/MWh impact on prices during November and around \$8/MWh of impact during October in the same market.

Because of the small impact of flexible ramping constraint relaxations on average 15-minute market prices in PacifiCorp East, these prices fell within the representative bilateral trading hub ranges during December. This may be compared to November when 15-minute PacifiCorp East market prices exceeded the bilateral trading hub price range by 30 to 50 percent. Prices in 15-minute PacifiCorp West market were modestly impacted by flexible ramping constraint relaxations during December, and price impacts have remained relatively consistent during the past few months. Prices in this market continue to remain very close to the representative bilateral trading hub range.

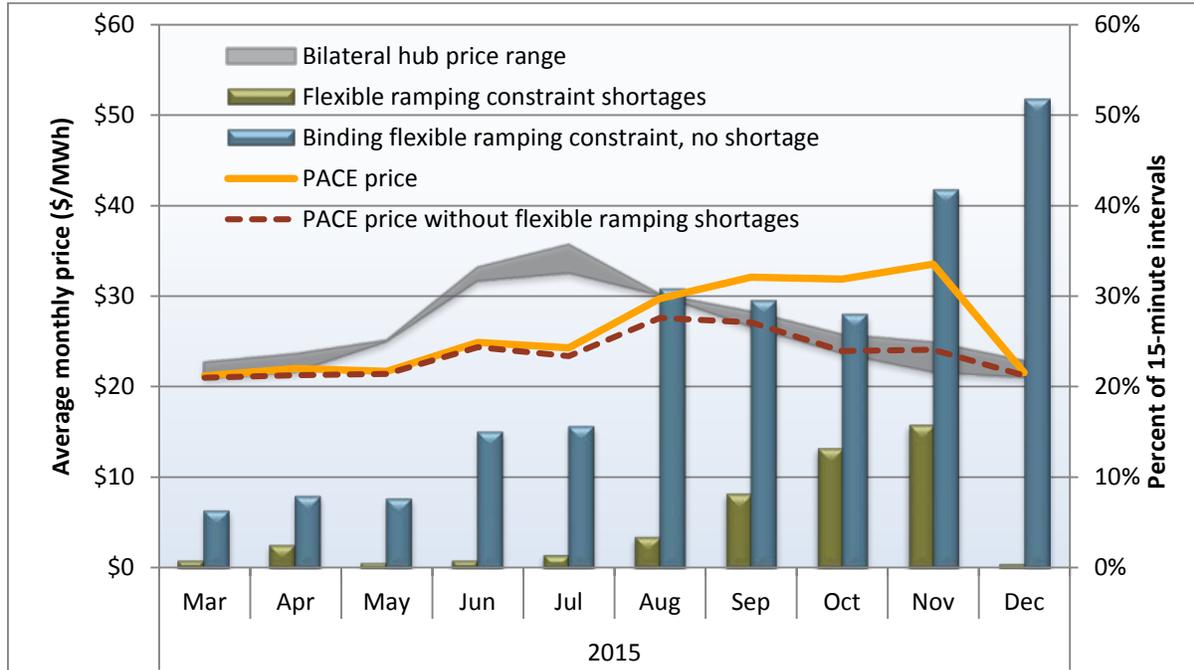
⁷ *Report on Energy Imbalance Market Issues and Performance*, Department of Market Monitoring, January 28, 2016, pp.13-19. http://www.caiso.com/Documents/Jan28_2016_Department_MarketMonitoringReport_Performance_Issues_EIM_Nov2015_ER15-402.pdf.

⁸ The percentage of intervals reported that the flexible ramping constraint is relaxed may differ between the figures in this section and Table 2.1. The figures include all intervals when the flexible ramping constraint binds, whereas Table 2.1 only includes intervals that the flexible ramping constraint binds and there is no coincident power balance constraint relaxation.

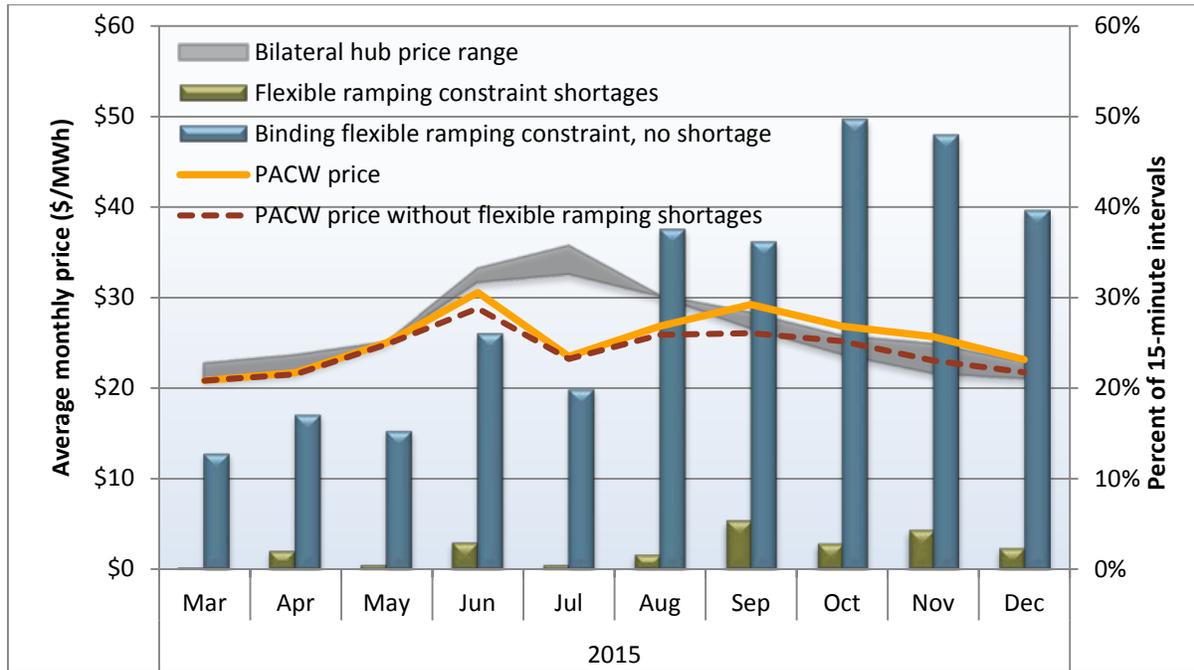
Table 2.1 Flexible ramping constraint requirements and market impacts

	Average flex ramp requirement (MW)	Binding flexible ramping constraint (no shortage)		Relaxed flexible ramping constraint (shortage)	
		% of intervals	Average shadow price	% of intervals	Average shadow price
<i>PacifiCorp East</i>					
March	33	6.4%	\$8.92	0.9%	\$21.17
April	44	8.0%	\$7.57	2.6%	\$27.67
May	39	7.7%	\$7.68	0.6%	\$47.86
June	63	15.1%	\$9.28	0.9%	\$60.00
July	87	15.7%	\$8.91	1.5%	\$60.00
August	112	30.8%	\$11.75	3.5%	\$60.81
September	139	29.5%	\$16.20	8.2%	\$60.31
October	139	28.0%	\$16.28	13.2%	\$60.11
November	134	41.7%	\$9.17	15.8%	\$60.00
December	139	51.7%	\$7.92	0.5%	\$60.00
<i>PacifiCorp West</i>					
March	27	12.9%	\$6.09	0.2%	\$9.54
April	47	17.2%	\$8.00	2.0%	\$9.75
May	32	15.4%	\$6.95	0.5%	\$41.02
June	54	26.1%	\$10.65	2.9%	\$60.85
July	69	20.0%	\$8.78	0.5%	\$60.00
August	86	37.6%	\$9.19	1.6%	\$60.14
September	97	36.2%	\$8.22	5.3%	\$60.00
October	99	49.7%	\$10.05	2.8%	\$60.00
November	99	48.0%	\$8.30	4.3%	\$60.00
December	99	39.7%	\$5.94	2.3%	\$60.00

**Figure 2.5 Impact of flexible ramping constraint relaxation
PacifiCorp East – 15-minute market**



**Figure 2.6 Impact of flexible ramping constraint relaxation
PacifiCorp West – 15-minute market**



Flexible ramping requirements

DMM believes that a primary factor contributing to flexible ramping constraint shortages may be the limited number of observations used by the current methodology to set flexible ramping requirements. As discussed in DMM's last few quarterly reports, on March 30 the ISO implemented an automated procedure to set the flexible ramping requirement in both the ISO and PacifiCorp balancing areas.⁹ This procedure is called the balancing area ramp requirement (BARR) tool.

Because the BARR tool calculates flexible ramping requirements based on a very limited set of historical observations, the tool returns results with a very high variability from one 15-minute interval to the next, in both the ISO and EIM areas. This results in the flexible ramping requirement being set frequently at either the lower or upper thresholds imposed by the ISO on the requirement. Both DMM and other ISO staff are concerned about the limited number of observations used by the BARR tool to calculate flexible ramping requirements and the resulting high percentage of intervals when the requirement is set by the threshold. The limited number of observations used may set requirements unnecessarily high in some intervals and too low in others, when compared to the actual potential demand for ramping capacity in other intervals.

The ISO implemented tighter thresholds in the second quarter of 2015 to decrease the amount of variability that the flexible requirements were set at. While this change helped reduce the volatility of flexible ramping requirements, it did not address the underlying concern about the limited size of observations that was being used by the tool. As noted in our second quarter report, DMM has recommended increasing the set of observations used to calculate the requirement – preferably by grouping surrounding intervals together – to increase the accuracy of the calculation and reduce the high level of variability due to random variations in historical data. The ISO has indicated it will seek to implement this enhancement but has taken several months to review how best to implement this change. DMM recommends that the ISO expedite the implementation of this enhancement.

⁹ *Report on Market Issues and Performance, Q2 2015*, Department of Market Monitoring, August 17, 2015, pp. 43-46.
http://www.caiso.com/Documents/2015_SecondQuarterReport-MarketIssues_Performance-August2015.pdf.

Report on Market Issues and Performance, Q3 2015, Department of Market Monitoring, November 16, 2015, pp. 33-36.
<http://www.caiso.com/Documents/2015ThirdQuarterReport-MarketIssuesandPerformance-November2015.pdf>.

3 Load Bias Limiter

When triggered, the load bias limiter would have the same effect as the price discovery feature by causing 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 was included in the DMM's April 2 report.¹⁰ The ISO included discussion of the load bias limiter in its answer to the comments regarding the ISO's response to the Commission's September 24, 2015 letter requesting additional information on the ISO's August 19, 2015 filing to implement its available balancing capacity proposal in the EIM.¹¹

The percentage of intervals when the energy power balance constraint was relaxed to allow the market software to balance modeled supply and demand remained relatively low during December. This was due to the relatively infrequent number of intervals when the power balance constraint was binding during the month. Without special price discovery provisions in effect, the load bias limiter feature would have been triggered during a low portion of the power balance shortages observed in December. Thus, the load bias limiter would have had a relatively low impact on prices, and would have decreased overall prices in all of the PacifiCorp areas between 4 and 12 percent.

As shown in Figure 3.1, the load bias limiter would have been triggered during a low proportion of the 15-minute intervals in PacifiCorp East when the power balance constraint was binding. It also shows that the power balance constraint was not binding particularly frequently. Similarly, Figure 3.2 shows that the load bias limiter would have been triggered during about one-third of the intervals with power balance shortages in the 15-minute PacifiCorp West market. On aggregate, these findings show that the load bias limiter would have had less impact on prices, and would also have been triggered less frequently than during prior months in the 15-minute markets.

Figure 3.3 shows that power balance constraint shortages were infrequent in PacifiCorp East during December, and when they did occur, the load bias limiter would have been triggered during about half of the intervals. Figure 3.4 shows that during power balance constraint shortages in the 5-minute PacifiCorp West market, the load bias limiter would have been triggered infrequently during December. These results are similar to the results discussed above in the 15-minute market, and thus the load bias limiter has a relatively low impact on overall prices in these markets as well. Figure 3.4 shows that the load bias limiter would have been triggered infrequently during power balance excesses in the 5-minute PacifiCorp market during December as well.

The estimates of EIM prices without price discovery in Section 1 of this report assumes that price discovery provisions are not in place, but energy prices would not be set by the \$1,000/MWh penalty price when the power balance constraint was relaxed and the criteria for triggering the load bias limiter were met.¹² The analysis in this section reflects that on March 20 the ISO indicated that the load bias

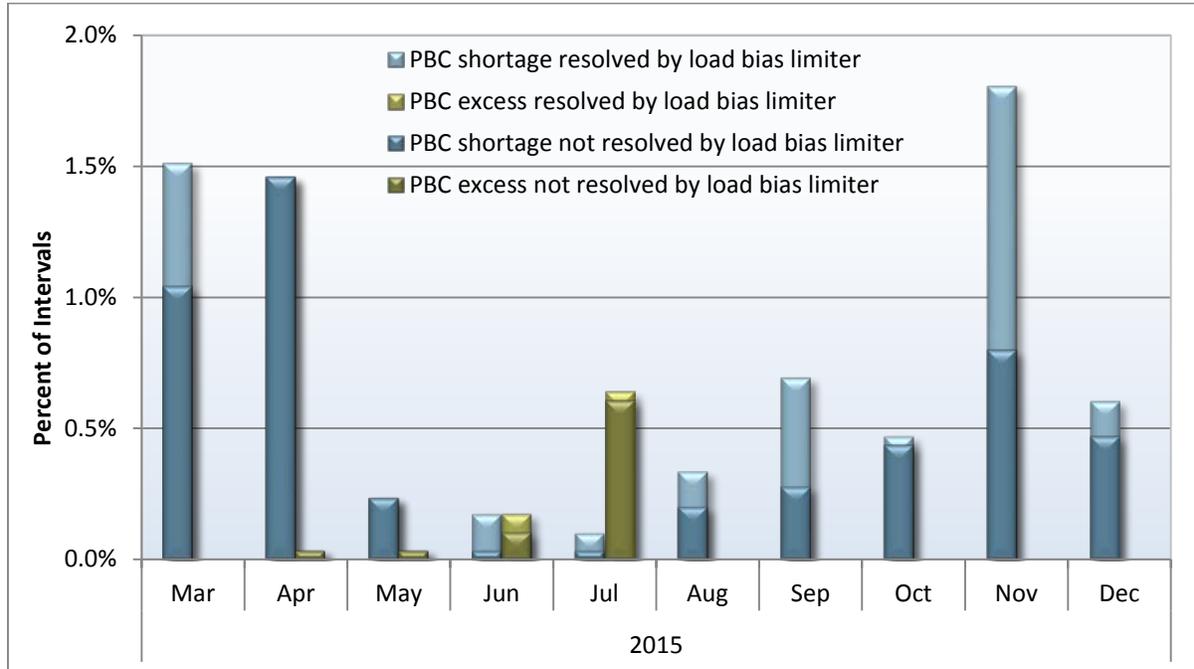
¹⁰ *Report on Energy Imbalance Market Issues and Performance*, Department of Market Monitoring, April 2, 2015, pp.34-35. http://www.caiso.com/Documents/Apr2_2015_DMM_AssessmentPerformance_EIM-Feb13-Mar16_2015_ER15-402.pdf.

¹¹ 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.

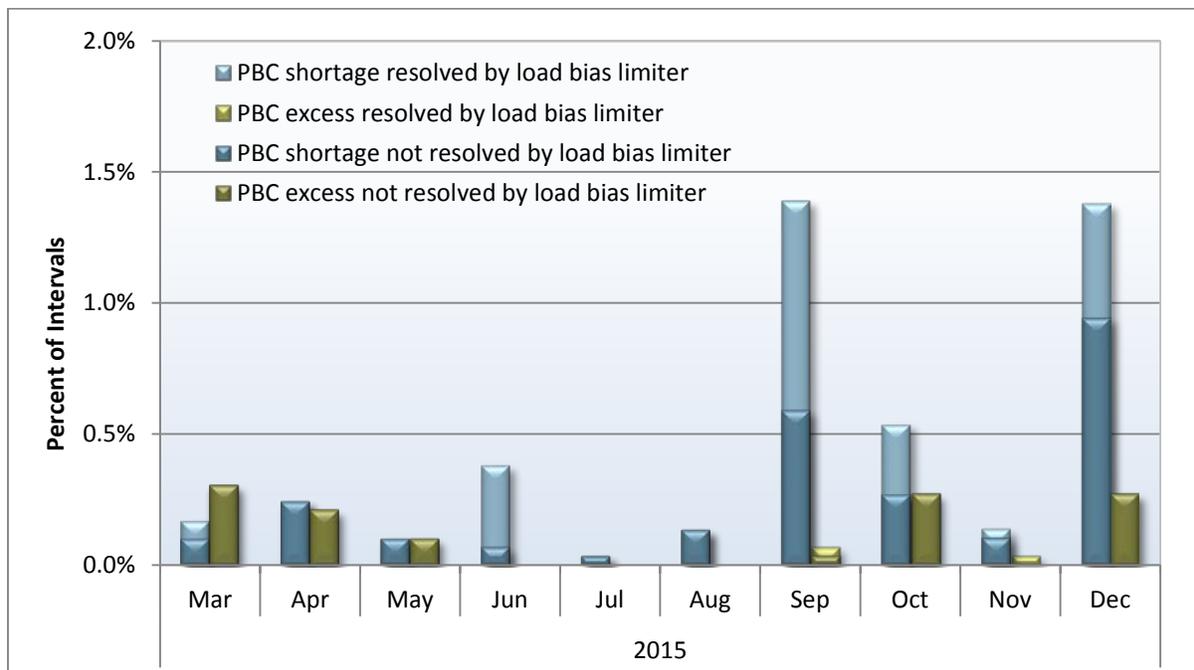
¹² See discussion on in Section 1, page 5.

limiter would have been triggered under these criteria, if price discovery provisions were no longer in effect.

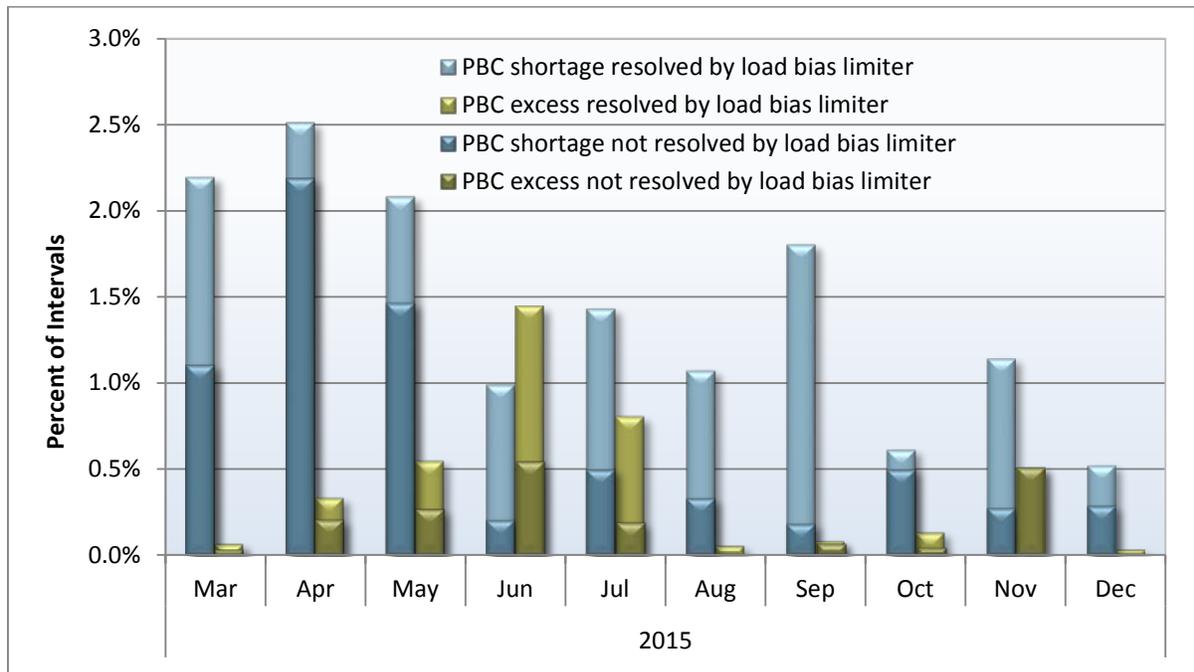
**Figure 3.1 Mitigation of power balance relaxation by load bias limiter
PacifiCorp East – 15-minute market**



**Figure 3.2 Mitigation of power balance relaxation by load bias limiter
PacifiCorp West – 15-minute market**



**Figure 3.3 Mitigation of power balance relaxation by load bias limiter
PacifiCorp East – 5-minute market**



**Figure 3.4 Mitigation of power balance relaxation by load bias limiter
PacifiCorp West – 5-minute market**

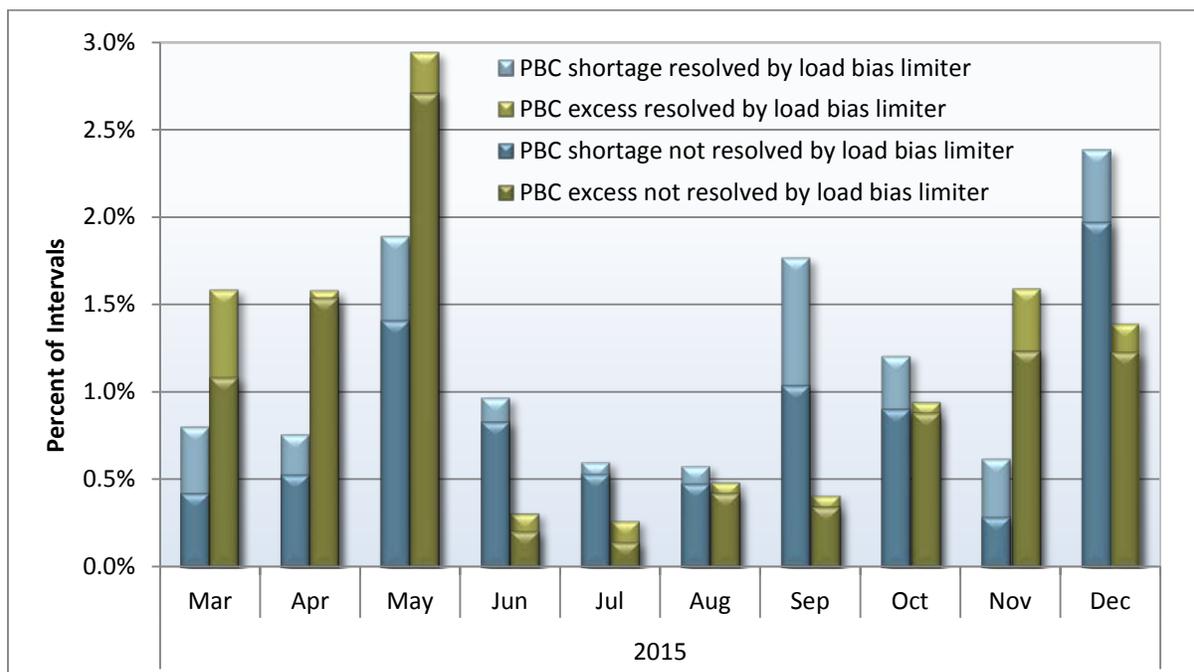


Table 3.1 shows estimated EIM prices if prices were set at the \$1,000/MWh penalty price during intervals when the load bias limiter would have been triggered and the price discovery provisions approved pursuant to FERC’s December 2014 Order were not in effect. As shown in these tables, without existing price discovery provisions, the load bias limiter would have decreased average 15-minute PacifiCorp East prices by only about 5 percent and decreased 15-minute PacifiCorp West prices by about 12 percent during December. Similarly, the load bias limiter would have lowered 5-minute prices by just under 10 percent in both PacifiCorp 5-minute markets during December.

Table 3.1 Impact of load bias limiter on EIM prices (December 2015)

	Bilateral trading hub price (ICE)	Bilateral trading hub price (Powerdex)	Average EIM price	EIM price without price discovery	EIM price without price discovery or load bias limiter	Impact of load bias limiter	
						Dollars	Percent
<i>PacifiCorp East</i>							
15-minute market (FMM)	\$21.18	\$22.99	\$21.53	\$25.78	\$27.02	-\$1.24	-4.6%
5-minute market (RTD)	\$21.18	\$22.99	\$17.59	\$20.24	\$22.33	-\$2.09	-9.4%
<i>PacifiCorp West</i>							
15-minute market (FMM)	\$21.18	\$22.99	\$23.14	\$31.69	\$35.82	-\$4.13	-11.5%
5-minute market (RTD)	\$21.18	\$22.99	\$17.77	\$35.16	\$38.92	-\$3.75	-9.6%

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 29th day of February, 2016.

Is/ Anna Pascuzzo
Anna Pascuzzo