

December 28, 2015

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 October 1, 2015 through October 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) 608-7287

Fax: (916) 608-7222

janders@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

December 22, 2015

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 December 18, 2015 covering the period from October 1 through October 31, 2015 (October Report).¹ This report provides a review by the Department of Market Monitoring (DMM) of EIM performance during the period covered in the ISO's October report. Key findings include the following:

- October marked the end of the first year of EIM operations. Over this twelve month period, average prices in all of the EIM markets were about equal to or below bilateral trading hub prices, providing another indication that EIM results are consistent with results of a competitive market.
- During October, the percentage of intervals when the flexible ramping constraint was relaxed in the 15-minute market – but price discovery provisions were not triggered by relaxation of the energy power balance constraint – continued to increase in PacifiCorp East. During these intervals, when there is a shortage of flexible ramping capacity, the energy price in the 15-minute market includes the \$60/MWh penalty price for the flexible ramping constraint.²
- The increased frequency of flexible ramping constraint shortages in PacifiCorp East has driven up the overall average price in the 15-minute market significantly. During October, flexible ramping constraint shortages drove 15-minute prices higher by about \$8/MWh in PacifiCorp East, up from an impact of about \$5/MWh during the prior month. This resulted in average 15-minute PacifiCorp East prices being higher than average bilateral prices by 34 percent during October. Prices in the 15-minute market were impacted by only about \$1.50/MWh in PacifiCorp West.
- The increased impact of the flexible ramping constraint on prices appears to be attributable to a number of factors. Analysis by DMM indicates that this trend has been driven in large part by an increase in the level of the flexible ramping requirements and a reduction of available ramping capacity due to generation outages. DMM has worked with the ISO and PacifiCorp to further assess and mitigate these flexible ramping constraint issues.
- According to the ISO, other factors contributing to this trend include a software defect impacting the multi-stage generation unit logic, as well as data alignment issues that can contribute to flexible ramping constraint infeasibilities in similar ways that such issues contribute to power balance infeasibilities. The ISO has provided additional explanation of this issue in its most recent monthly report.³
- The trend of increased flexible ramping constraint relaxations in PacifiCorp East continued in November, with prices in the 15-minute market continuing to exceed bilateral prices due to impacts from the flexible ramping constraint. This trend may be mitigated with the addition of Nevada Energy to the energy imbalance market in December since this may significantly increase the amount of additional energy that can be scheduled in the 15-minute market into the PacifiCorp

¹ The ISO's October Report was filed at FERC on December 18 and has not yet been posted to the ISO website.

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

³ Energy Imbalance Market Pricing Waiver Report, October 1 – October 31, 2015, December 18, 2015, p.64.

areas. 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.

- The percentage of intervals when the energy power balance constraint was relaxed decreased in all four markets and returned to low or moderate levels in October from somewhat elevated levels in September. Prices during these intervals continue 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.
- During October, without special price discovery provisions in effect, the load bias limiter feature would have been triggered during very few of the 15-minute intervals in PacifiCorp East when the power balance constraint was relaxed, and about half of the intervals in PacifiCorp West when the power balance constraint was relaxed due to a shortage. In the 5-minute market, the load bias limiter would have been triggered during around 20 percent of intervals with power balance constraint shortages during October in PacifiCorp East and West. This is a reverse from the results during September, when a significantly larger number of intervals of power balance relaxations would have been resolved by the load bias limiter.
- 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. Without the price discovery provisions, the load bias limiter would have reduced average prices in each of the four markets by less than 10 percent during October.

Our last report noted that the ISO has modified the way it performs the flexible ramping sufficiency test over the last year and that DMM has recommended that the ISO continually update the EIM Business Practice Manual to accurately reflect how the flexible ramping sufficiency test is being performed. On December 2, 2015 the ISO posted an updated Business Practice Manual that the ISO indicates reflects the way the way the flexible ramping sufficiency test is currently being performed.⁴

This report is organized as follows: This summary section highlights key findings and trends occurring in October 2015. Section 1 through 3 provide updated charts and tables which have been included in prior reports. Section 4 provides the same figures provided in the special update on the increased impact that the flexible ramping constraint and load bias limiter have had on EIM prices from the last published report from DMM.⁵Energy imbalance market prices

Figure 1.1 and Figure 1.3 show the average daily frequency of constraint relaxations in the 15-minute market by month in PacifiCorp East and PacifiCorp West, respectively. Figure 1.5 and Figure 1.7 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.⁶

⁴ *Business Practice Manual for the Energy Imbalance Market*, Version 4, Revision Date: December 2, 2015, pp.45-52.
<https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Energy%20Imbalance%20Market>.

⁵ *Report on Energy Imbalance Market Issues and Performance*, Department of Market Monitoring, December 1, 2015.
http://www.caiso.com/Documents/Dec1_2015_Department_MarketMonitoringReport_Performance_Issues_EIMfromAug_Sep2015_ER15-402.pdf.

⁶ *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.

Figure 1.2 and Figure 1.4 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 1.6 and Figure 1.8 provide the same monthly price summary for the 5-minute market. All four figures also include monthly average bilateral market prices for trading points that were used to determine balancing energy charges prior to EIM implementation in PacifiCorp East and PacifiCorp West.

Several general results and trends may be observed during the first year of market operation when examining the figures below and are summarized in Figure 1.9. Bilateral trading hub prices for energy averaged under \$26.50/MWh over the entire span of EIM. During that same time period prices in PacifiCorp East averaged about \$26/MWh in the 15-minute market, or 2 percent lower than bilateral prices, and prices averaged about \$22/MWh in the 5-minute market, or about 20 percent lower than bilateral prices. Prices in PacifiCorp West averaged about \$25.50/MWh in the 15-minute market, or 3 percent lower than bilateral prices, and almost \$23/MWh in the 5-minute market, or about 15 percent lower than bilateral prices. Overall this is relatively good convergence and suggests that prices across the market have been competitive.

Furthermore, during the first year, several multiple-month trends emerged that should be noted. During the first few months of EIM the market prices were heavily influenced by price discovery, and with the price discovery provisions in place EIM market prices were roughly equal to the bilateral trading prices that had been used to set market prices prior to the implementation of EIM. Then, during the summer months, there was better convergence between the EIM prices with and without price discovery, and generally the prices tended to be below the bilateral trading prices. Finally, in recent months, there continues to be good convergence between prices with and without price discovery, but the prices in the 15-minute markets have been elevated above bilateral trading prices due to increased relaxations of the flexible ramping constraint.

Table 1.1 shows that without price discovery, prices in PacifiCorp East during October would have been 50 percent higher in the 15-minute market and 7 percent lower in the 5-minute market than bilateral market prices. In PacifiCorp West, prices in October would have been 21 percent higher than bilateral market prices in the 15-minute market and 26 percent higher in the 5-minute market without price discovery. This is the second consecutive month where large deviations from bilateral prices have prevailed in the 5-minute market in PacifiCorp West and 15-minute market for both markets. Table 1.1 shows that prices with price discovery were 34 percent higher than bilateral prices in PacifiCorp East and 13 percent higher in PacifiCorp West in the 15-minute markets. This represents the second consecutive month where a premium of greater than 20 percent has existed in PacifiCorp East in the 15-minute market. These divergences are driven by the increased frequency of relaxation of flexible ramping constraints.

A detailed description of the methodology used to calculate these counterfactual prices that would result without price discovery has been provided in prior reports.⁷ 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

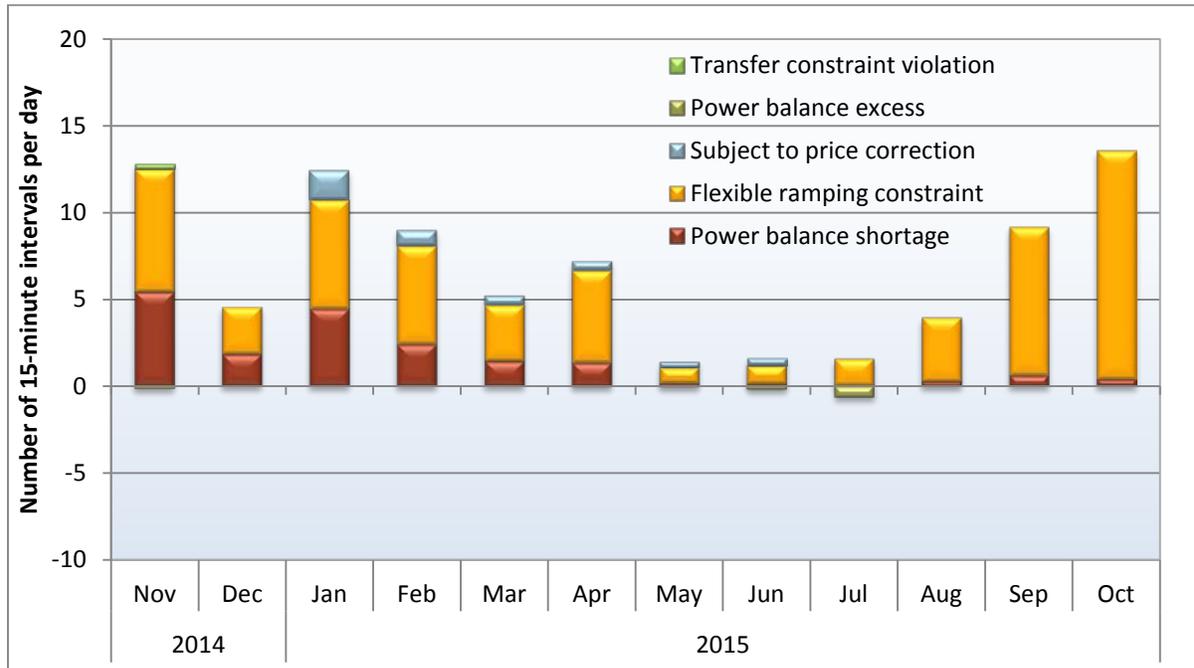
⁷ *Report on Energy Imbalance Market Issues and Performance*, Department of Market Monitoring, April 2, 2015, p.6.
http://www.caiso.com/Documents/Apr2_2015_DMM_AssessmentPerformance_EIM-Feb13-Mar16_2015_ER15-402.pdf.

run, but this software feature would have been triggered if price discovery was not in effect. DMM has also adjusted its analysis to be consistent with the data in the ISO report.⁸

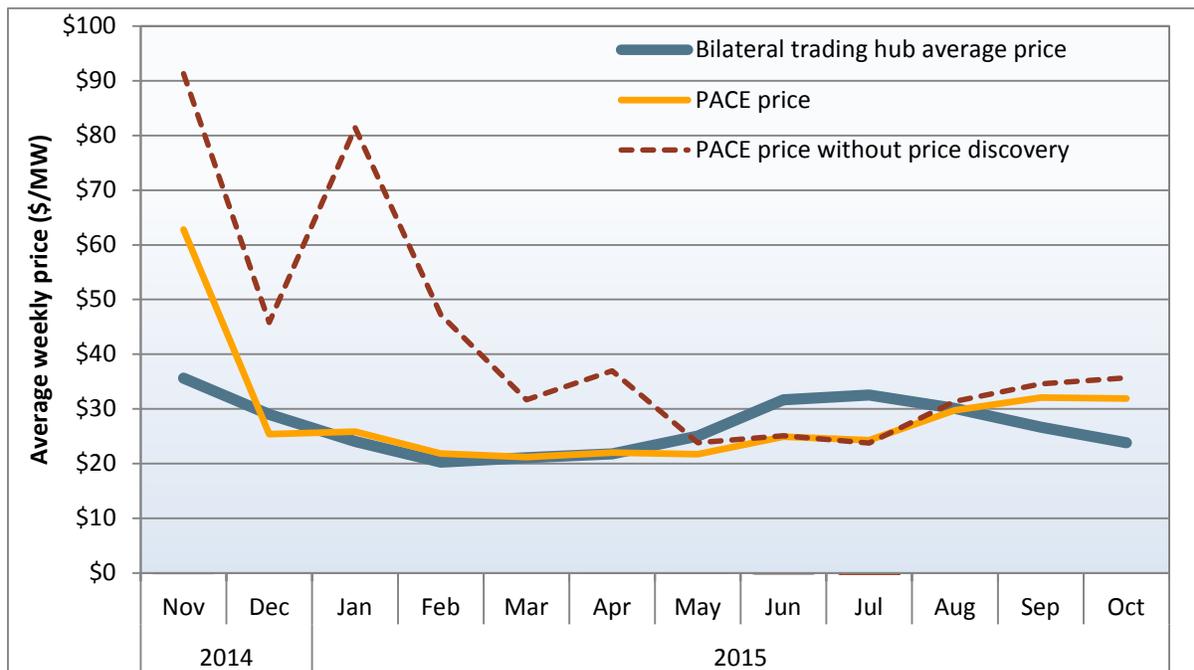
As shown in these figures, the price discovery mechanism approved under the Commission's December 1, 2014 order has mitigated the impact of constraint relaxation on market prices in prior months. In October, the price discovery mechanism was not triggered frequently and prices with and without this mechanism converged relatively well in the 15-minute market in both PacifiCorp East and PacifiCorp West. PacifiCorp West continued to have a somewhat increased frequency of intervals when the power balance constraint was relaxed, which was accompanied with a nearly \$10/MWh divergence between the regional price with the price discovery mechanism and without the price discovery mechanism in the 5-minute market in October. Fewer power balance relaxations resulted in little divergence in the 5-minute PacifiCorp East market during October.

⁸ As in the ISO report, data on the frequency of constraint relaxation exclude 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 limiter would have been triggered, the resulting price would have been equal to the actual price that resulted with price discovery in effect.

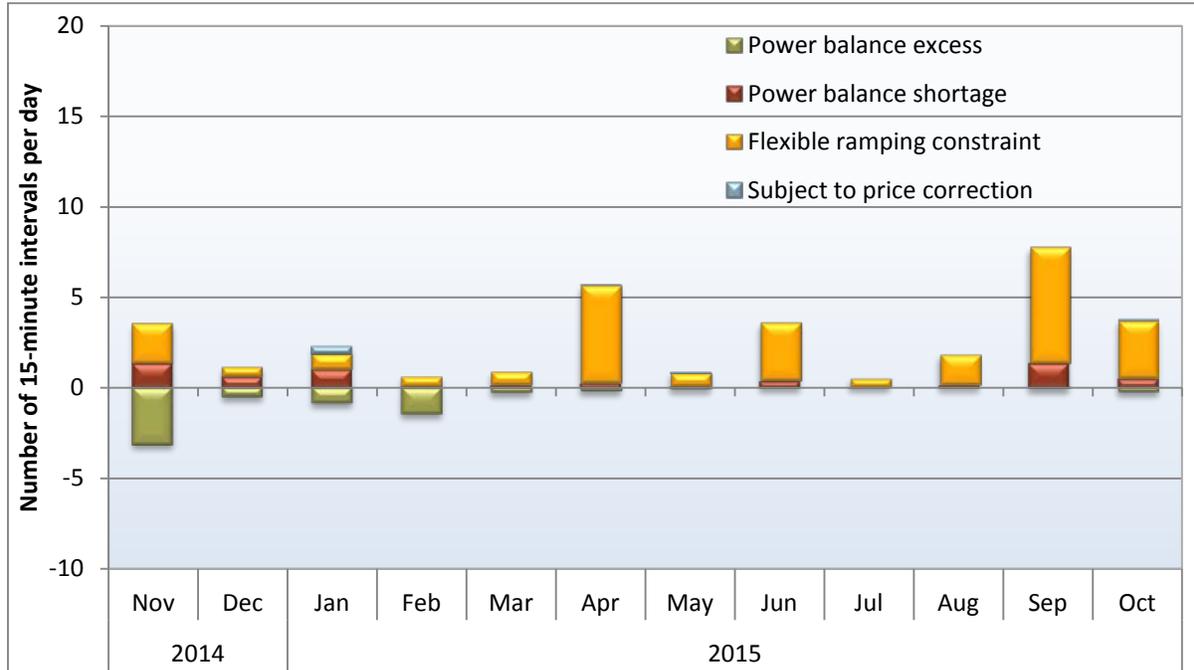
**Figure 1.1 Frequency of constraint relaxation
PacifiCorp East - 15-minute market**



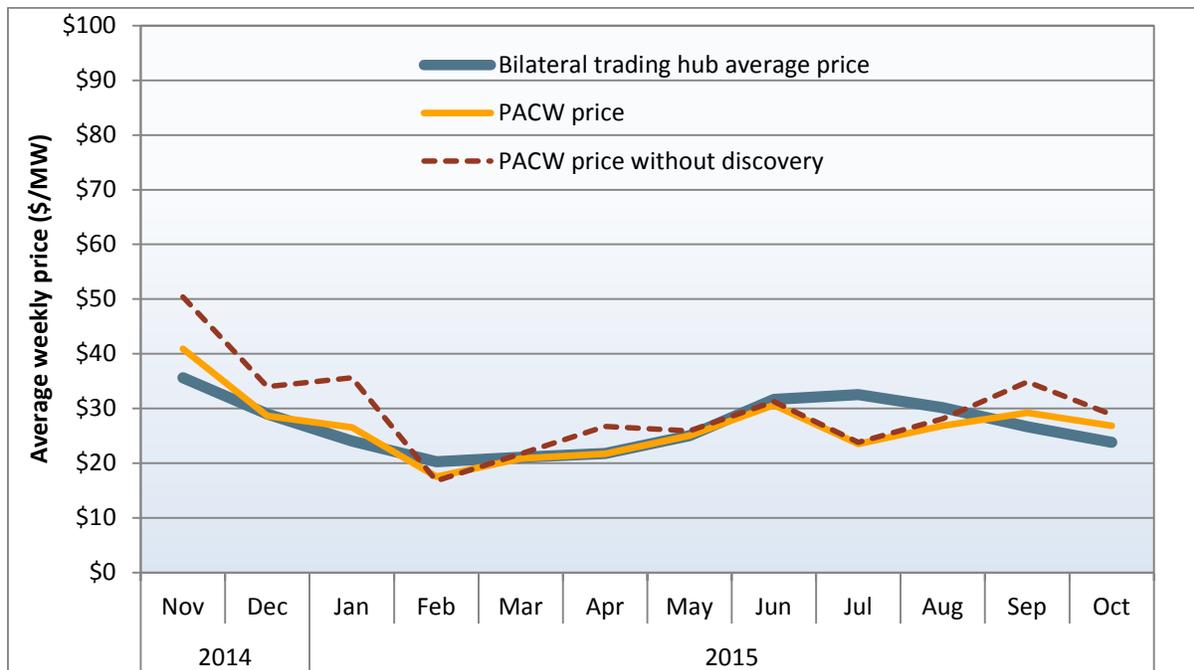
**Figure 1.2 Average daily prices with and without price discovery
PacifiCorp East - 15-minute market**



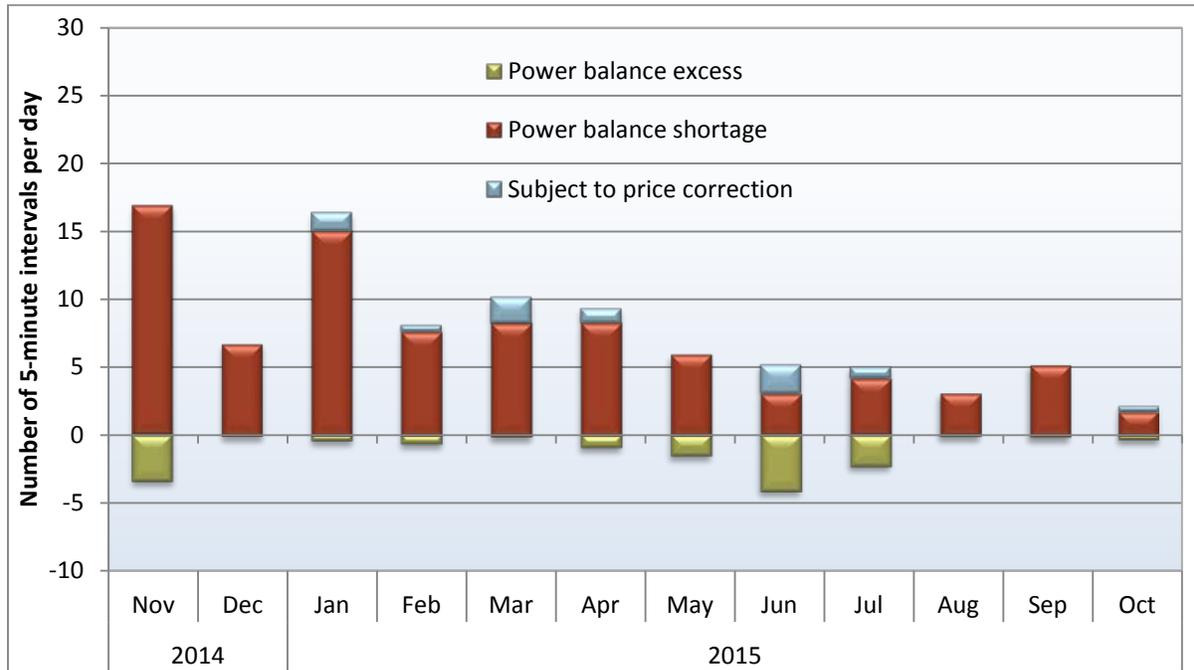
**Figure 1.3 Frequency of constraint relaxation
PacifiCorp West - 15-minute market**



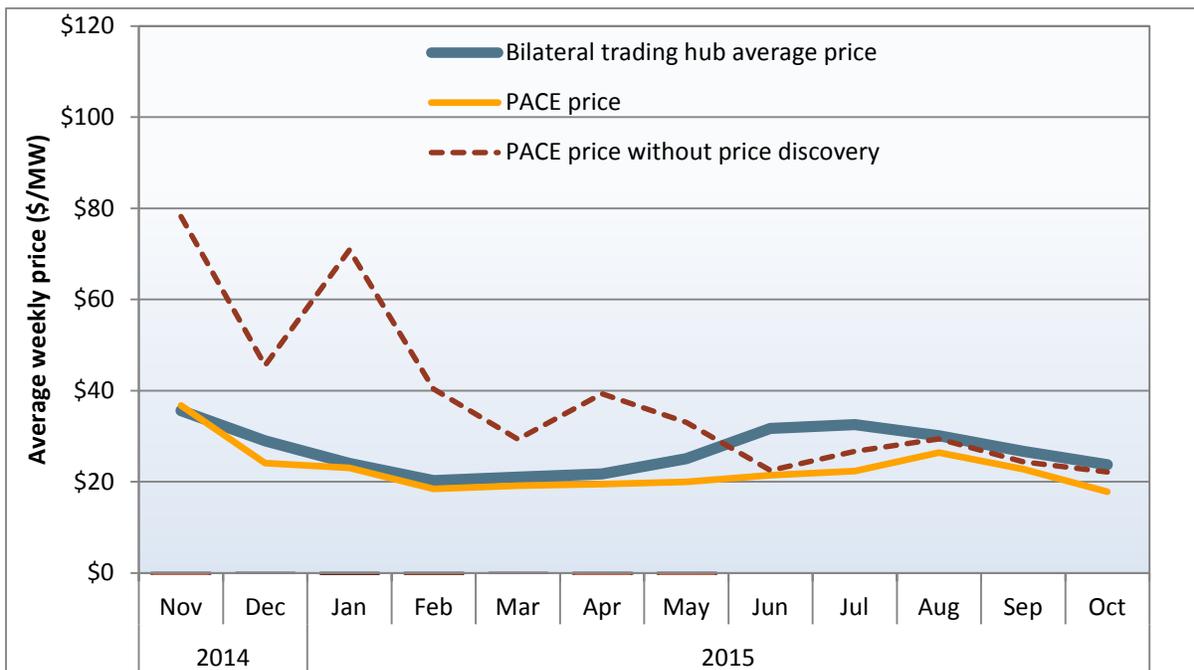
**Figure 1.4 Average daily prices with and without price discovery
PacifiCorp West - 15-minute market**



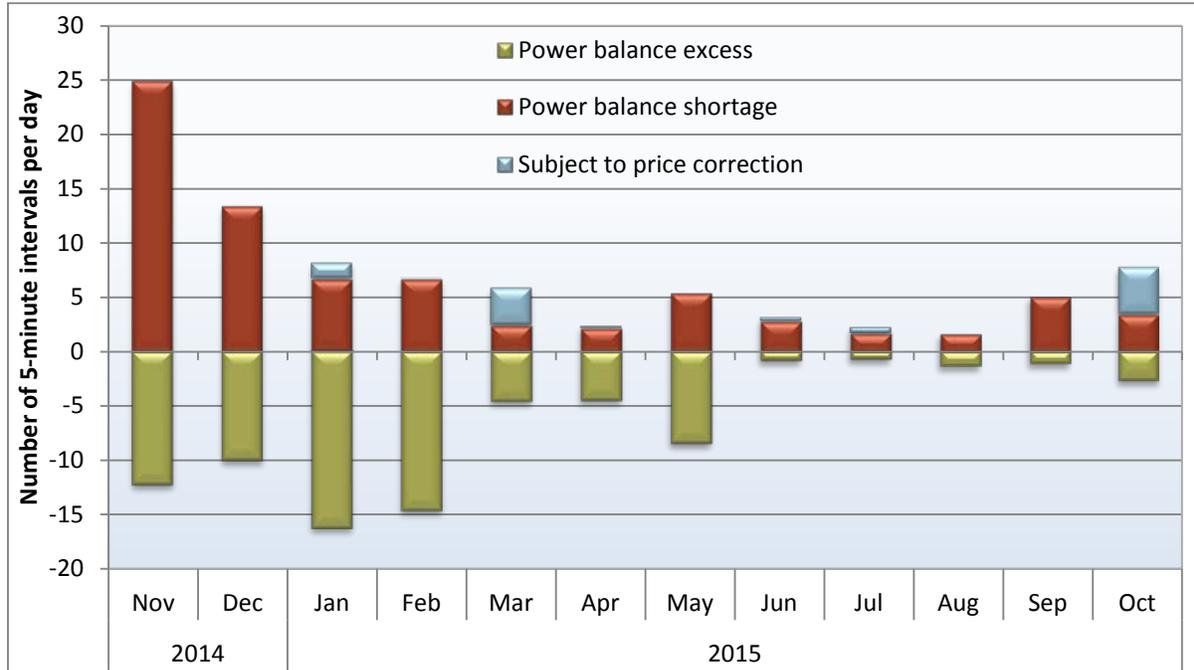
**Figure 1.5 Frequency of constraint relaxation
PacifiCorp East - 5-minute market**



**Figure 1.6 Average daily prices with and without price discovery
PacifiCorp East - 5-minute market**



**Figure 1.7 Frequency of constraint relaxation
PacifiCorp West - 5-minute market**



**Figure 1.8 Average daily prices with and without price discovery
PacifiCorp West - 5-minute market**

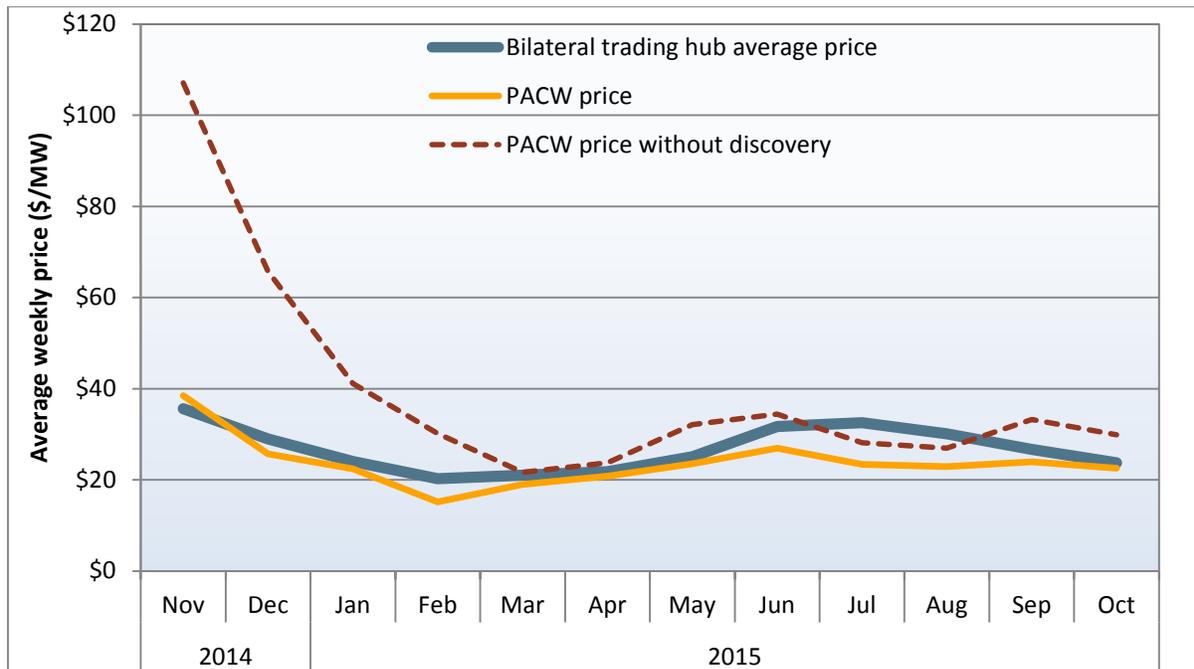


Figure 1.9 Average EIM prices with and without price discovery (Nov 2014 – Oct 2015)⁹

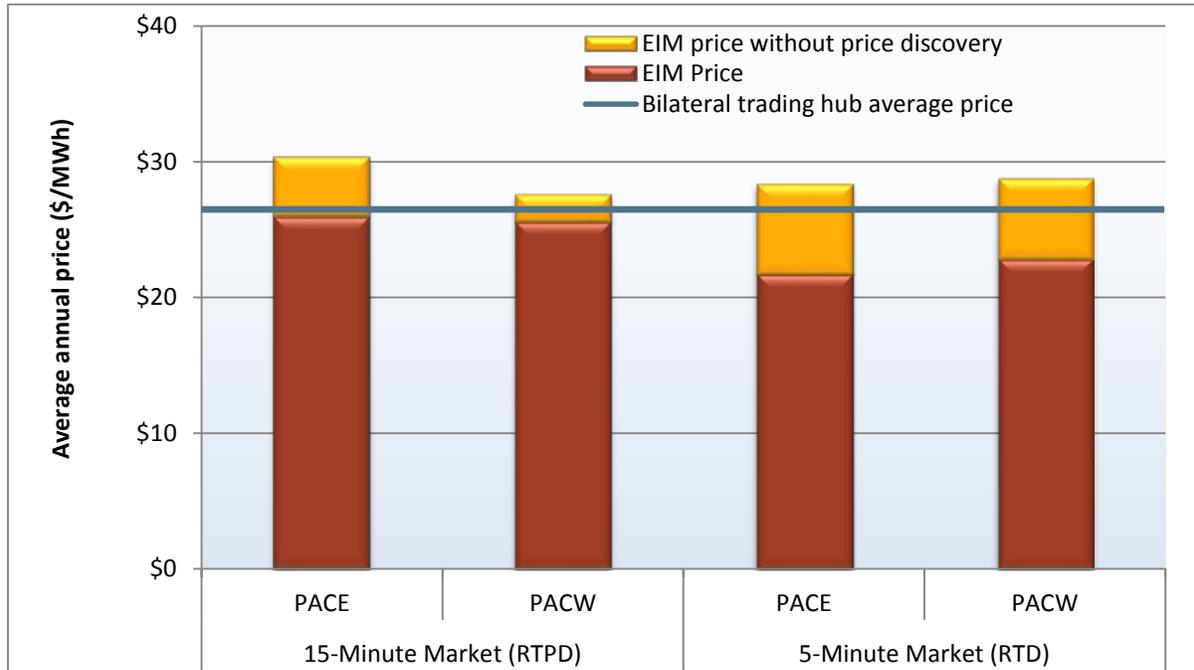


Table 1.1 Average prices in EIM and bilateral markets (October 2015)

	Bilateral trading hub average price	Average EIM price	EIM price without price discovery
<i>PacifiCorp East</i>			
15-minute market (FMM)	\$23.78	\$31.87	\$35.68
5-minute market (RTD)	\$23.78	\$17.79	\$22.17
<i>PacifiCorp West</i>			
15-minute market (FMM)	\$23.78	\$26.84	\$28.89
5-minute market (RTD)	\$23.78	\$22.57	\$29.92

⁹ Data from the first two weeks in November 2014 was excluded due to lack of price discovery information.

1 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 PacifiCorp East and PacifiCorp West, respectively.

Figure 2.1, Figure 2.2, Figure 2.3 and Figure 2.4 show that the frequency of intervals when the power balance constraint was relaxed in October declined in all four markets from somewhat elevated levels in September. In PacifiCorp East relaxations decreased to 0.5 percent of intervals in 15-minute market in October, and decreased to 0.6 percent in the 5-minute market. Similarly, relaxation rates decreased to 0.5 percent in the 15-minute market in PacifiCorp West in October, and decreased to 1.2 percent in the 5-minute market. The continued higher rate of power balance constraint relaxation in PacifiCorp West resulted in greater price separation between EIM prices with and without price discovery, as discussed above. The frequency of power balance constraint relaxations in the other markets for October were low compared to previous periods, and thus we saw good convergence between EIM prices with and without price separation.

Figure 2.1 shows a continued trend of record levels of flexible ramping constraint relaxations in the 15-minute market in PacifiCorp East. In October flexible ramping relaxation rates rose to 13.7 percent of all intervals in that market. The increased frequency of intervals when the flexible ramping constraint is relaxed, at the \$60/MWh penalty price, has driven the overall average price in the 15-minute market up significantly in PacifiCorp East during October and the prior month. As discussed above, flexible ramping constraint relaxations has resulted in a greater than 30 percent divergence between the 15-minute PacifiCorp East price and bilateral prices.

Figure 2.2 shows that flexible ramping constraint relaxations in PacifiCorp West remained at an elevated level in October, but were not nearly as pronounced as those in PacifiCorp East for the same month. Overall relaxation rates dropped from 6.7 percent in September to 3.3 percent in October, a rate that continues to be above average.

The increase in flexible ramping constraint activity is likely to have occurred as a result of higher flexible ramping requirements and a reduction of available ramping capacity due to generation outages, compounded with a software defect that affected the flexible ramping constraint. The ISO suggests that the need for the software enhancements were an important driver of infeasibilities, but it is unclear to what degree the software fix will reduce the infeasibilities. DMM continues to believe that the two primary drivers for the infeasibilities were the increase in flexible ramping requirements and the generation outages.

Figure 2.1 Frequency of constraint relaxation by month – PacifiCorp East

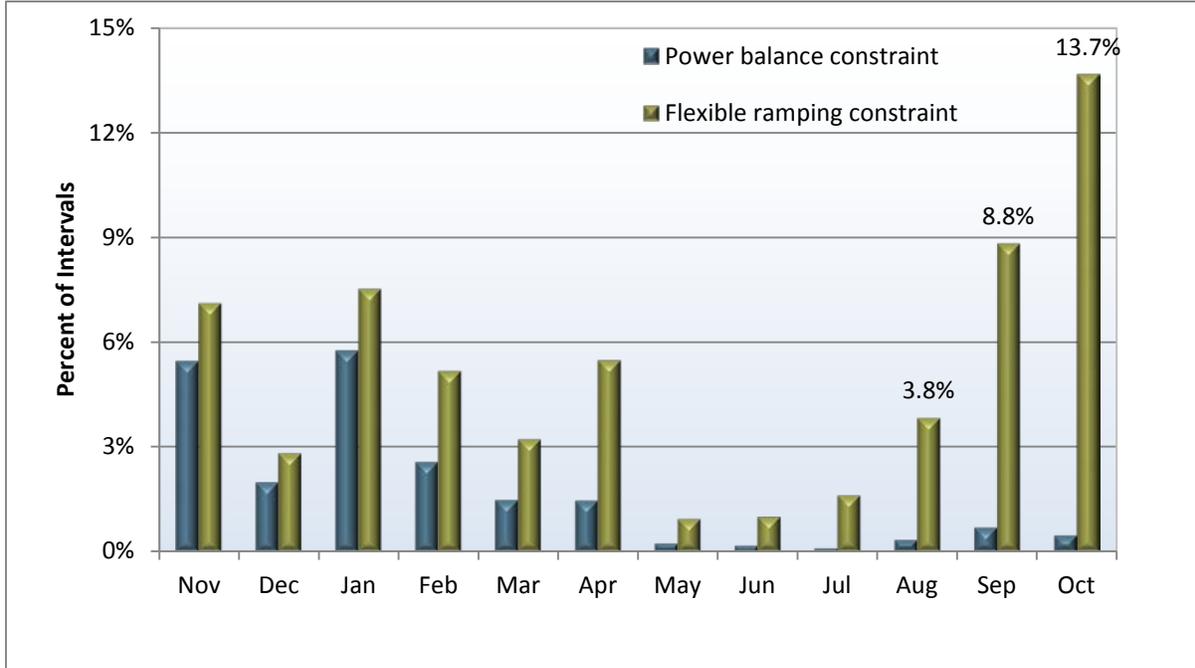


Figure 2.2 Frequency of constraint relaxation by month – PacifiCorp West

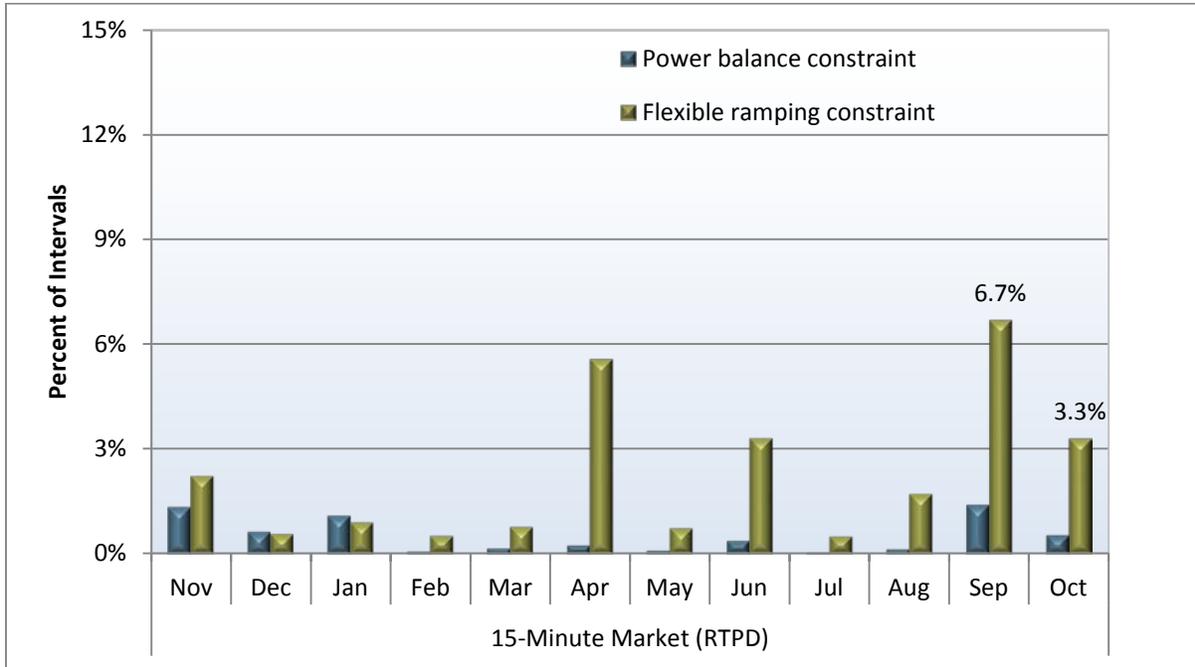


Figure 2.3 Frequency of 5-minute market constraint relaxation by month PacifiCorp East

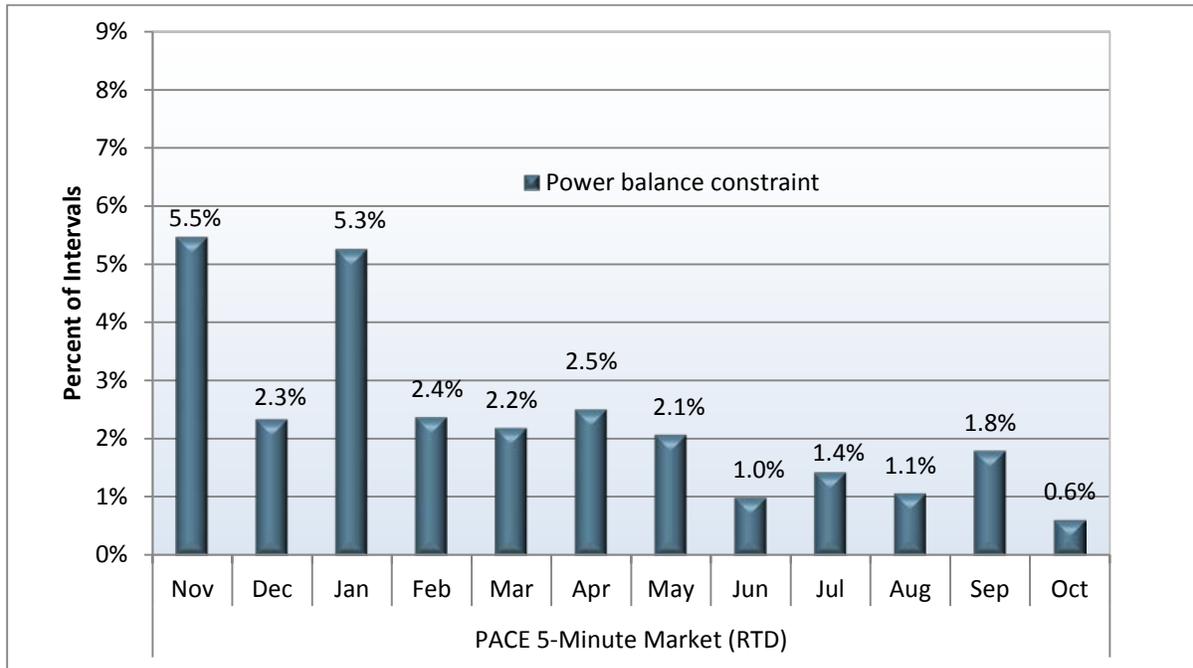
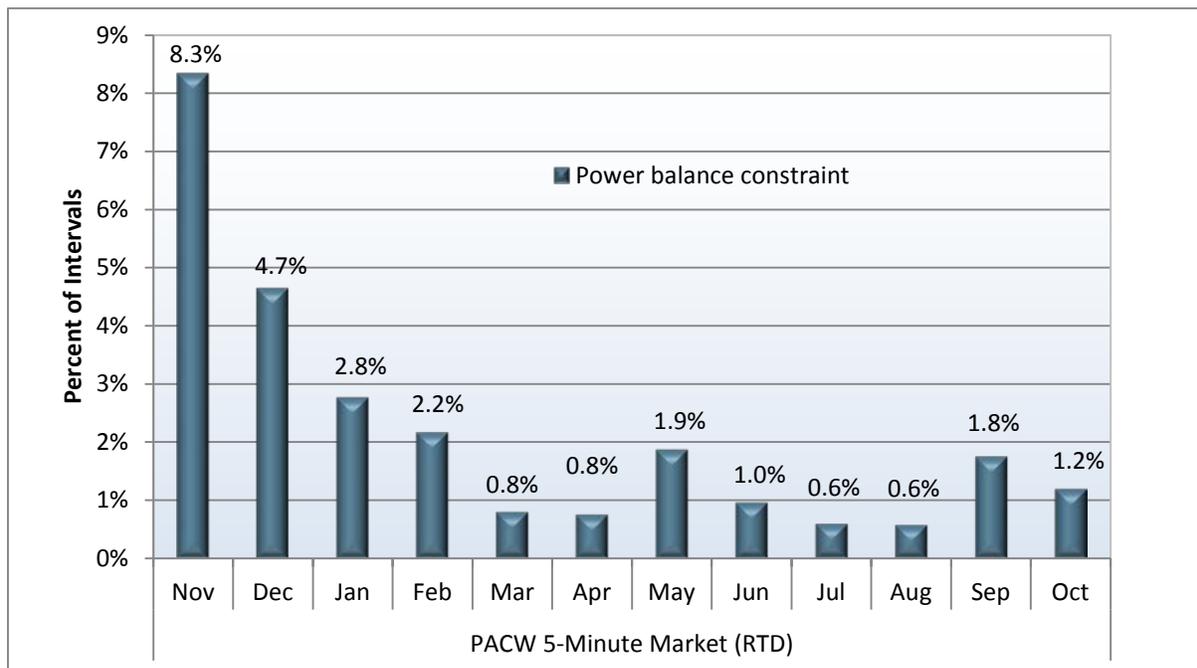


Figure 2.4 Frequency of 5-minute market constraint relaxation by month PacifiCorp West



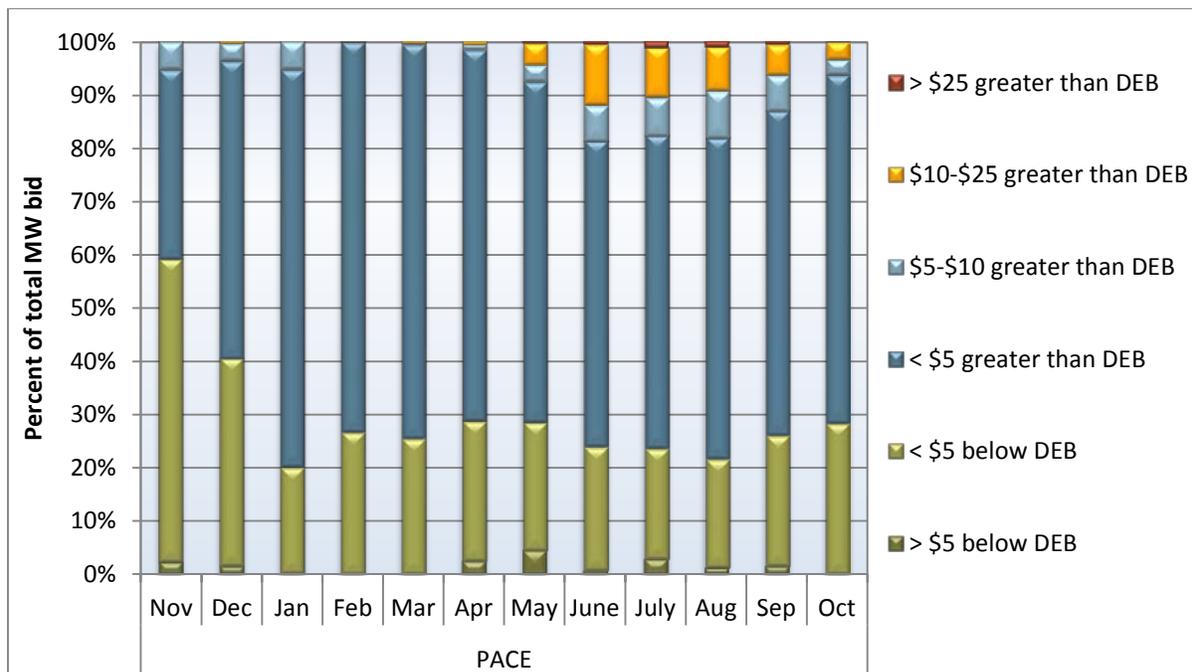
2 Market bidding and mitigation

Most of the bids for capacity are below or slightly above default energy bids (DEBs) used for market power mitigation. In addition, when bids are mitigated due to market power mitigation provisions, these procedures generally result in modest reductions in bid prices.

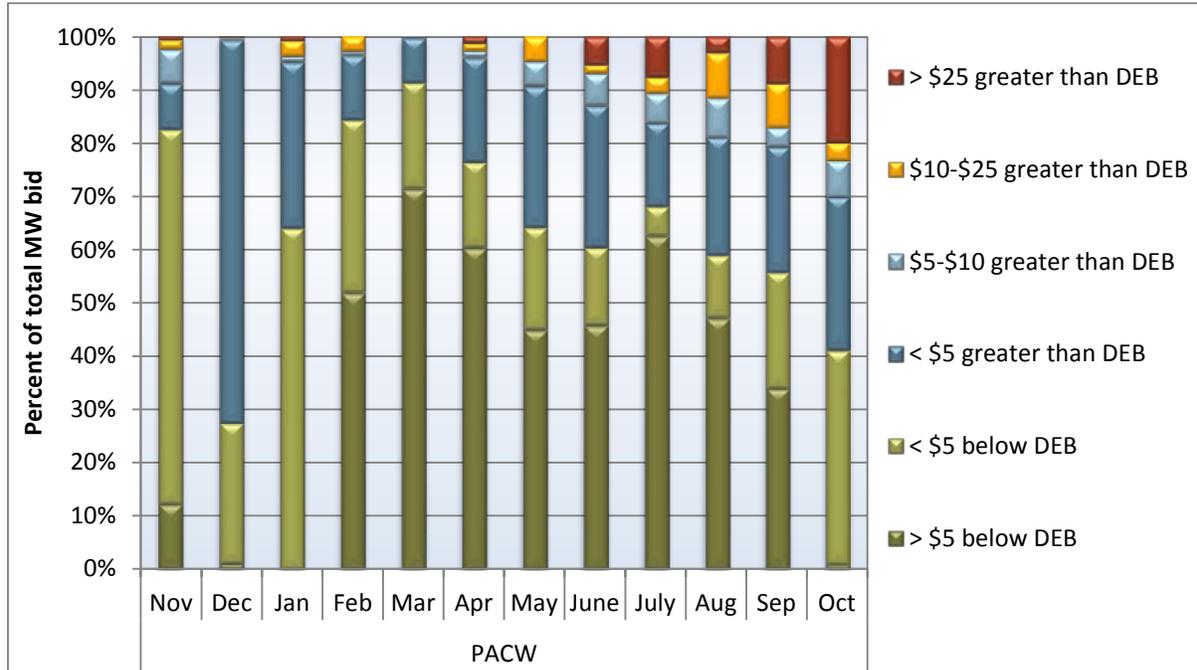
Figure 3.1 summarizes a comparison of bid prices in PacifiCorp East for thermal and hydro units compared to DEBs used in market power mitigation. Figure 3.2 shows the same information for PacifiCorp West. These DEBs are based on the marginal operating costs of thermal resources or opportunity cost for hydro resources with limited energy and energy storage capabilities.

Figure 3.1 shows that the bidding pattern in PacifiCorp East in October was fairly similar to prior months. In PacifiCorp East, there was a very small volume of bids more than \$5/MWh above the default energy bid and a steady volume of bids below the default energy bid. Figure 3.2 shows that in PacifiCorp West there was an increase in the volume of bids more than \$25/MWh above the default energy bid in October and a near elimination of bids greater than \$5/MWh below the default energy bid. The continued increase in bids more than \$25/MWh above the default energy bid during October is mainly due to bids from hydroelectric facilities.

**Figure 3.1 Comparison of market bids to default energy bids
PacifiCorp East**



**Figure 3.2 Comparison of market bids to default energy bids
PacifiCorp West**



3 Special issues

DMM's last monthly report on energy imbalance market issues and performance provided a detailed description of the impact that the flexible ramping constraint and load bias limiter have had on EIM prices.¹⁰ That monthly report also provides a detailed description of the flexible ramping sufficiency test, the flexible ramping constraint, and the load bias limiter. In this section we provide the same set of figures and tables that were included in that report, and provide a short analysis of the results from October.

Flexible ramping sufficiency test and constraint

Table 4.1 shows that in October the flexible ramping requirement is significantly higher than the requirements observed earlier in the year. In PacifiCorp East, the average requirement increased from 39 MW in May to 139 MW in October. In PacifiCorp West the average requirement increased from 32 MW to 99 MW during the same interval.

Our last report noted that the ISO has modified the way it performs the flexible ramping sufficiency test over the last year and that DMM has recommended that the ISO continually update the EIM Business Practice Manual to accurately reflect how the flexible ramping sufficiency test is being performed. On December 2 the ISO posted an updated Business Practice Manual that the ISO indicates reflects the way the way the flexible ramping sufficiency test is currently being performed.¹¹

Table 4.1 also shows the percentage of intervals that the flexible ramping constraint bound was significantly higher in October than months earlier in the year, particularly in PacifiCorp East. This table also shows that during intervals when the constraint was relaxed it had an impact on energy imbalance market price of over \$60/MWh, which is also significantly higher than average shadow prices during months earlier in the year.

As shown in Figure 4.1, the frequency of hours when the flexible ramping sufficiency test failed in PacifiCorp East increased significantly from September to October, and a majority of that increase was during intervals when the flexible ramping constraint bound at the same time the flexible ramping sufficiency test fails. Figure 4.2 shows that during October there was a significant decrease of hours when the flexible ramping sufficiency test fails in PacifiCorp West.

Figure 4.2 and Figure 4.3 show that most 15-minute intervals in which the flexible ramping constraint was relaxed occur during hours when the flexible ramping sufficiency test was passed, which continues to be the trend from the last few months.

The increased frequency of intervals when the flexible ramping constraint is relaxed at the \$60/MWh penalty price has driven the overall average price in the 15-minute market up significantly in both PacifiCorp areas. Figure 4.4 and Figure 4.5 show the incremental impact from shortages of flexible ramping capacity on average prices in the 15-minute market

¹⁰ *Report on Energy Imbalance Market Issues and Performance*, Department of Market Monitoring, December 1, 2015: http://www.caiso.com/Documents/Dec1_2015_Department_MarketMonitoringReport_Performance_Issues_EIMfromAug_Sep2015_ER15-402.pdf.

¹¹ *Business Practice Manual For The Energy Imbalance Market*, Version 4, Revision Date: December 2, 2015, pp.45-52, <https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Energy%20Imbalance%20Market>

During October, flexible ramping constraint shortages had a greater impact on prices and drove 15-minute prices higher by about \$8/MWh in PacifiCorp East and about \$1.50/MWh in PacifiCorp West. This resulted in prices being higher than bilateral prices by about 34 percent and 13 percent in each of these markets respectively.

Prior to August, the flexible ramping constraint shortages had never increased prices by more than \$1/MWh during 2015 in either PacifiCorp East or PacifiCorp West. DMM is working with the ISO and PacifiCorp to further assess and mitigate these flexible ramping constraint issues.

Table 4.1 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%	\$8.92	0.9%	\$21.17
April	44	8%	\$7.57	2.6%	\$27.67
May	39	8%	\$7.68	0.6%	\$47.86
June	63	15%	\$9.28	0.9%	\$60.00
July	87	16%	\$8.91	1.5%	\$60.00
August	112	31%	\$11.75	3.5%	\$60.81
September	139	30%	\$16.20	8.2%	\$60.31
October	139	28%	\$16.28	13.2%	\$60.11
<i>PacifiCorp West</i>					
March	27	13%	\$6.09	0.2%	\$9.54
April	47	17%	\$8.00	2.0%	\$9.75
May	32	15%	\$6.95	0.5%	\$41.02
June	54	26%	\$10.65	2.9%	\$60.85
July	69	20%	\$8.78	0.5%	\$60.00
August	86	38%	\$9.19	1.6%	\$60.14
September	97	36%	\$8.22	5.3%	\$60.00
October	99	50%	\$10.05	2.8%	\$60.00

Figure 4.1 Flexible ramping sufficiency test results - PacifiCorp East

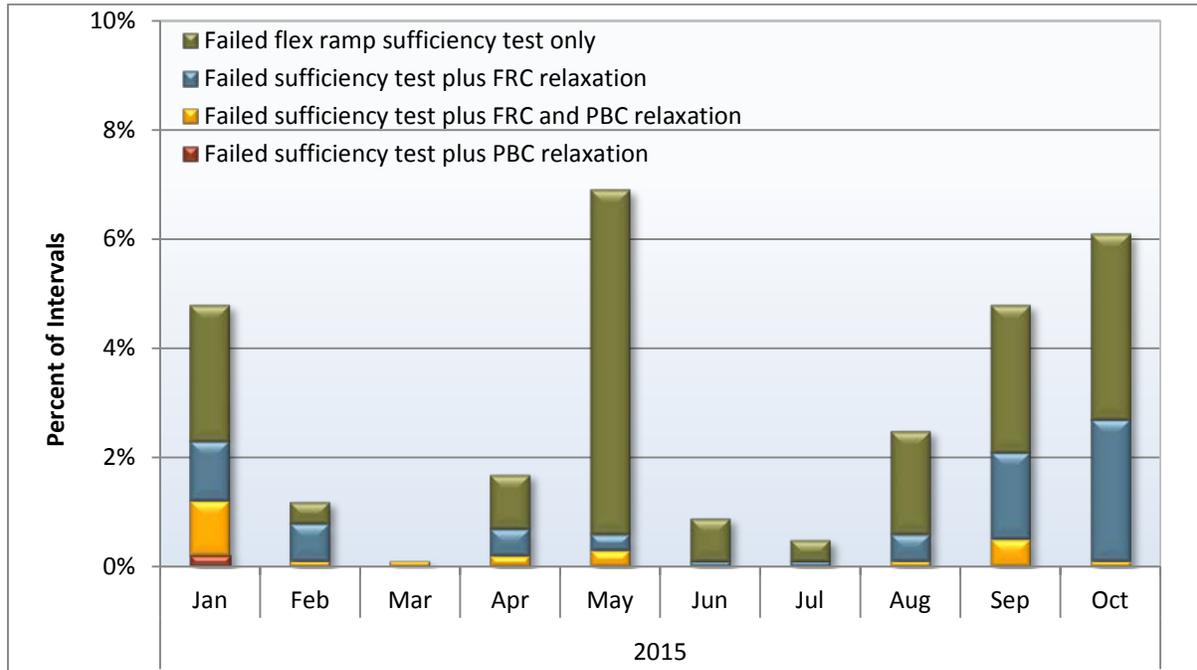


Figure 4.2 Flexible ramping sufficiency test results - PacifiCorp West

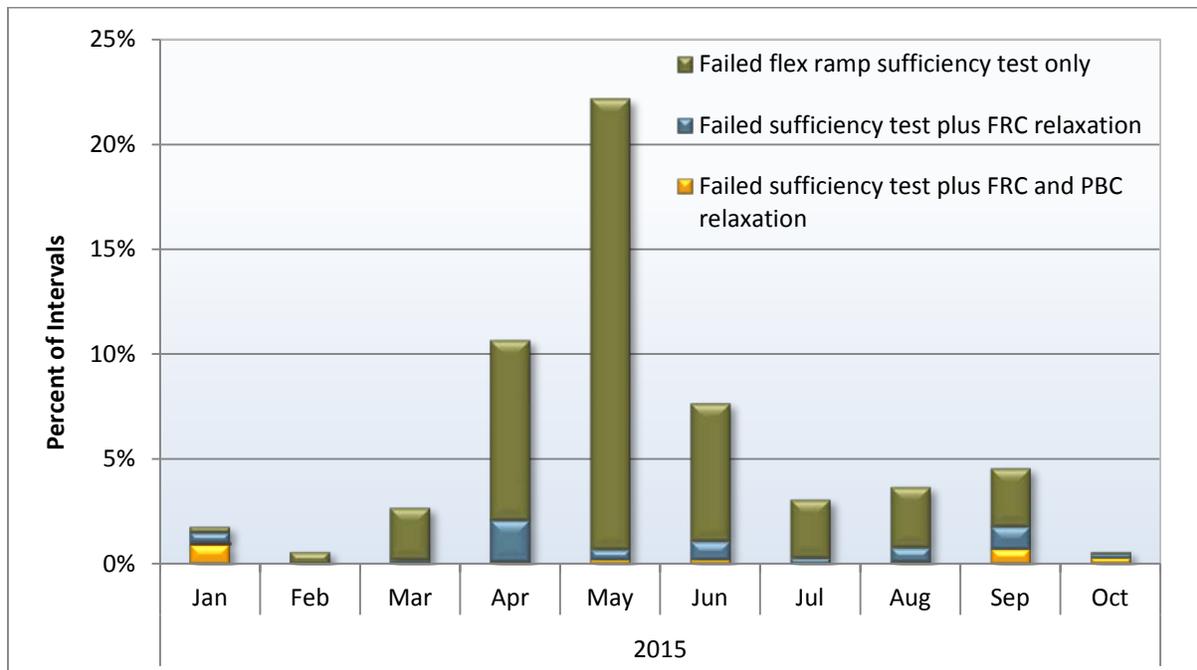


Figure 4.3 Flexible ramping constraint relaxation and sufficiency test results PacifiCorp East

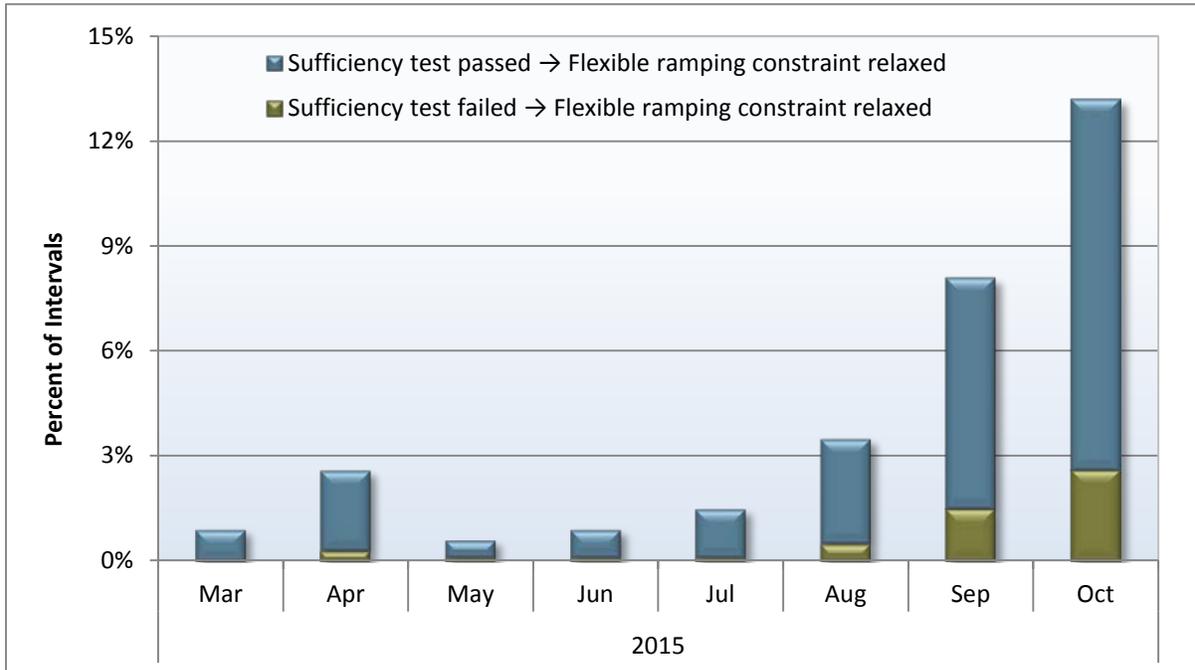


Figure 4.4 Flexible ramping constraint relaxation and sufficiency test results PacifiCorp West

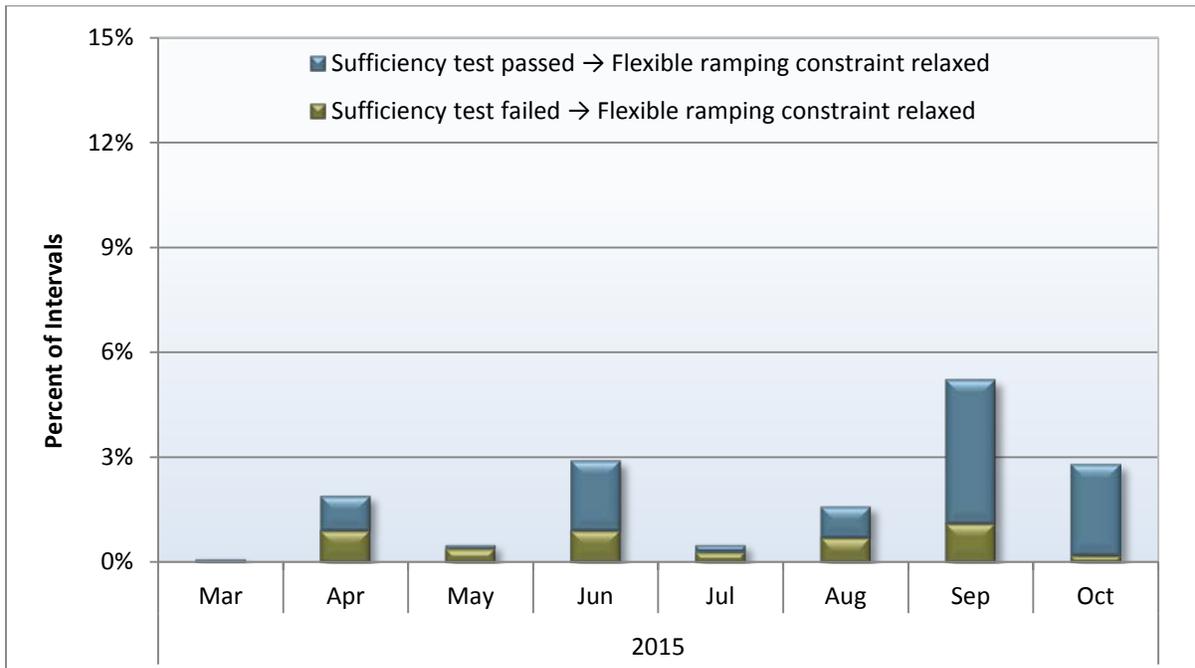


Figure 4.5 Impact of flexible ramping constraint relaxation on 15-minute market price PacifiCorp East

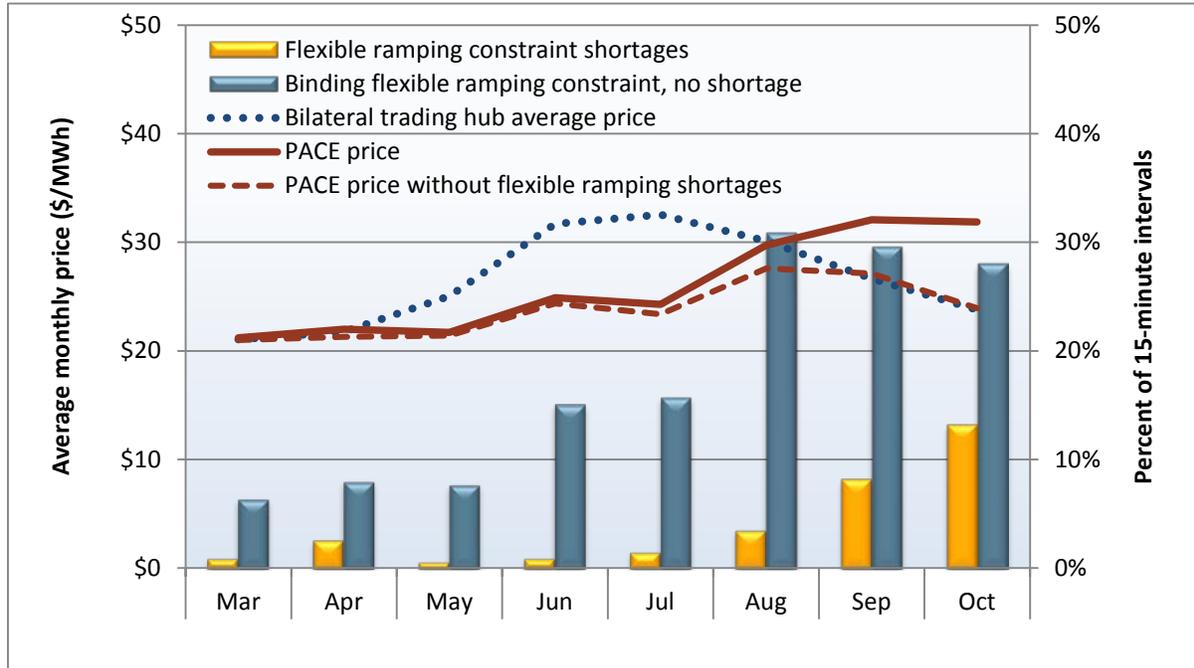
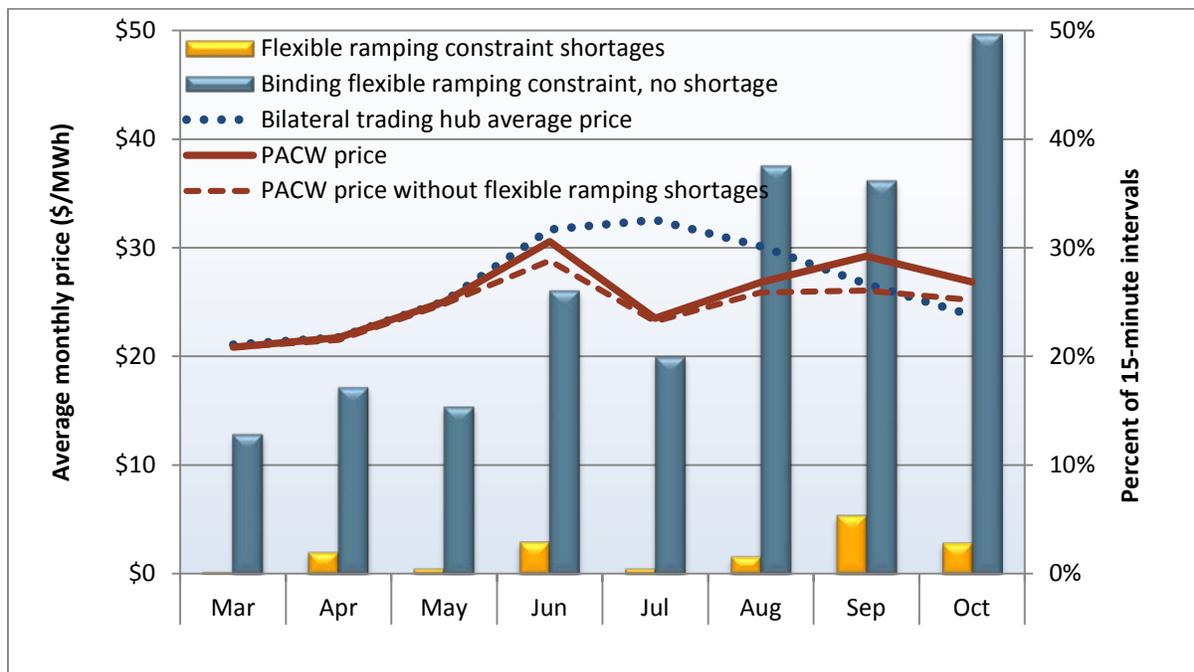


Figure 4.6 Impact of flexible ramping constraint relaxation on 15-minute market price PacifiCorp West



Analysis by DMM indicates that the two major factors contributing to the increase in flexible ramping constraint relaxations include the increase in the level of flexible ramping requirements and a reduction of available ramping capacity due to generation outages.

According to the ISO, other factors contributing to this trend include a software defect impacting the multi-stage generation unit logic, as well as data alignment issues that can contribute to flexible ramping constraint infeasibilities in similar way that such issues contribute to power balance infeasibilities. As explained in the ISO's October report:¹²

The flexible ramping constraint is part of the market clearing optimization. Therefore, in clearing the market, the market optimization in each market run optimally allocates resource capacity to either for energy or flexible ramping capacity and all the issues discussed above that might result in a power balance constraint infeasibility, might also result in a flexible ramping constraint infeasibility. Moreover, since the flexible ramping constraint infeasibility is associated with a penalty price of \$60, it is relatively cheaper for the optimization to relax the flexible ramping constraint than it is to relax the power balance constraint. Therefore, if any of the seven category of issues discussed above occur, i.e., the data alignments or outages, etc, the optimization is likely to first relax the flexible ramping constraint before it relaxes the power balance constraint. This would explain why the flexible ramping constraint can bind more frequently.

The CAISO detected in early November a software defect related to the multi-stage generation logic, which may have also impacted to some extent the frequency of flexible ramp constraint infeasibilities during October. Because the software issue is a correctable event under Section 35 of the CAISO tariff, the CAISO started correcting prices beginning on November 10. The issue was fixed on November 24, 2015.

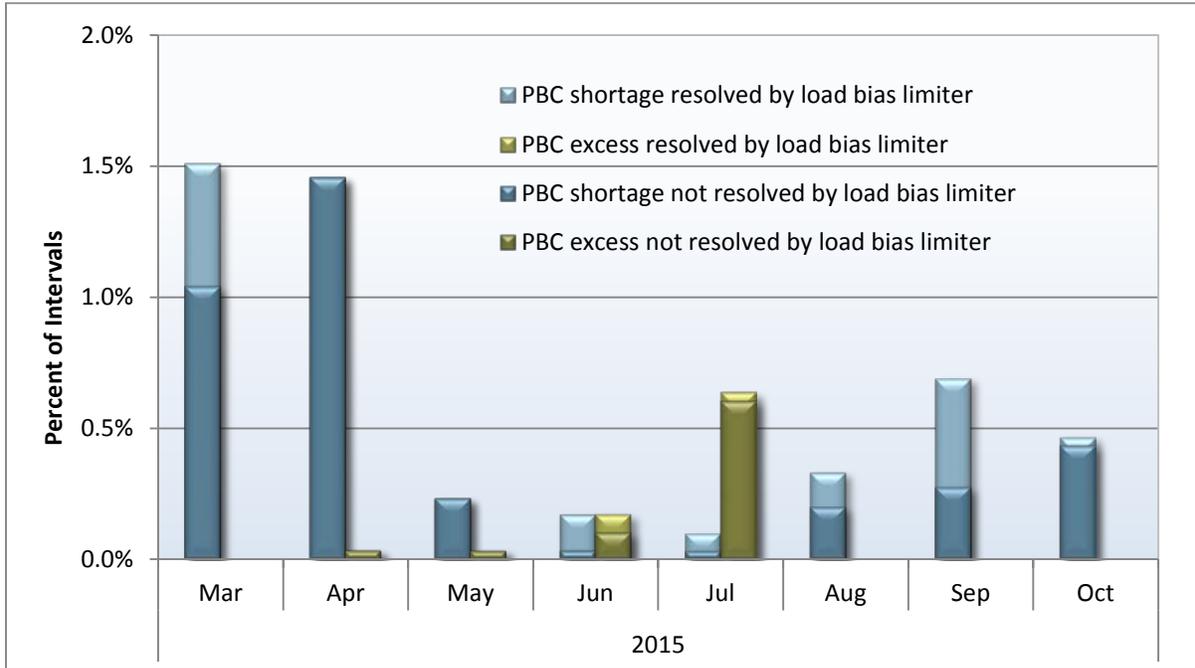
The trend of frequent flexible ramping constraint shortages continued in November with prices in the 15-minute market continuing to exceed bilateral prices due to the impact of the flexible ramping constraint. This trend may be mitigated with the addition of Nevada Energy to the energy imbalance market, since this may significantly increase the amount of additional energy that can be scheduled in the 15-minute market into the PacifiCorp areas. 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.

Load bias limiter

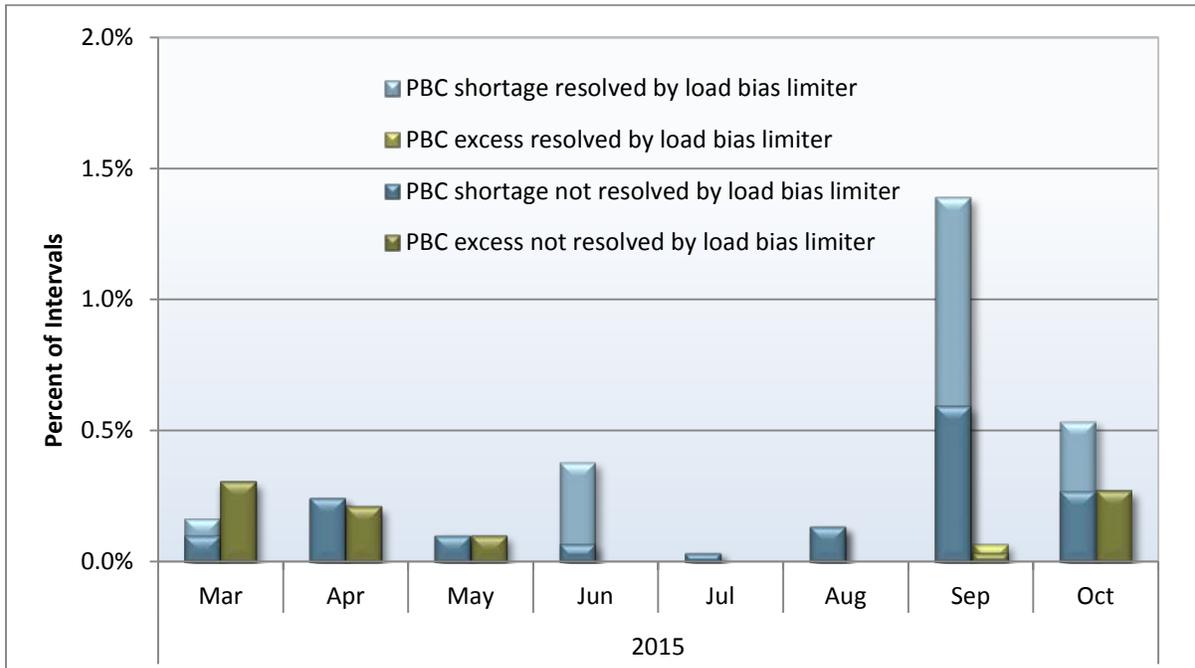
As shown in Figure 4.6 the load bias limiter would have been triggered a small percentage of the 15-minute intervals when the power balance constraint was relaxed in PacifiCorp East during October. Figure 4.7 shows that the load bias limiter would have been triggered about half of the time there are shortages causing the power balance constraint to be relaxed in PacifiCorp West during October. Figure 4.8 and Figure 4.9 show that the load bias limiter would have been triggered relatively infrequently in both 5-minute markets when the power balance constraint was relaxed in October.

¹² Energy Imbalance Market Pricing Waiver Report, October 1 – October 31, 2015, December 18, 2015, p.64.

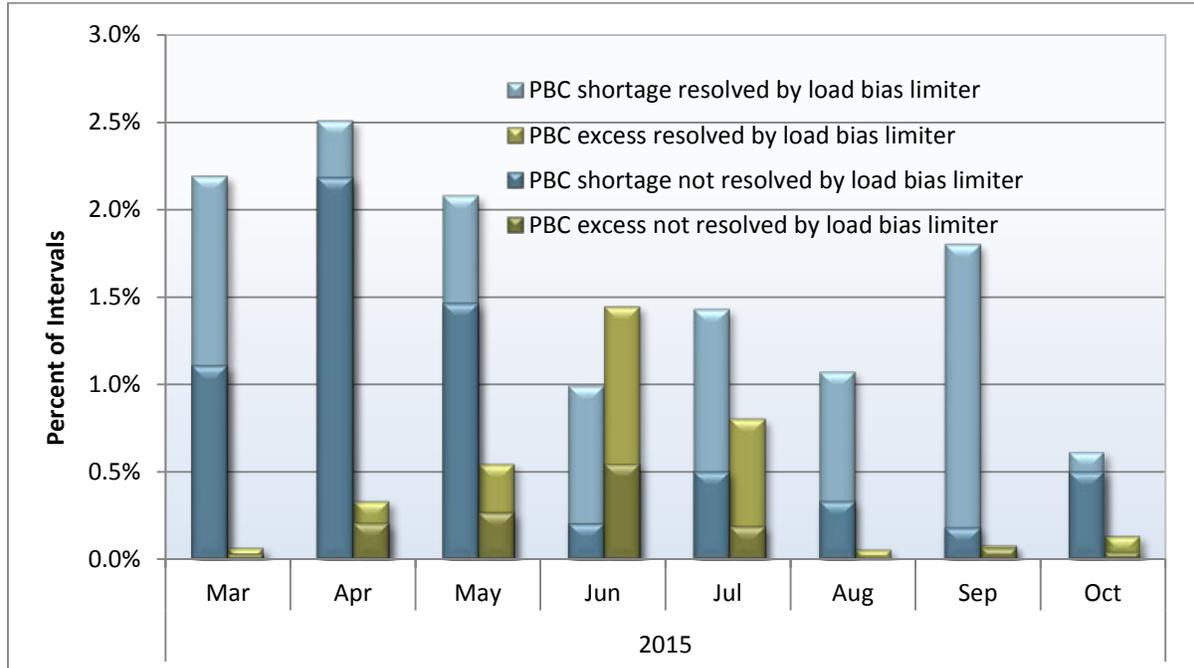
**Figure 4.7 Mitigation of power balance relaxation by load bias limiter
PacifiCorp East - 15-minute market**



**Figure 4.8 Mitigation of power balance relaxation by load bias limiter
PacifiCorp West - 15-minute market**



**Figure 4.9 Mitigation of power balance relaxation by load bias limiter
PacifiCorp East - 5-minute market**



**Figure 4.10 Mitigation of power balance relaxation by load bias limiter
PacifiCorp West - 5-minute market**

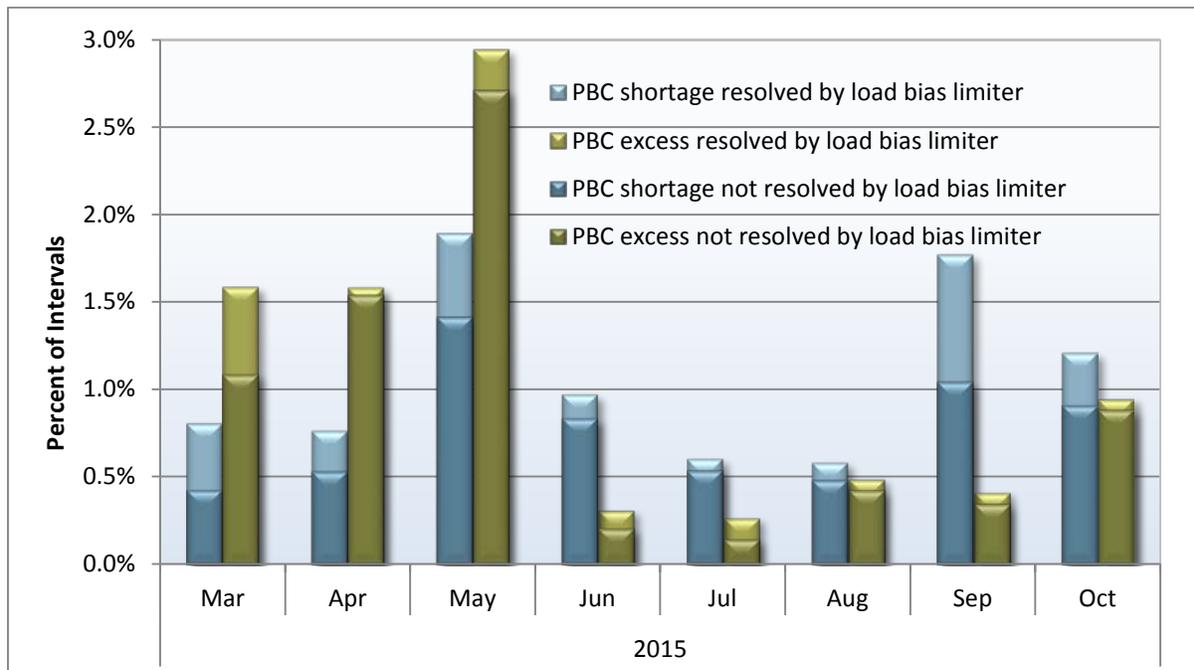


Table 4.2 shows estimated EIM prices if prices were set at the \$1,000/MWh penalty price during intervals when the load bias limiter would have been triggered and the price discovery provisions approved pursuant to FERC’s December 2014 Order were not in effect. As shown in these tables, without these other price discovery provisions, the load bias limiter would have reduced average 15-minute prices in PacifiCorp East by only 1 percent and prices in PacifiCorp West by 8 percent during October. It would have lowered 5-minute prices in PacifiCorp East by about 4 percent and by 8 percent in PacifiCorp West during October.

Table 4.2 Impact of load bias limiter on EIM prices (October 2015)

	Western trading hub average price	Average EIM price	EIM price without price discovery	EIM price without price discovery or load bias limiter	Impact of load bias limiter	
					\$/MWh	Percent
<i>PacifiCorp East</i>						
15-minute market (FMM)	\$23.78	\$31.87	\$35.68	\$35.99	-\$0.31	-0.9%
5-minute market (RTD)	\$23.78	\$17.79	\$22.17	\$23.09	-\$0.92	-4.0%
<i>PacifiCorp West</i>						
15-minute market (FMM)	\$23.78	\$26.84	\$28.89	\$31.32	-\$2.43	-7.8%
5-minute market (RTD)	\$23.78	\$22.57	\$29.92	\$32.66	-\$2.73	-8.4%

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 28th day of December, 2015.

Martha Sedgley
Martha Sedgley