January 23, 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 Performance of Energy Imbalance Market

Dear Secretary Bose:

The Department of Market Monitoring hereby submits its second 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 – December 31, 2014.[1]

Please contact the undersigned with any questions.

Respectfully submitted,

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

California Independent
System Operator Corporation

California ISO

Report on Energy Imbalance Market Issues and Performance

January 23, 2014

Prepared by: Department of Market Monitoring

Executive Summary

This report represents the second report by the Department of Market Monitoring (DMM) pursuant to the Commission's December 1, 2014, Order on the ISO's Energy Imbalance Market (EIM). The report covers the same period as the ISO second report issued pursuant to the Commission's December 1 Order (November 2014 through December 31, 2014). Key observations and findings include the following:

- During most intervals, prices in the EIM have been highly competitive and have been set by bids closely reflective of the marginal operating cost of the highest cost resource dispatched to balance loads and generation. However, during a relatively small portion of intervals, energy or flexible ramping constraints have had to be relaxed for the market software to balance modeled supply and demand.
- In PacifiCorp East, the frequency of constraint relaxations in the 15-minute market was relatively high following EIM implementation in November, and then declined significantly through most of December.
- In PacifiCorp West, the frequency of constraint relaxations in the 15-minute market dropped substantially during November and remained relatively low through the end of December.
- However, DMM notes that the need to relax the power balance and flexible ramping constraints in the 15-minute market rose significantly in the first few weeks of January 2015. This trend will be covered in the ISO's next monthly report, and DMM's subsequent report on the ISO's findings.
- In the 5-minute market, the need to relax the power balance constraint has also remained relatively high in both PacifiCorp East and PacifiCorp West since EIM implementation. This reflects the fact that supply in the 5-minute market is much more constrained, including schedules between EIM balancing areas and the ISO.
- The impact of constraint relaxation on market prices has been effectively mitigated by the price discovery mechanism approved under the Commission's December 1 Order. Average EIM prices since the November 14 effective date of the price discovery provisions have been slightly lower than bilateral market price indices that were used to set prices in the PacifiCorp areas prior to EIM implementation. Without these provisions, EIM prices since November 14 would have been significantly higher than these bilateral market price indices.
- The amount of capacity participating in the EIM increased significantly over the second half of November, and most available capacity from EIM participating resources is being offered into the market. On average, over 85 percent of the nameplate capacity registered to participate in EIM has been bid into the market during peak hours. Almost all capacity that is not bid into the market appears to be unavailable due to outages and other unit limitations.
- The total capacity offered into the EIM appears to be more than sufficient to meet demand during most hours. Overall, about 45 percent of all bids submitted in the EIM have been dispatched to meet demand. However, the portion of this supply available for dispatch on a 15-minute and 5-minute basis is still sometimes insufficient to meet the demand for imbalance energy as projected by the market software. In many cases, these insufficiencies appear to be largely attributable to the various factors cited in the ISO's December 15 and January 15 reports rather than more fundamental market or system conditions.

- Bidding in the EIM has been highly competitive, with bids for most capacity slightly below or above default energy bids used in market power mitigation. When bids are mitigated due to market power mitigation provisions, these procedures generally result in modest reductions in bid prices.

1 Background

On November 13, 2014, the ISO requested a 90-day waiver of two tariff provisions for establishing the price of energy in the Energy Imbalance Market (EIM) during intervals when, due to a lack of sufficient supply from capacity bid into the market, the ISO's market software must resort to relaxing transmission or system energy balance constraints in order to reach a market solution.[1]

Under these conditions, the waiver would allow prices to be set by a special *price discovery* process designed to let prices reflect the last market bids dispatched, rather than based on penalty pricing parameters such as the $1,000/MW price otherwise applied to the amount by which the power balance constraint relaxed. The ISO has also applied this price discovery feature when the flexible ramping constraint must be relaxed in the market software. In these cases, this price discovery mechanism allows prices to reflect the highest priced market bid dispatched rather than the $247/MW penalty price otherwise assigned to flexible ramping constraint relaxation.[2]

The ISO's November 13 waiver request was submitted as a means of mitigating high prices that the ISO believes resulted from a variety of factors which prevented the market software from producing prices reflective of actual supply and demand conditions. The ISO explained that these high prices are not always indicative of actual physical conditions on the system, and instead reflect factors such as (1) challenges in providing timely and complete data to ensure system visibility under the new procedures, (2) limitations on the resources available to PacifiCorp for use in the EIM, and (3) several forced outages of large EIM participating resources.

On December 1, the Federal Energy Regulatory Commission (FERC) issued an order granting the ISO's petition for waiver of these provisions for 90 days, effective November 14, 2014, as requested.[3] The Commission also directed the ISO to file detailed informational reports at 30-day intervals during the 90-day waiver period, providing detailed supporting data demonstrating progress towards identifying and eliminating the problems giving rise to the waiver petition. FERC indicated that these reports should include independent assessments from the Department of Market Monitoring on the causes and the solutions identified by the ISO. The Commission indicated that the first report be filed 30 days from the effective date of the tariff waiver, December 15, 2014.

This represents DMM's second report pursuant to the Commission's December 1 Order. The ISO filed its second report pursuant to the December 1 Order on January 15.[4] The ISO's report covered market performance through December 31, 2014.

The ISO's reports identify a wide range of factors contributing to the need to relax software constraints and trigger the special price discovery features, along with steps to be taken by the ISO and PacifiCorp to address these issues. These steps include a range of software improvements and tools, enhanced processes and procedures, and increased operational training and experience. DMM does not have the resources to monitor or assess the progress or impact of these specific steps. However, DMM has

[1] http://www.caiso.com/Documents/Nov13_2014_PetitionWaiver_EIM_ER15-402.pdf

[2] As of January 15, 2015, the parameter for the flexible ramping constraint is set to $60.

[3] http://www.caiso.com/Documents/Dec1_2014_OrderGrantingWaiver_EIMPricingParameters_ER15-402.pdf

[4] http://www.caiso.com/Documents/Jan15_2015_EnergyImbalanceMarket_REPORT_ER15-402.pdf

developed a range of metrics and analysis to provide insights into the ultimate effectiveness of these efforts on EIM market performance.

This report provides estimates of average prices in the PacifiCorp West and PacifiCorp East areas after November 14 if the same pricing parameters used in the ISO real-time market were used for all constraints relaxed in the EIM. As noted in our first report, DMM believes this will provide a valuable quantitative measure of EIM market performance and progress made as the result of various steps being taken by the ISO and PacifiCorp to improve market performance.

This report also provides a comparison of EIM prices to bilateral market price indices that were used to set prices in the PacifiCorp areas prior to EIM implementation. Prior to EIM implementation, DMM identified this bilateral price index to stakeholders and regulators as a benchmark DMM would use to assess the competitiveness and overall performance of the EIM.

2 Energy imbalance market prices

During most intervals, prices in the EIM have been highly competitive and have been set by bids closely reflective of the marginal operating cost of the highest cost resource dispatched to balance loads and generation. However, during a relatively small portion of intervals, energy or flexible ramping constraints have had to be relaxed for the market software to balance modeled supply and demand.

Figure 2.1 and Figure 2.3 show the frequency of constraint relaxations in the 15-minute market by day in PacifiCorp East and PacifiCorp West, respectively, through December 31, 2014. As shown in these figures, four different constraints have been relaxed in the 15-minute market:

- The flexible ramping constraint shortages (yellow) occur when there is insufficient ramping capacity in the 15-minute market to meet the capacity requirement. During this period, this requirement has been set at about 25 to 40 MW. The penalty price for shortages of the flexible ramping constraint is set at $500/MW in the scheduling run and is normally set at $247/MW in the pricing run.[5] The pricing parameter when this constraint is relaxed has been set to $0 in the EIM when the price discovery mechanism has been implemented. This constraint is enforced in the binding 15-minute market but not in the binding 5-minute market.

- Power balance constraint shortages (red bar) occur when the power balance constraint that matches generation and load is relaxed when load exceeds the available generation. The penalty price for power balance relaxation due to energy shortage within EIM balancing authority areas is set at $1,100/MW in the scheduling run. In the pricing run, the penalty price normally assigned to relaxations of this constraint would be consistent with the offer cap of $1,000/MW. The pricing parameter when this constraint is relaxed has been set to $0 in the EIM when the price discovery mechanism has been implemented.

- Transfer limit relaxation (blue bars) occurs when the transfer limit from one EIM balancing authority area is violated to meet demand in another area. As shown in Figure 2.1, this constraint was relaxed in PacifiCorp East during a relatively few intervals in the first two weeks of EIM, but has not been relaxed since mid-December. This appears to be attributable to the fact that the penalty price for transfer limit violations between balancing authority areas in the scheduling run ($1,500/MW) has been set by the ISO at a higher level than the penalty price used for power balance constraint relaxations in the scheduling run ($1,100/MW). In the pricing run, the penalty price normally assigned to relaxations of this constraint would be consistent with the offer cap of $1,000/MW. The pricing parameter when this constraint is relaxed has been set to $0 in the EIM when the price discovery mechanism has been implemented.

- Power balance constraint excess (green bar) occurs when the power balance constraint that matches generation and load is relaxed because generation exceeds load. The penalty price for excess generation related to the power balance constraint is set at -$155/MW in the scheduling run and is normally set at the offer floor of -$150/MW in the pricing run. The pricing parameter when this constraint is relaxed has been set to $0 in the EIM when the price discovery mechanism has

[5] Beginning on January 15, the constraint was lowered to $60/MW in the pricing run.

been implemented. The figures show the count of intervals where power balance excess occurred in terms of a negative number, since these violations reduce overall prices.

As shown in Figure 2.1, the frequency of constraint relaxations in the 15-minute market in PacifiCorp East was relatively high during the first month of EIM, and then declined significantly through most of December. As shown in Figure 2.3, the frequency of constraint relaxations in the 15-minute market in PacifiCorp West dropped substantially during November and remained relatively low through the end of December.

However, DMM notes that the need to relax the power balance and flexible ramping constraints in the 15-minute market rose significantly in the first few weeks of January 2015.[6] This trend will be covered in the ISO's next monthly report, and DMM's subsequent report on the ISO's findings.

Figure 2.2 and Figure 2.4 show average daily prices in the 15-minute market *with* and *without* the special price discovery mechanism being applied to mitigate price in PacifiCorp East and PacifiCorp West, respectively. These figures also provide a comparison of EIM prices to bilateral market price indices that were used to set prices in the PacifiCorp areas prior to EIM implementation.[7] For this analysis, the estimated EIM price without price discovery is calculated as follows:

- When the power balance constraint was relaxed for a shortage of energy, it is assumed prices would be $1,000/MW minus estimated losses of about 3 percent on average.
- When the EIM transfer constraint was relaxed for a shortage of energy, it is assumed prices would be $1,000/MW minus estimated losses of about 3 percent on average.
- When only the flexible ramping constraint was relaxed due to a shortage of 15-minute ramping, it is assumed shadow prices for this constraint would be $247/MW, which would be incorporated in the locational price.
- When the power balance constraint needed to be relaxed in market software for an excess of energy, it is assumed prices would be -$150/MW plus estimated losses of about 1 percent.

This methodology differs for the estimates of counterfactual price in the ISO's January 15 report in one key respect. DMM's analysis estimates prices without application of any special price discovery provisions in EIM. The ISO's analysis only incorporates the effects of price discovery provisions implemented by the ISO following approval of the ISO's November 13 waiver request. Specifically, the ISO analysis reflects the fact that shortly prior to EIM go-live, the ISO amended the EIM business practice manual (BPM) so that price discovery was triggered if a constraint was relaxed during an interval when the EIM balancing area had failed to pass the flexible ramping requirement test.[8]

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[6] See Market Performance and Planning Forum, January 20, 2015, *Department of Market Monitoring – Energy Imbalance Market Update*, pp. 41-47, http://www.caiso.com/Documents/Agenda-Presentation_MarketPerformance-PlanningForum_Jan20_2015.pdf

[7] The bilateral market index represents a daily average of peak and off-peak prices for four major Western trading hubs representative of the PacifiCorp East and West areas (California Oregon Border, Mid-Columbia, Palo Verde and Four Corners). Prior to EIM implementation, DMM identified this bilateral price index to stakeholders and regulators as a benchmark DMM would use to assess the competitiveness and overall performance of the EIM.

[8] See pp. 10-11 of *Energy Imbalance Market Pricing Waiver Report*, December 1 - 31, 2014, January 15, 2015, http://www.caiso.com/Documents/Jan15_2015_EnergyImbalanceMarket_REPORT_ER15-402.pdf.

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

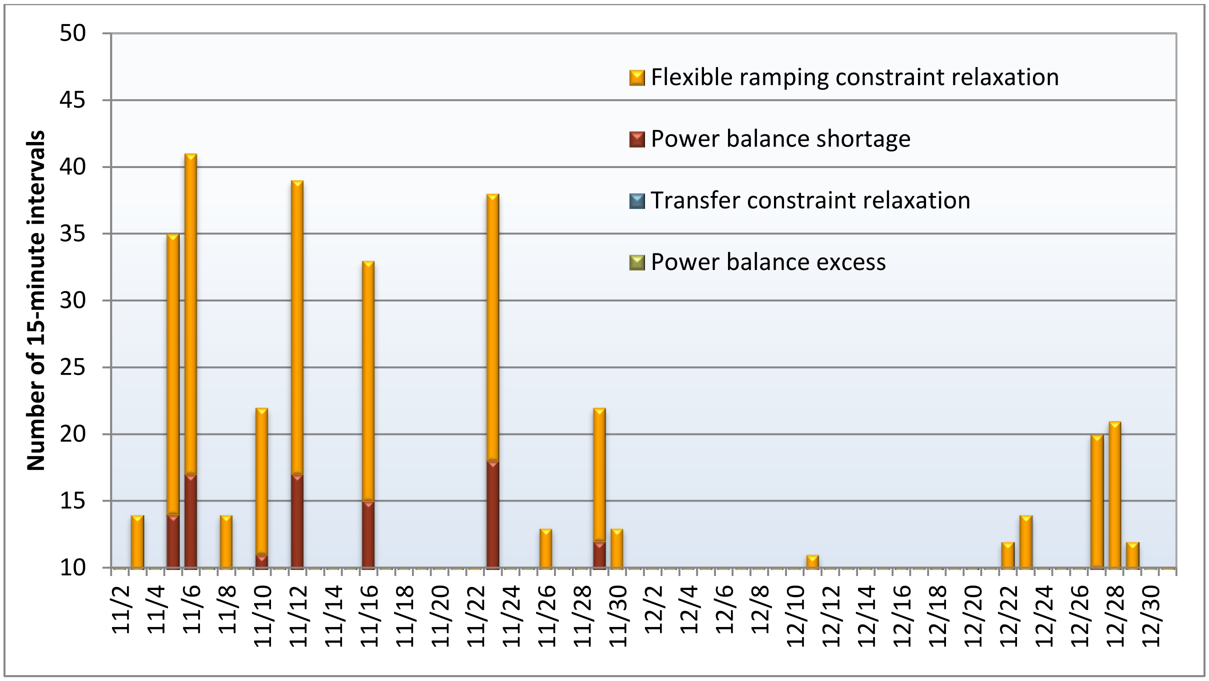


Figure 2.2 Average daily prices with and without price discovery
PacifiCorp East - 15-minute market

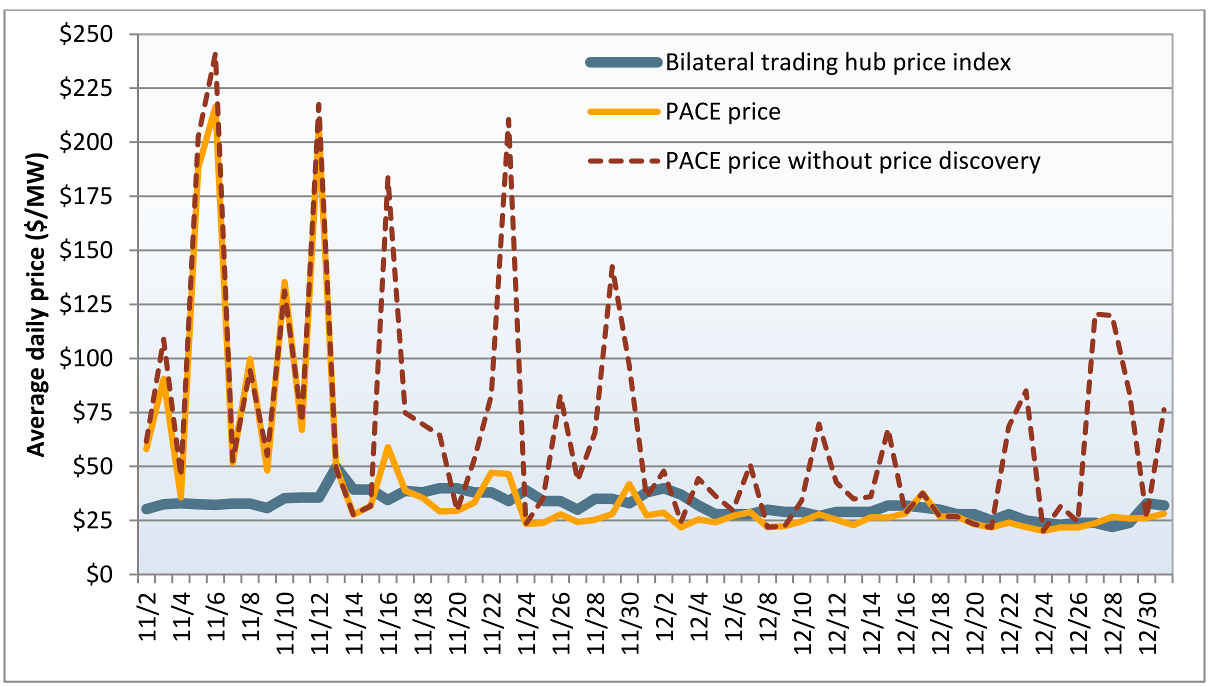


Figure 2.3 Frequency of constraint relaxation
PacifiCorp West - 15-minute market

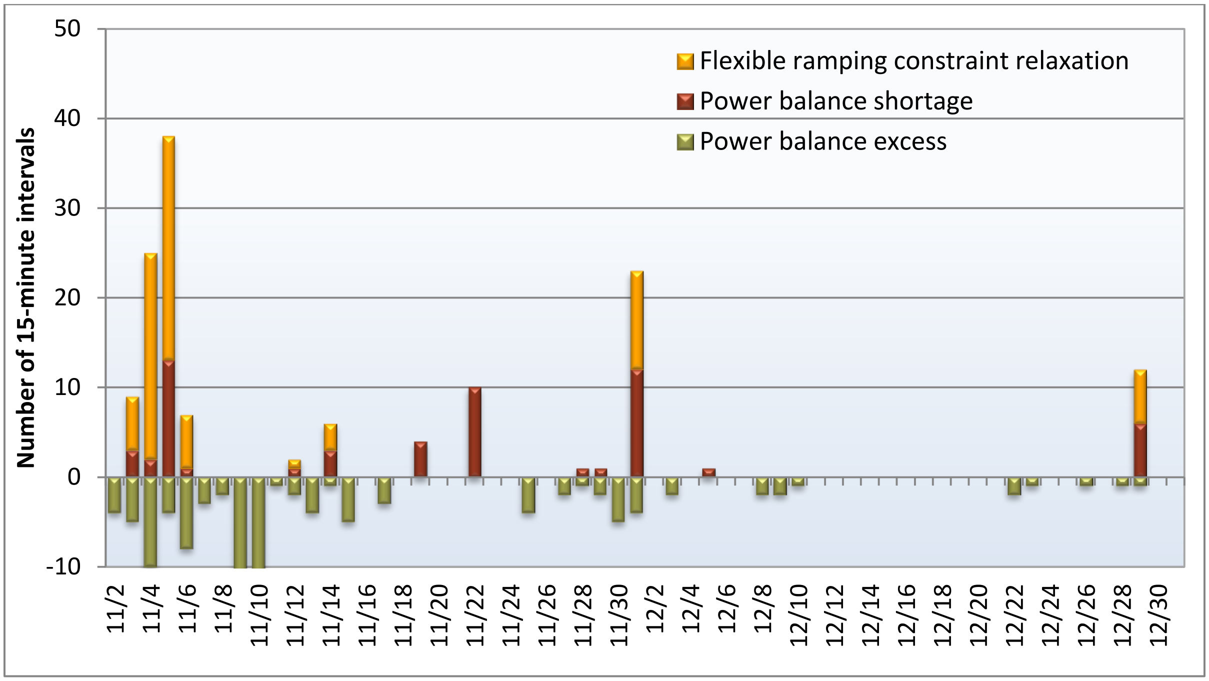
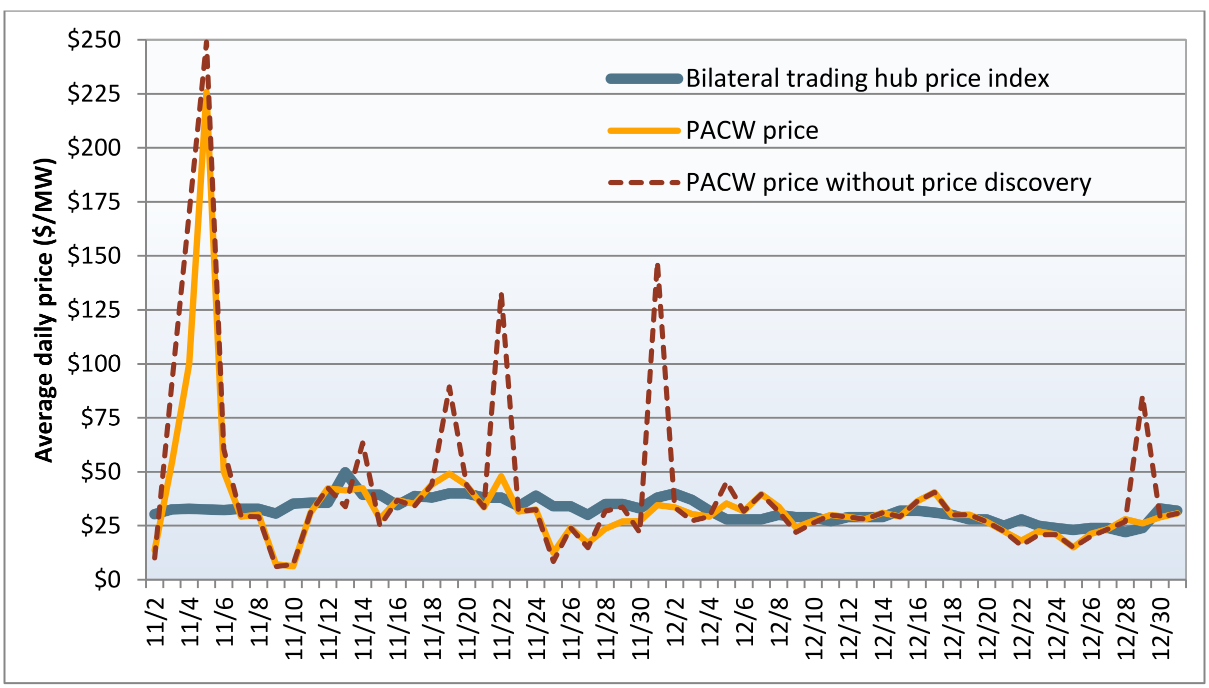


Figure 2.4 Average daily prices with and without price discovery
PacifiCorp West - 15-minute market



As shown in Figure 2.2 and Figure 2.4, without the price discovery provisions being applied in EIM, on days when the power balance or flexible ramping constraints need to be relaxed more than a few intervals of the 15-minute market, average daily prices would consistently exceed the bilateral market price index reflective of prices for imbalance energy in the PacifiCorp areas prior to EIM. However, with price discovery, EIM prices track very closely with this bilateral price index.

Figure 2.5 and Figure 2.6 provide a weekly summary of the frequency of constraint relaxation, average prices with and without price discovery, and bilateral market prices for PacifiCorp East and PacifiCorp West, respectively.

Figure 2.7 and Figure 2.8 provide the same weekly summary for the 5-minute market. As shown in these figures, the need to relax the power balance constraint in the 5-minute market has also remained relatively high in both PacifiCorp East and PacifiCorp West since EIM implementation. This reflects the fact that in the 5-minute market the supply of ramping capacity within PacifiCorp is more constrained. This also reflects the fact that incremental transfers into Pacificorp from the ISO in the 5-minute market have been essentially prevented during almost all intervals. The dynamic transfer constraint (DTC), which constrains the extent to which transfers between PacifiCorp and the ISO scheduled in the 15-minute market can change in the 5-minute market, has been set to a limit of less than 0.003 MW during more than 92% of 5-minute market intervals between November 1 and December 31.

As shown in Figure 2.5 through Figure 2.8, the price discovery mechanism approved under the Commission's December 1 Order has effectively mitigated the impact of constraint relaxation on market prices. Table 2.1 shows average EIM prices in the 15-minute and 5-minute markets with and without application of price discovery, along with average bilateral market prices. As shown in Table 2.1:

- Application of the price discovery mechanism has made average EIM prices in the 15-minute market in PacifiCorp East about 10 percent lower than bilateral market price indices that were used to set rates in the PacifiCorp area prior to EIM. Prices in PacifiCorp East in the 15-minute market after price discovery have been about 5 percent lower than these bilateral prices.

- Prices in the 5-minute market since the price discovery mechanism has been in effect have been lower than these bilateral market price indices by about 17 percent in PacifiCorp East and about 12 percent in PacifiCorp West.

- Without price discovery, prices in PacifiCorp East would be about 80 percent higher than bilateral market price indices in the 15-minute and about 70 percent higher in the 5-minute market.

- In PacifiCorp West, prices without price discovery would be about 15 percent higher than bilateral market prices in the 15-minute market and more than twice as high in the 5-minute market.

Figure 2.5 Frequency of constraint relaxation and average prices by week PacifiCorp East - 15-minute market

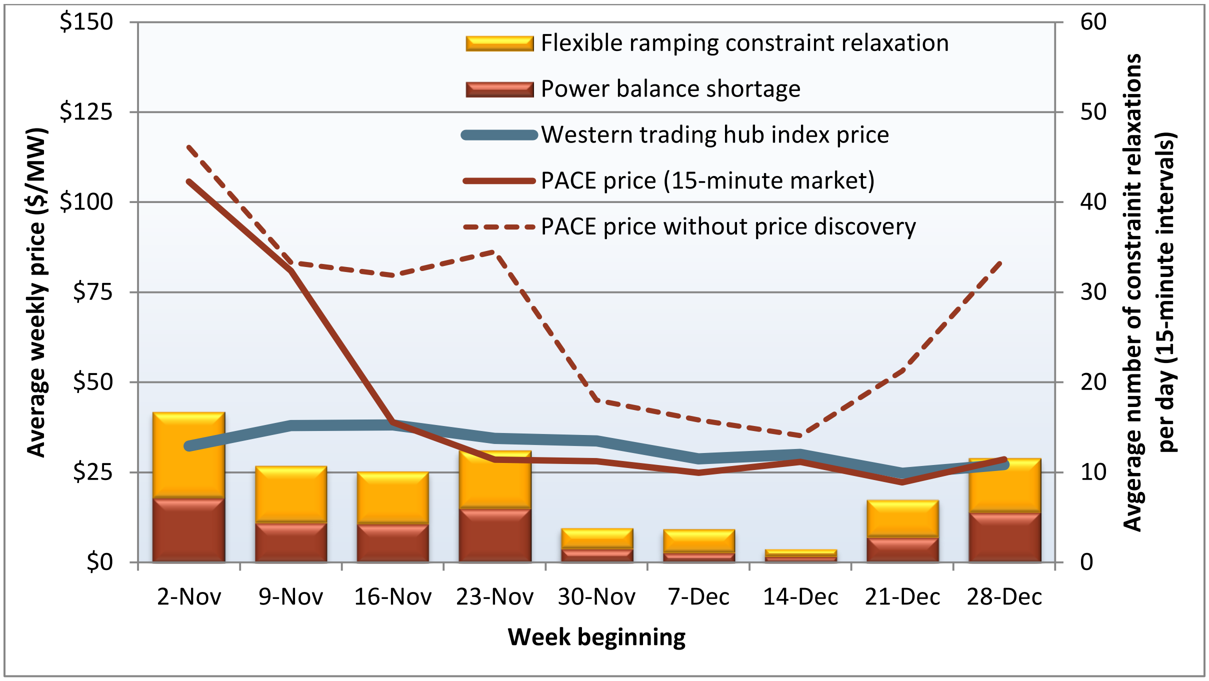


Figure 2.6 Frequency of constraint relaxation and average prices by week PacifiCorp West - 15-minute market

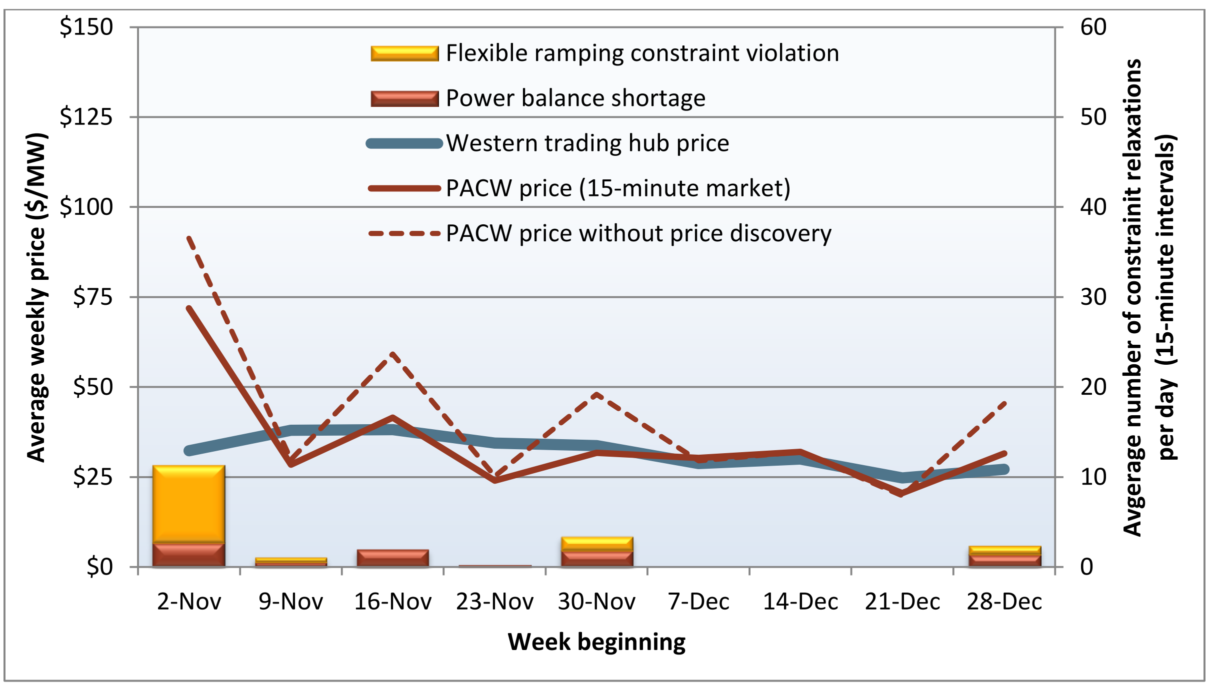


Figure 2.7 Frequency of constraint relaxation and average prices by week PacifiCorp East - 5-minute market

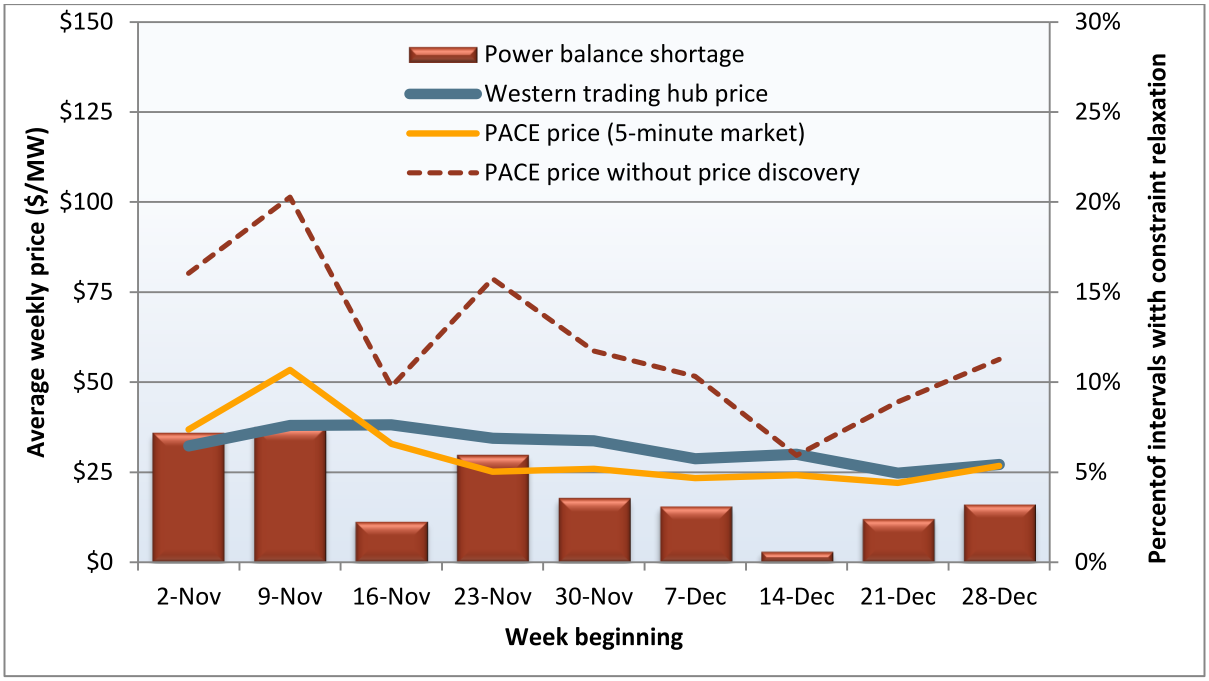


Figure 2.8 Frequency of constraint relaxation and average prices by week PacifiCorp West - 5-minute market

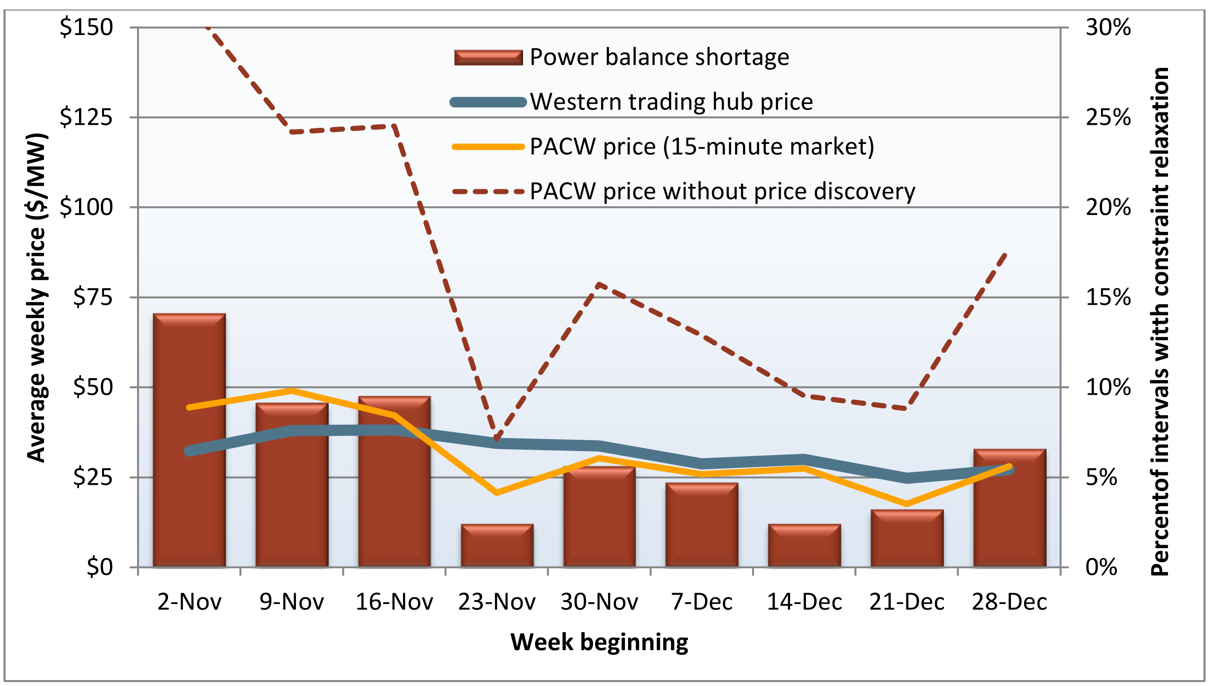


Table 2.1 Average prices in EIM and bilateral markets (November 15, 2015 – December 31, 2015)

	Western trading hub average price	Average EIM price	EIM price without price discovery
PacifiCorp East			
15-minute market (FMM)	$31.46	$28.33	$57.65
5-minute market (RTD)	$31.46	$26.11	$52.72
PacifiCorp West			
15-minute market (FMM)	$31.46	$29.81	$36.00
5-minute market (RTD)	$31.46	$27.65	$69.89

Flexible ramping sufficiency test

As previously noted, DMM's estimates of EIM prices that would result without price discovery include price discovery that would be triggered when the EIM balancing area had failed to pass the flexible ramping requirement test under a business practice manual modification made shortly prior to EIM go-live.

The ISO tariff specifies that when an EIM area fails to pass the flexible ramping sufficiency test, transfers of energy into that EIM area may not increase. As noted in the ISO report:

> As specified in section 29.34(n) of the CAISO tariff and section 10.3.2.1 of the Business Practice Manual for the Energy Imbalance Market, if the EIM Entity balancing authority area fails the sufficient ramp test, or is deemed to have failed the test because it failed the capacity (resource plan) test, CAISO will restrict additional EIM Transfer imports into that EIM Entity balancing authority area during the hour starting at T beyond the optimal solution for T-7.5 minutes. The CAISO will enforce the individual EIM Entity balancing authority area flexible ramp requirement in the isolated EIM Entity balancing authority area and will not include that balancing authority area in area group constraints.[9]

This provision was included in the EIM design to deter "capacity leaning" and provide a strong incentive for each EIM area to ensure it has enough ramping capacity available to meets its own needs. In practice, this provision means that if an EIM area fails the sufficiency test, transfers of energy into that EIM area in the 15-minute market may not increase. For instance, if 100 MW is being transferred into the EIM area, transfers are constrained not to exceed 100 MW. If 100 MW is being exported from an EIM area when the area fails the ramping sufficiency test, the transfer out of that EIM area may be reduced to 0 MW, but the constraint on imports into that area is set to 0 MW.

Shortly prior to EIM go-live, the EIM Business Practice Manual for the Energy Imbalance Market was changed so that when an EIM area failed the ramping sufficiency test, the price discovery mechanism

[9] See pp. 10-11 (ii) in *Energy Imbalance Market Pricing Waiver Report*, December 1 - 31, 2014, January 15, 2015, http://www.caiso.com/Documents/Jan15_2015_EnergyImbalanceMarket_REPORT_ER15-402.pdf

would be applied in the event any constraint such as the power balance or flexible ramping constraint was relaxed in the 15-minute or 5-minute market.[10]

Figure 2.9 through Figure 2.12 show the frequency of failures of the ramping sufficiency test, along with the portion of these events during which the power balance or flexible ramping constraint was subsequently relaxed in the 15-minute or 5-minute market in the PacifiCorp areas.

As shown in Figure 2.9 through Figure 2.12:

- Failures of the ramping sufficiency test are relatively frequent in the PacifiCorp East area, but much less frequent in PacifiCorp West.
- In the 15-minute market, while the power balance or flexible ramping constraints often need to be relaxed when an area fails to meet the ramping sufficiency test, during many intervals this is not the case.
- When an area fails to meet the ramping sufficiency test, chances are relatively high that the power balance constraint will need to be relaxed in the 5-minute market.

[10] See p. 35, Business *Practice Manual For The Energy Imbalance Market*, as revised 10/30/2014. http://bpmcm.caiso.com/BPM%20Document%20Library/Energy%20Imbalance%20Market/BPM_for_Energy%20Imbalance%20Market_V2_redline.pdfhttp://bpmcm.caiso.com/BPM%20Document%20Library/Energy%20Imbalance%20Market/BPM_for_Energy%20Imbalance%20Market_V2_redline.pdf

Figure 2.9 Frequency of constraint relaxation when flexible ramping sufficiency test failed PacifiCorp East - 15-minute market

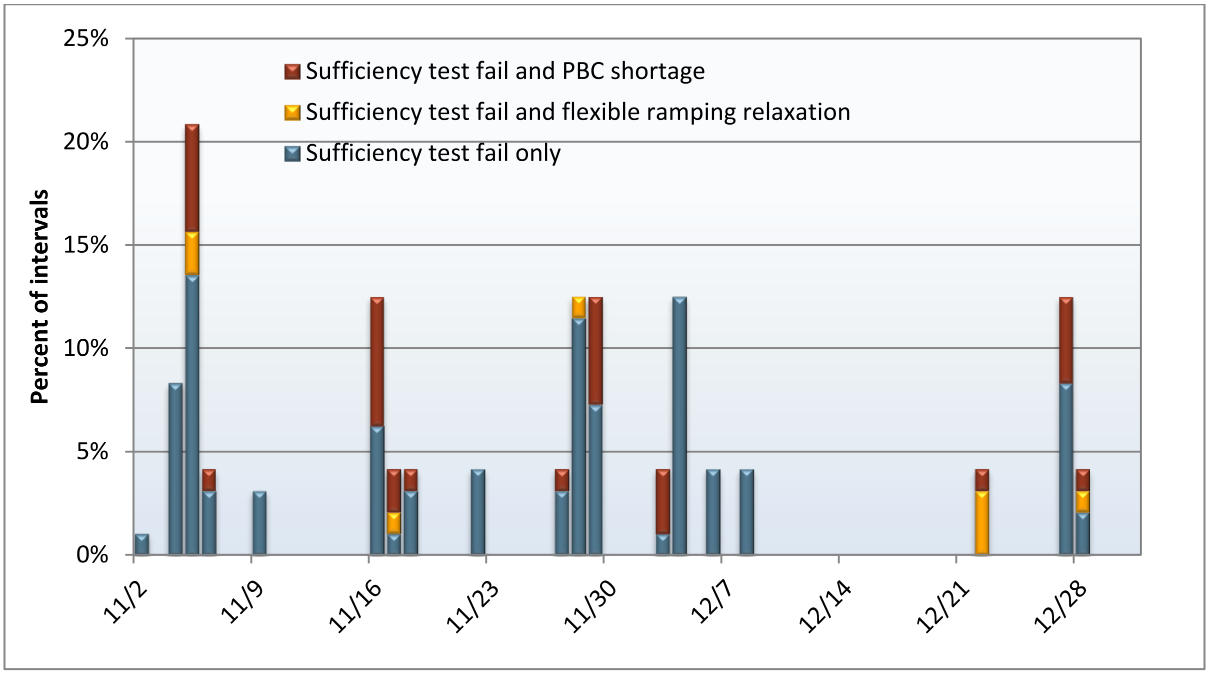


Figure 2.10 Frequency of constraint relaxation when flexible ramping sufficiency test failed PacifiCorp West - 15-minute market

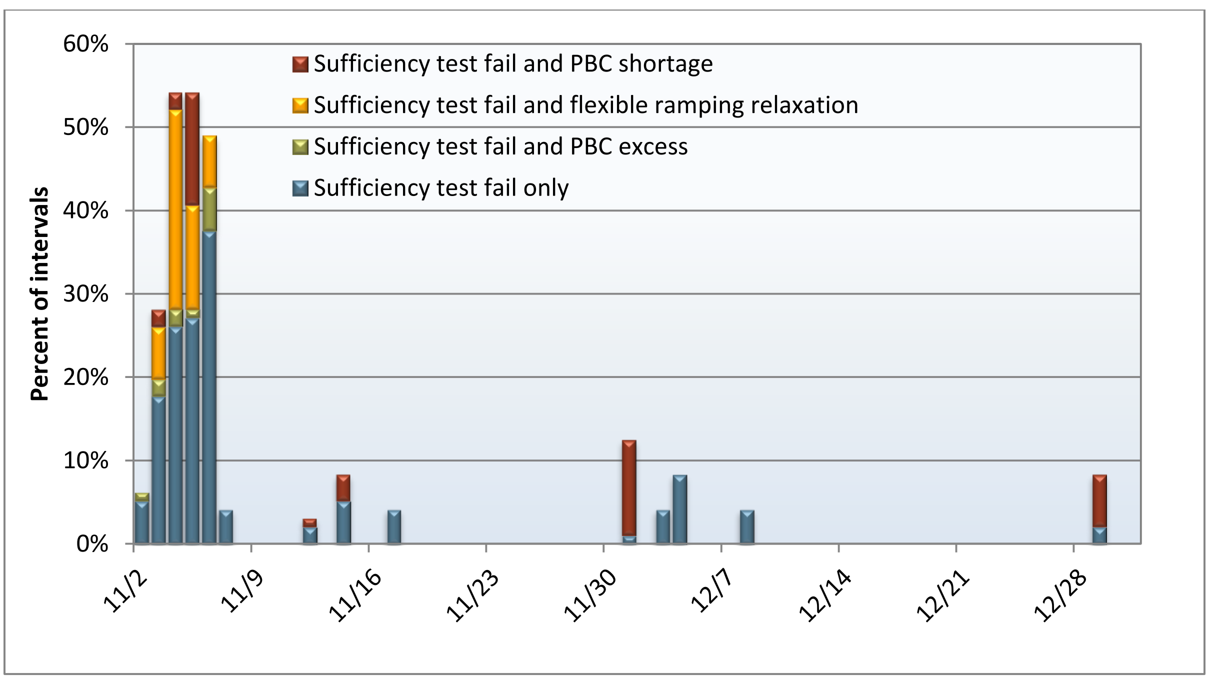


Figure 2.11 Frequency of constraint relaxation when flexible ramping sufficiency test failed PacifiCorp East - 5-minute market

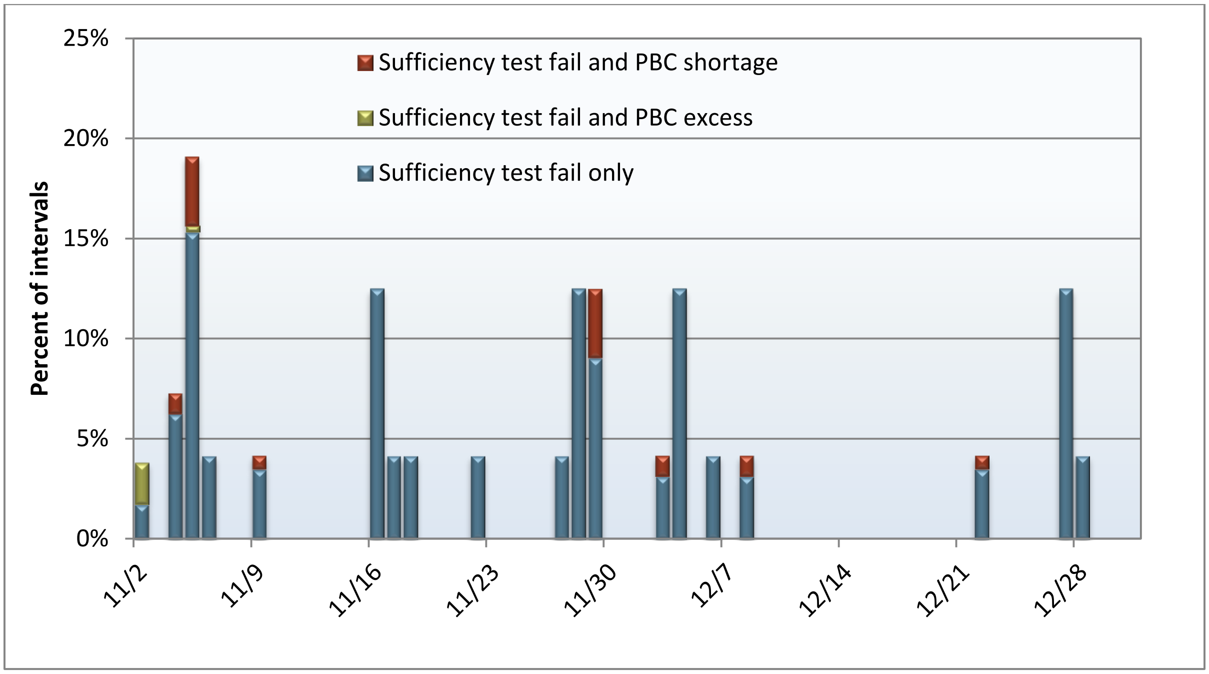
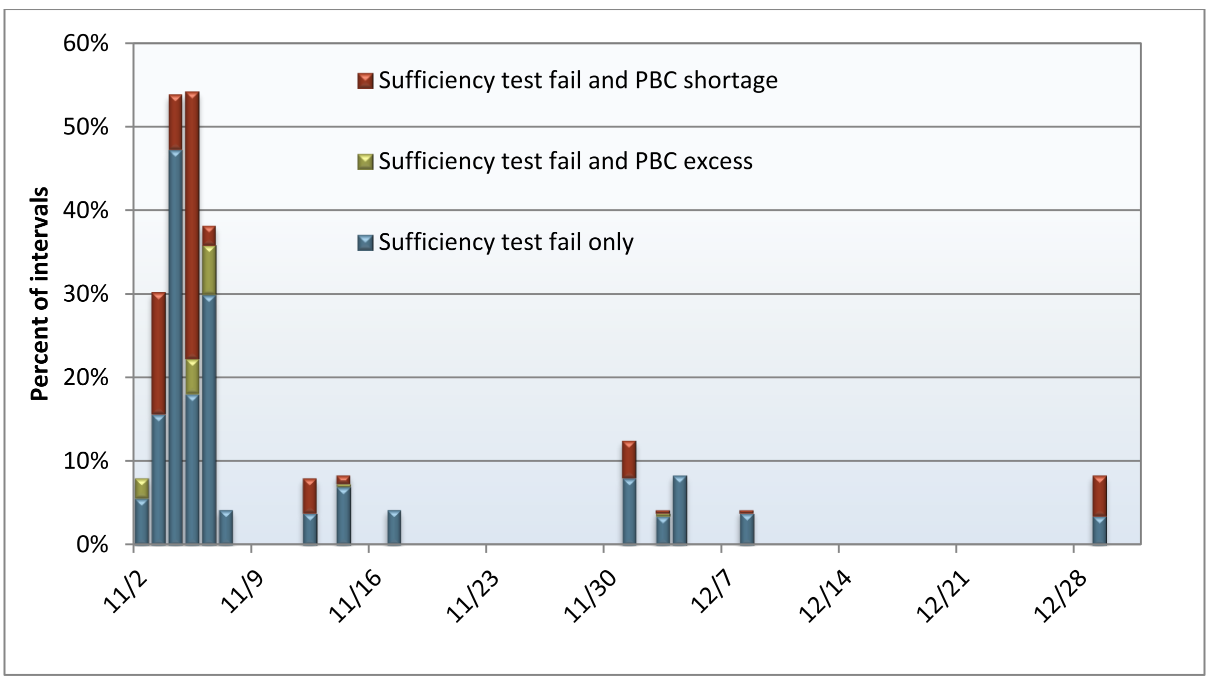


Figure 2.12 Frequency of constraint relaxation when flexible ramping sufficiency test failed PacifiCorp West - 5-minute market



3 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 additional information on the frequency and causes of various constraint violations in the EIM during November and December 2014.

Figure 3.1 and Figure 3.2 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.

As shown in Figure 3.1, in PacifiCorp East the frequency of constraint relaxation dropped significantly in December but is still in the 2 to 3 percent range in the 15-minute and 5-minute markets.

As shown in Figure 3.2, in PacifiCorp West the frequency of constraint relaxation also dropped significantly in December, but the power balance constraint was still relaxed in about 5 percent of intervals in the 5-minute market.

As described in the ISO's January 15 report, the ISO has reviewed each interval in which the power balance constraint was relaxed due to supply insufficiency in December and categorized each of these in terms of a primary cause of this supply insufficiency.[11] DMM has aggregated data underlying the Figures 11 and 12 of the ISO's January 15 report to highlight the relative magnitude of the different factors driving supply insufficiency events in December. These data are provided in Figure 3.3 through Figure 3.6.

Provided below is a summary of the primary cause of EIM supply insufficiencies in the approximate order of the frequency of which these issues caused supply insufficiencies in December based on data underlying the ISO report.

- **Resource data alignment.** As shown in Figure 3.3, this category is cited as the primary cause of 42 percent of supply insufficiencies in the 15-minute market in PacifiCorp East during December examined by the ISO. This category is cited as the primary cause of about one-fourth of insufficiencies in the 5-minute market in both PacifiCorp areas. The ISO report explains that "this group accounts for resource deviating from their dispatch, differences between base schedules and bids or dispatches, and changes between markets."[12] Based on DMM's review of the ISO's analysis and discussions with the ISO, many of these events appear to be related to issues related to how multi-state generating units are scheduled, bid and dispatched in the market. The ISO and PacifiCorp have indicated they are working to improve how this software functionality is utilized to reduce this type of issue.

[11] See Figures 11 and 12, page 17, in *Energy Imbalance Market Pricing Waiver Report*, December 1 - 31, 2014, January 15, 2015, http://www.caiso.com/Documents/Jan15_2015_EnergyImbalanceMarket_REPORT_ER15-402.pdf

[12] See p. 9 in *Energy Imbalance Market Pricing Waiver Report*, December 1 - 31, 2014, January 15, 2015, http://www.caiso.com/Documents/Jan15_2015_EnergyImbalanceMarket_REPORT_ER15-402.pdf

Figure 3.1 Frequency of constraint relaxation by month – PacifiCorp East (PACE)

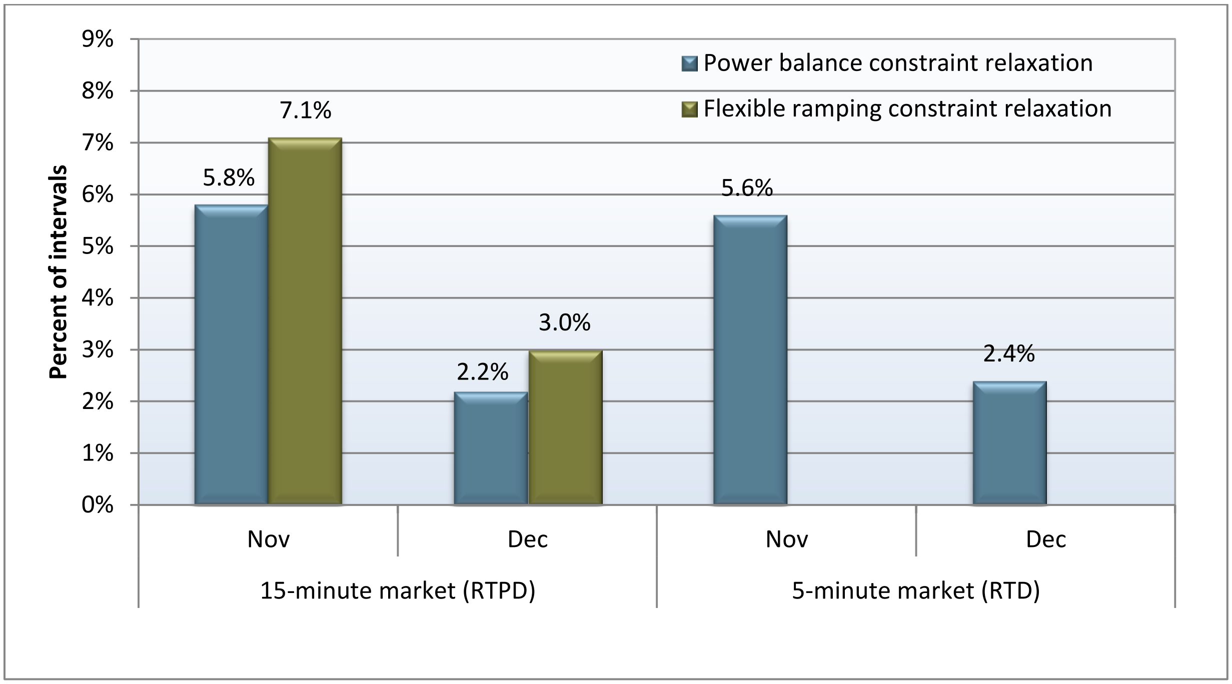


Figure 3.2 Frequency of constraint relaxation by month – PacifiCorp West (PACW)

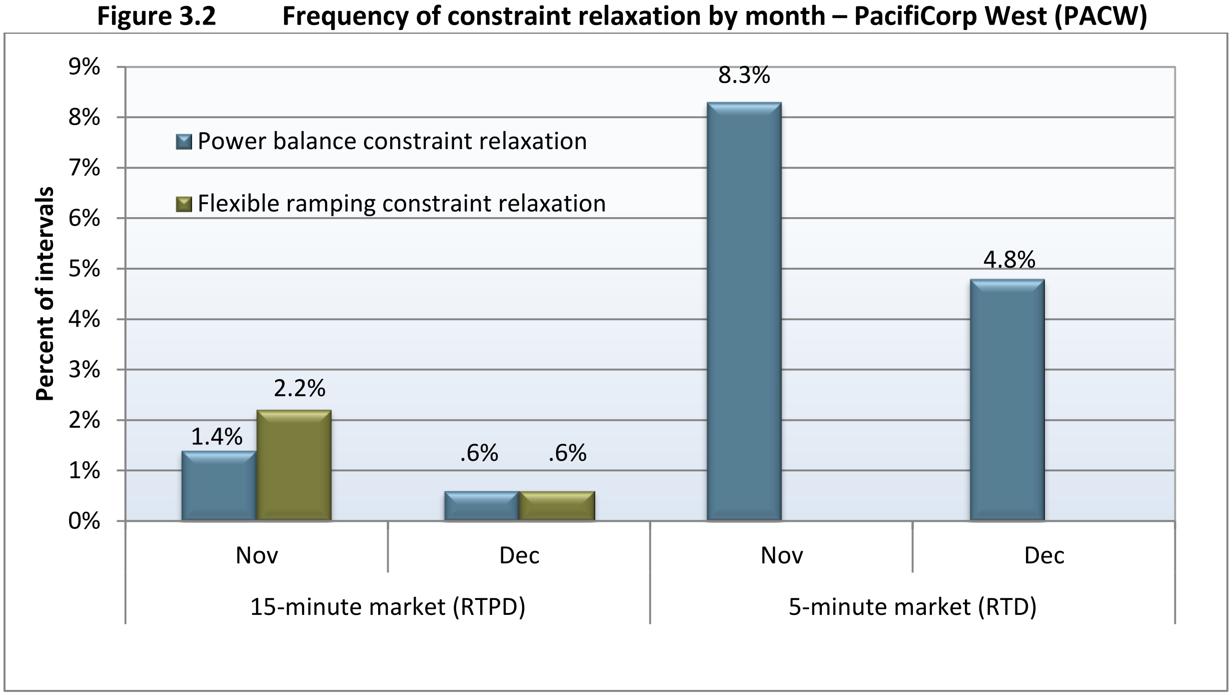


Figure 3.3 Major causes of power balance constraint relaxation PacifiCorp East - 15-minute market (December 2014)

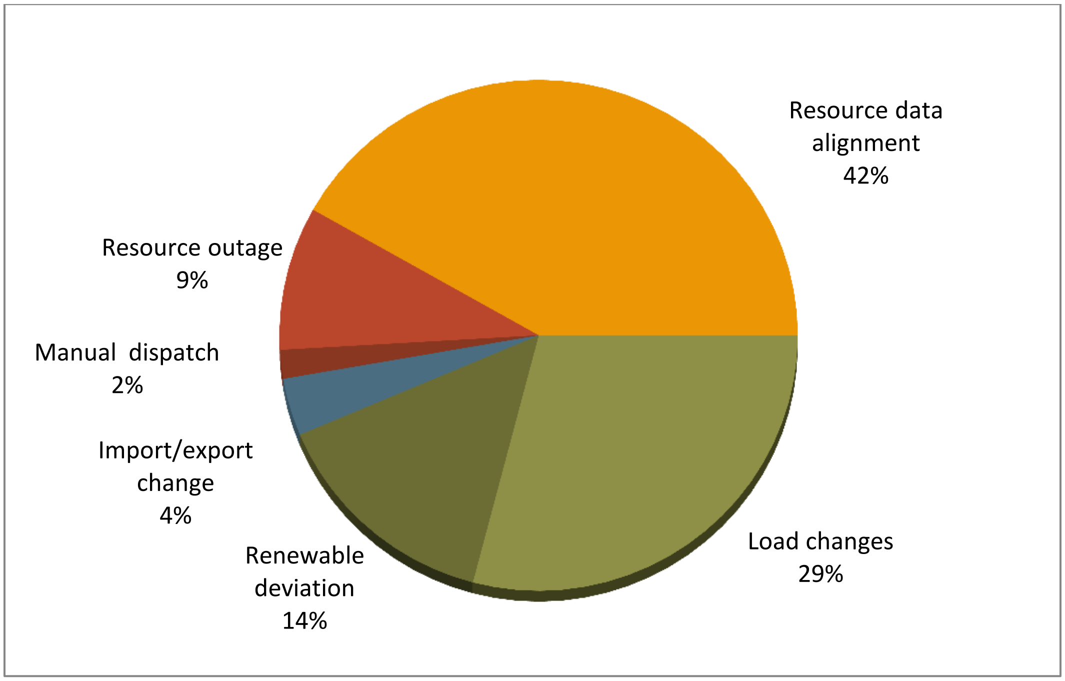


Figure 3.4 Major causes of power balance constraint relaxation PacifiCorp West - 15-minute market (December 2014)

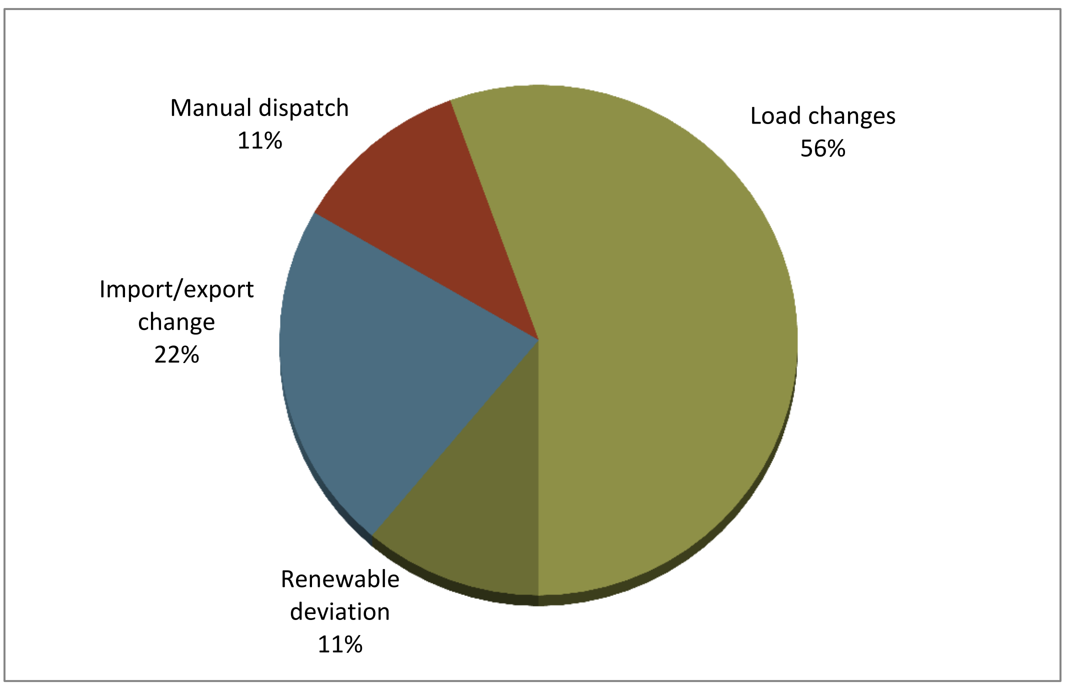


Figure 3.5 Major causes of power balance constraint relaxation PacifiCorp East - 5-minute market (December 2014)

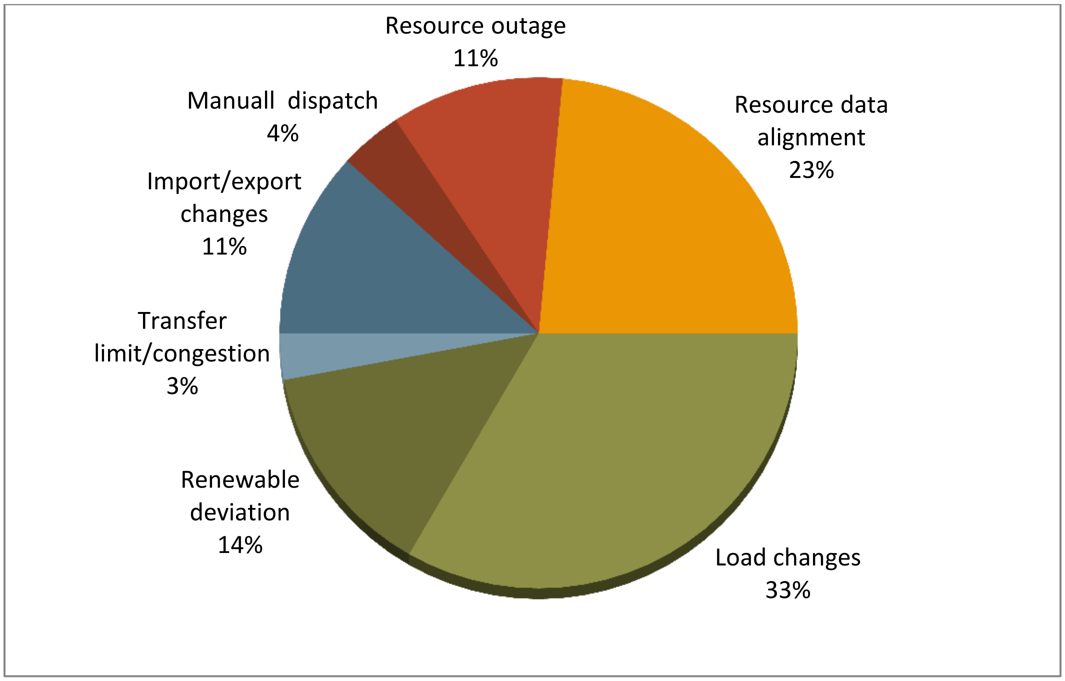
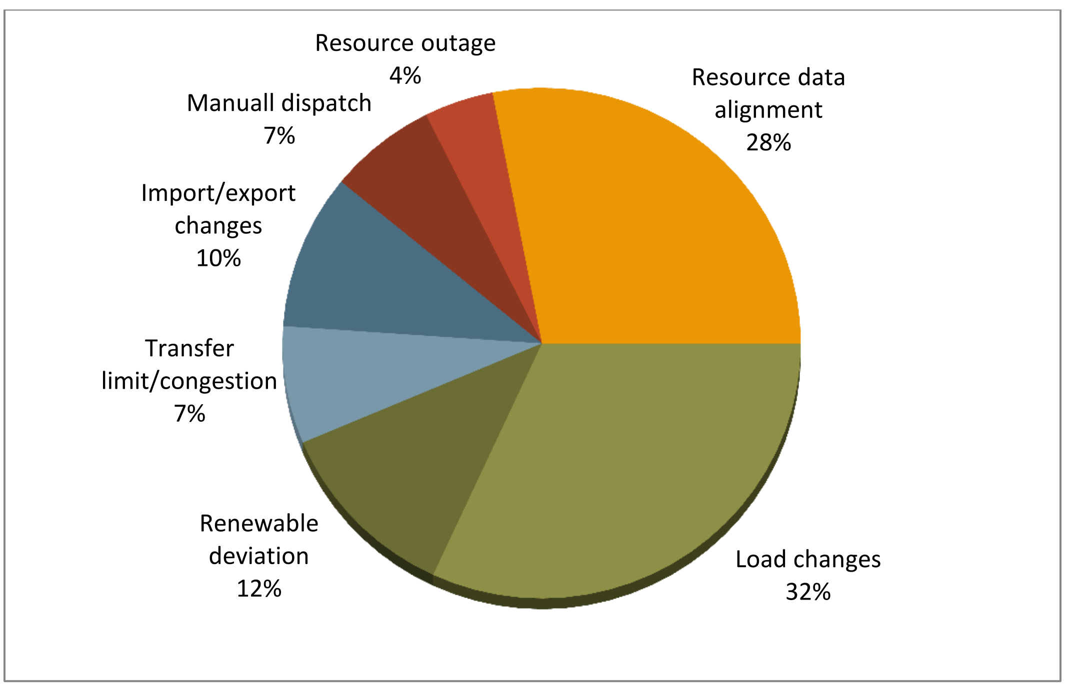


Figure 3.6 Major causes of power balance constraint relaxation PacifiCorp West - 5-minute market (December 2014)



- **Load changes.** This category is cited as the primary cause of 56 percent of supply insufficiencies in the 15-minute market in PacifiCorp West during December, and about one-third of supply insufficiencies in all other EIM markets. The ISO report indicates that this category includes conditions where either the load forecast is adjusted or there is a change in the load bias. In practice, it should be noted that load forecast adjustments or biasing is often the tool by which the EIM operator may seek to account for many sources of modeling discrepancies besides actual fluctuation in loads versus forecasts. For instance, if the EIM operator overestimates the amount of load adjustment or bias actually needed, this may create a supply insufficiency that does not reflect actual system conditions. DMM notes that the need to rely on load adjustments may be reduced by modeling improvements, and that use of adjustments may improve as EIM operators gain additional experience, as occurred in the ISO over time.

- **Renewable deviation.** This category is cited as the primary cause of 11 to 14 percent of supply insufficiencies in the 15-minute and 5-minute markets in both PacifiCorp areas in December. This category represents cases in which changes in wind generation lead to the loss of capacity and for the need to increase generation from other resources. DMM notes that wind deviations appear to represent a higher portion of total load in PacifiCorp than the ISO. As noted in the ISO report, PacifiCorp is working to improve the forecast of wind generation in its area.

- **Resource outages.** This category is cited as the primary cause of about 10 percent of supply insufficiencies in the 15-minute and 5-minute markets in PacifiCorp West during December. When a generating resource outage occurs, the market software needs to increase generation from other resources. When a resource is no longer on outage and is scheduled by an EIM entity, it is also important that the outage be reported in a timely manner so that the market software represents that this capacity is available. Otherwise, the market software perceives that there is capacity shortage to meet the load. As noted in the ISO report, PacifiCorp is working to improve the timeliness with which outages are reported and outages are cancelled for units no longer on outage.

- **Manual dispatch.** This category is cited as the primary cause of about 11 percent of supply insufficiencies in the 15-minute market and 7 percent of supply insufficiencies in the 5-minute market in PacifiCorp West. Manual dispatches are issued to dispatch additional generation when outages or other issues occur causing a sudden need for additional generation. However, if these out-of-market dispatches are not entered into the market software, this generation is not reflected in the available supply modeled in the market software, which can cause a supply insufficiency in the market software. As indicated in the ISO report, the ISO and PacifiCorp have discussed the need for improvement in the timeliness of manual dispatch logging processes.

- **Import/export changes**. This category is cited as the primary cause of about 22 percent of supply insufficiencies in the 15-minute market in PacifiCorp West, and about 10 percent of supply insufficiencies in the 5-minute market in both PacifiCorp areas. This category involves delays in making adjustments and updates to imports and exports schedules in the market software during resources outage times or steep load ramping conditions. Although additional energy may be procured for import in the bilateral market, e-tags are not due until 20 minutes prior to the operating hour. If this energy is not e-tagged before the 15-minute market is run 37.5 minutes prior to the operating hour, this energy is not available to meet supply in the EIM 15-minute market.

- **Transfer constraints/congestion**. This category is cited as the primary cause of about 7 percent of supply insufficiencies in the 5-minute market in PacifiCorp West and 3 percent of supply insufficiencies in the 5-minute market in PacifiCorp East. This category appears to include cases where energy was transferred out of an EIM area in the 15-minute market, and then was needed to meet demand within that area, but was not available since transfers out of the EIM area could not be reduced to the limits placed on EIM transfers in the 5-minute market. In practice, the amount of changes made to 15-minute schedules in the 5-minute market in the EIM have been set to not more than 0.003 MW during most intervals (>92 percent between November 1 and December 31), so that no significant changes can be made to net EIM transfers in the 5-minute market. DMM has identified this as a major contributing factor to supply insufficiencies in the EIM during most intervals.

Figure 3.7 through Figure 3.10 show the frequency of various constraint relaxations by operating hour in PacifiCorp East and PacifiCorp West in the 15-minute market during November and December 2014. These charts also include the average total load (green line) in the PacifiCorp areas in each hour.

As shown in Figure 3.7 through Figure 3.10, the overall frequency of constraint relaxations dropped in December in both PacifiCorp areas. However, the pattern of constraint relaxation does not appear to be highly correlated with hours of high ramping requirements or loads.

Figure 3.7 Constraint relaxation by operating hour (November 2014)
PacifiCorp East - 15-minute market

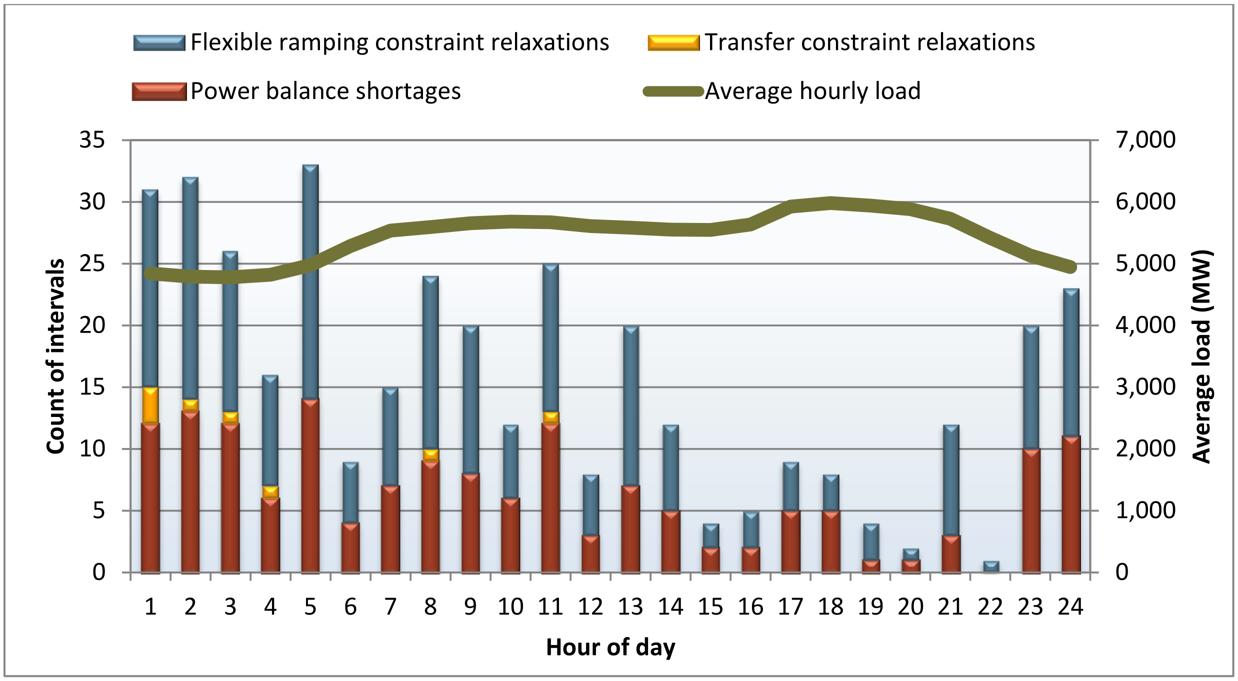


Figure 3.8 Constraint relaxation by operating hour (December 2014)
PacifiCorp East - 15-minute market

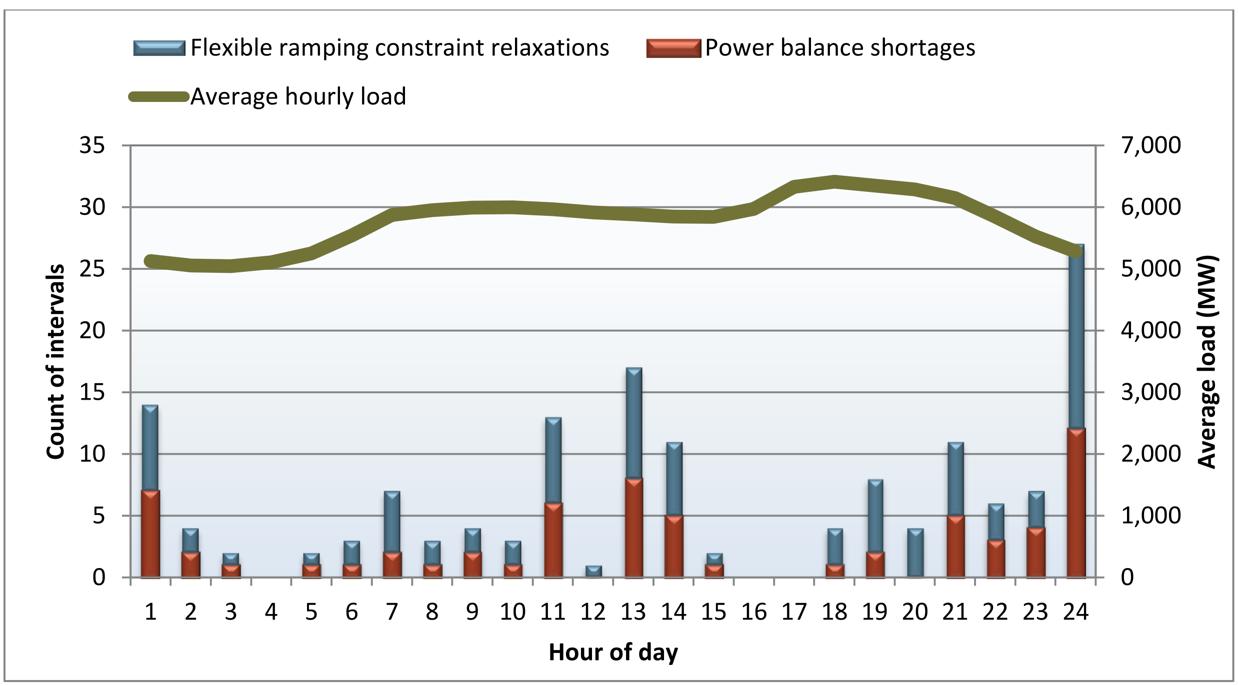


Figure 3.9 Constraint relaxation by operating hour (November 2014)
PacifiCorp West - 15-minute market

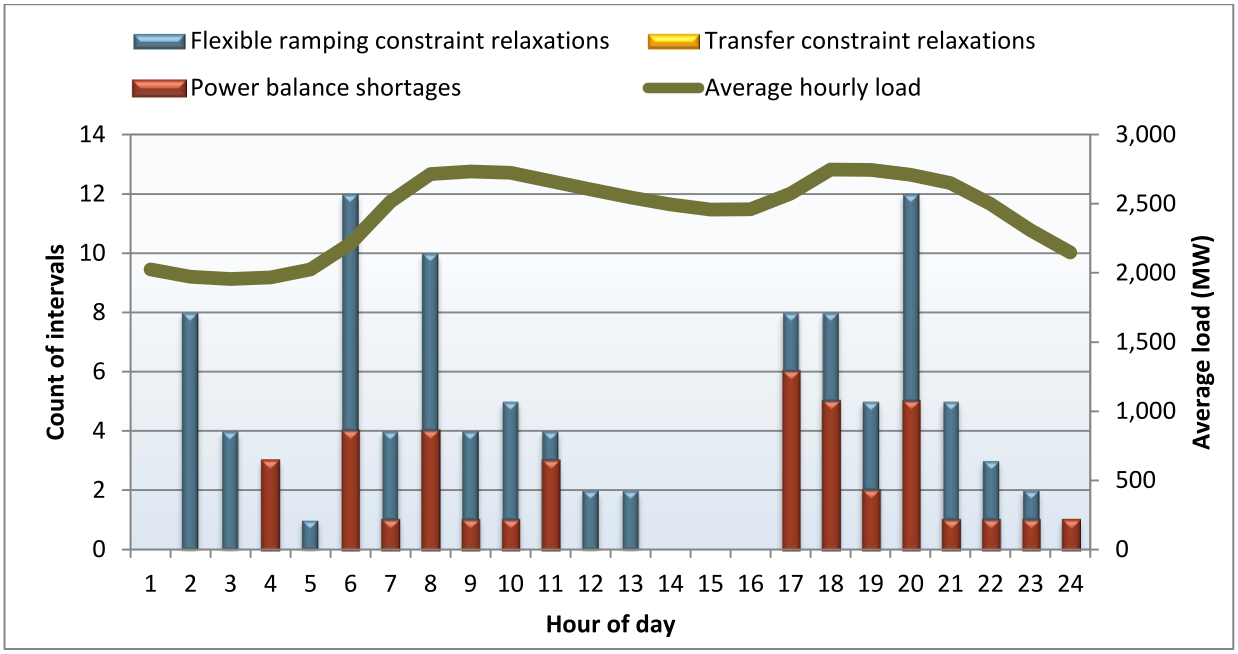
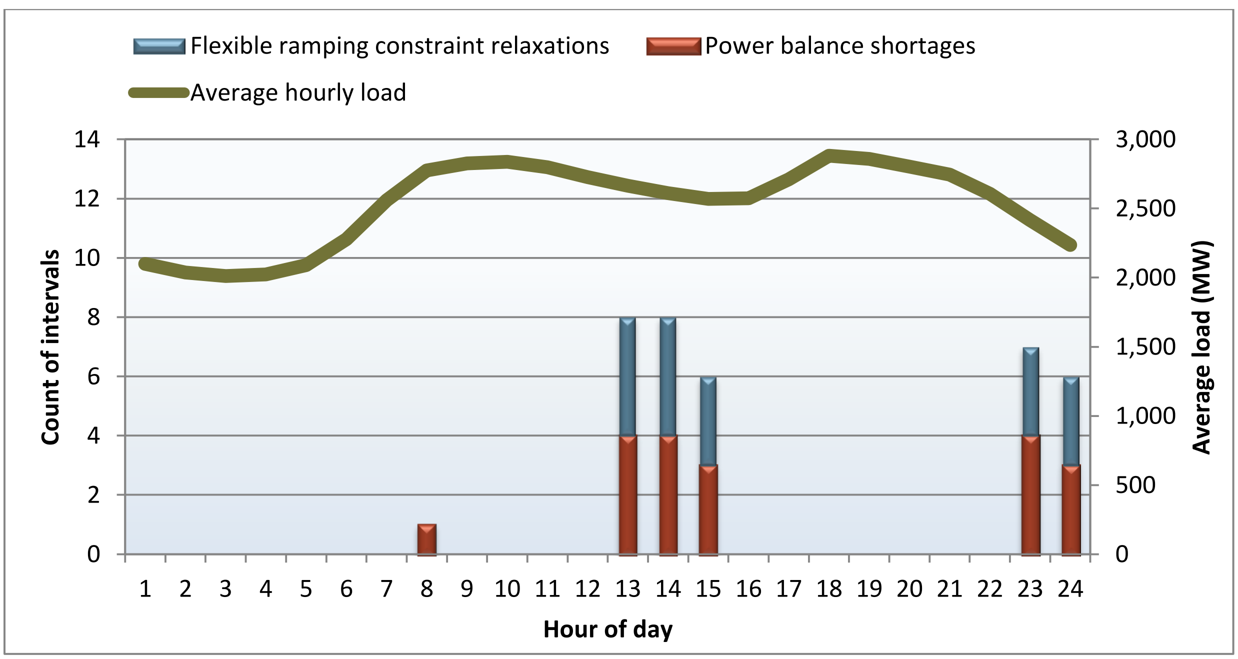


Figure 3.10 Constraint violations by operating hour (December 2014)
PacifiCorp West - 15-minute market



4 Resource schedules, bids and dispatches

This section provides a summary of the amount of capacity being scheduled, bid and dispatched in the EIM. As noted in DMM's first report, the amount of capacity bid into the EIM continues to generally exceed the amount of energy dispatched from EIM resources by a substantial margin.

Figure 4.1 and Figure 4.2 show the total amount of gas and coal capacity participating in EIM from November through December 2014, along with the portion of this capacity reported on outage.

Figure 4.3 and Figure 4.4 show the average amount of capacity scheduled, bid and dispatched in PacifiCorp East and PacifiCorp West in the 15-minute market during December 2014 by operating hour.

- The red lines represent the average of total capacity participating in EIM over the month of December in PacifiCorp East (4,756 MW) and PacifiCorp West (2,382 MW).[13]
- The black lines represent the average amount of this capacity that was available after accounting for outages and de-rates reported in the ISO outage system. DMM's review of reasons codes recorded in outage logs suggests that about one-fifth of capacity reported on outage may be due to generator restrictions, such as minimum off-line times and other operating limitations, rather than operational problems.
- The darker blue area represents the average base schedules for all of the capacity from participating EIM resources by operating hour during December.
- The lighter blue area shows the average amount of capacity above each resource's base schedule that was bid-in and dispatched in the EIM.
- The green area shows DMM's estimate of the amount of undispatched bids available within a 15-minute ramp beyond the level at which units were actually dispatched in the 15-minute market.
- The yellow area shows DMM's estimate of the additional amount of undispatched bids available beyond a 15-minute ramping horizon.

This analysis differentiates the estimated level of bid-in capacity available on a 15-minute horizon (shown in green) from capacity that is bid-in but only available on a longer time-frame (shown in yellow), since much of the capacity shown in yellow may not be available for dispatch in response to many of the factors driving constraint violations in the EIM. For example, the yellow area in Figure 4.3 and Figure 4.4 includes capacity that is bid into the EIM from multi-stage generating units that would only be available if the resource is transitioned to another configuration. The availability of this capacity can often be significantly restricted due to minimum operating times, minimum down times and transition times for different configurations.

[13] The total capacity participating in EIM in PacifiCorp East and PacifiCorp West during each day in December 2014 is provided in Figure 4.1 and Figure 4.2, respectively.

Figure 4.1 Participating capacity and outages (Gas and coal)
PacifiCorp East

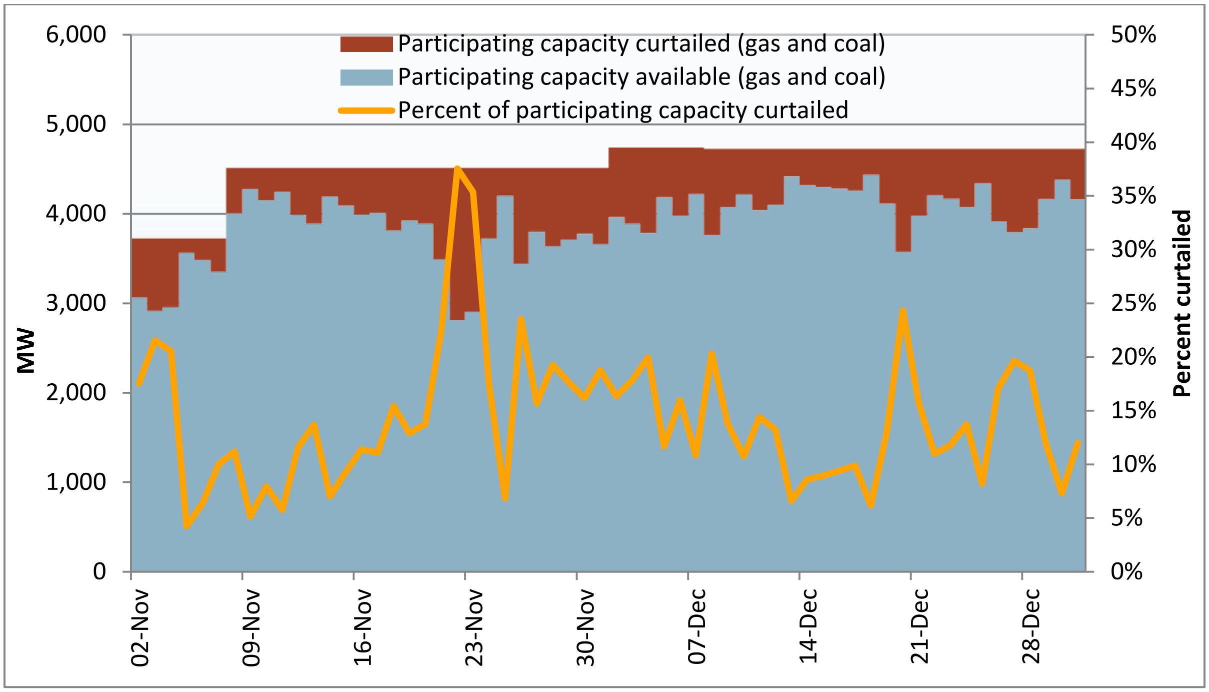


Figure 4.2 Participating capacity and outages (Gas and coal)
PacifiCorp West

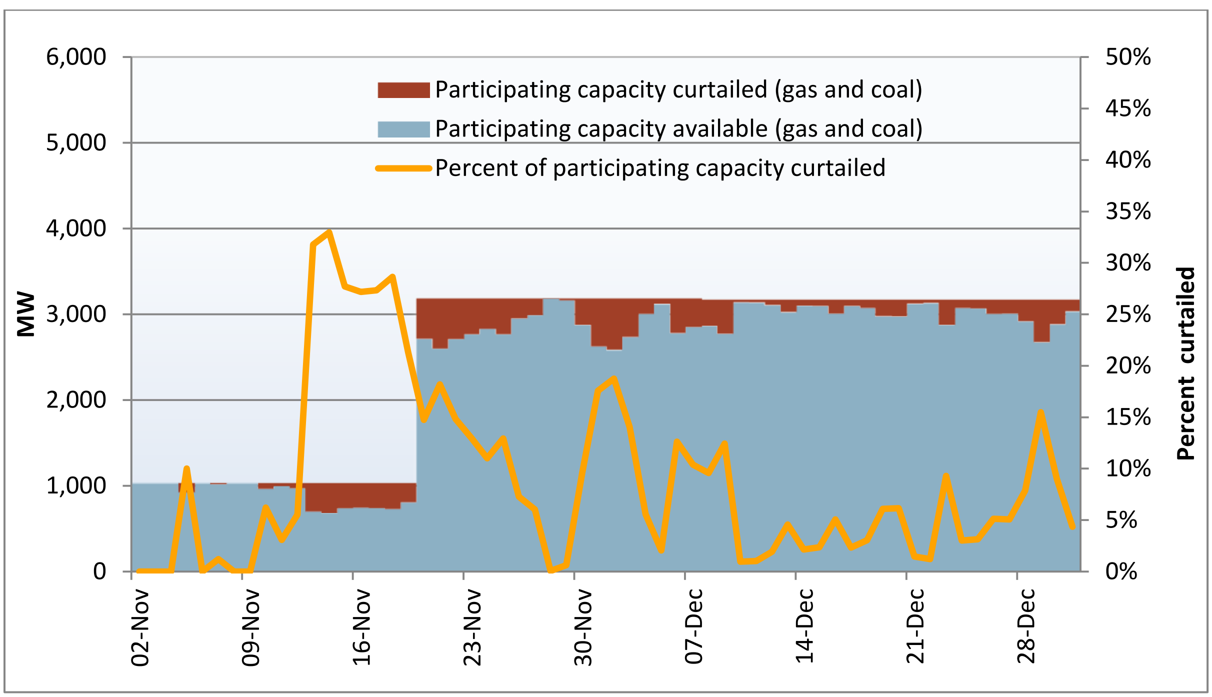


Figure 4.3 Average schedules, bids and dispatches by operating hour - December 2014 PacifiCorp East - 15-minute market (participating gas and coal units)

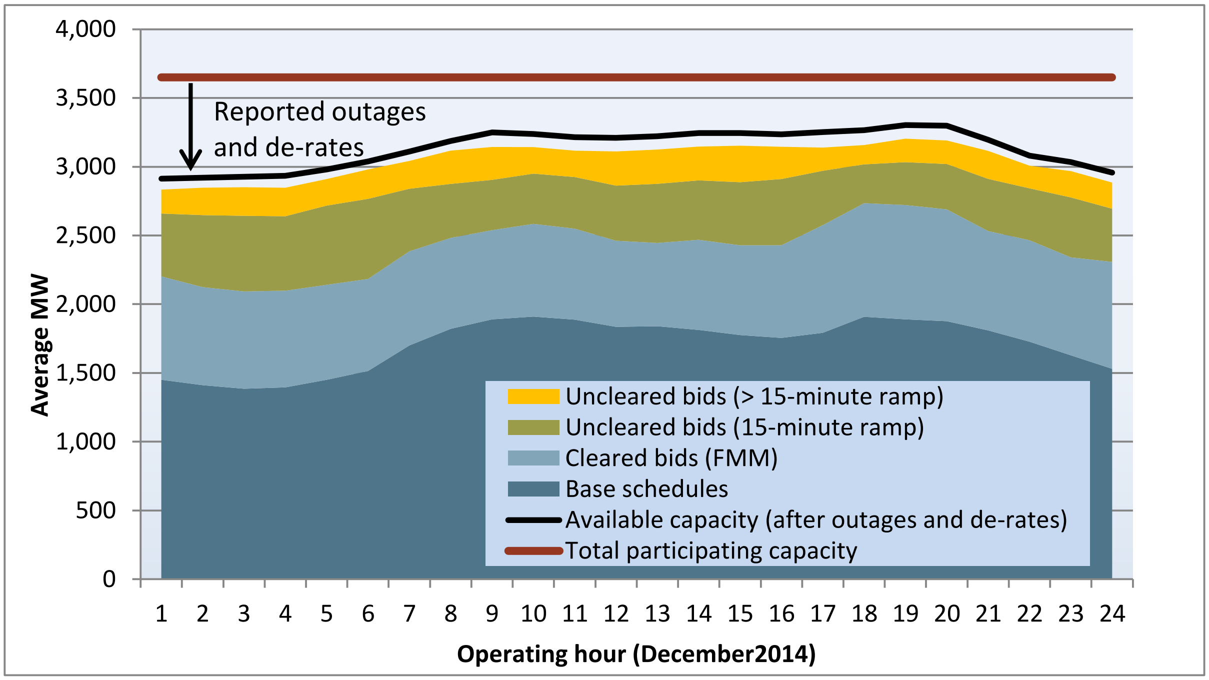
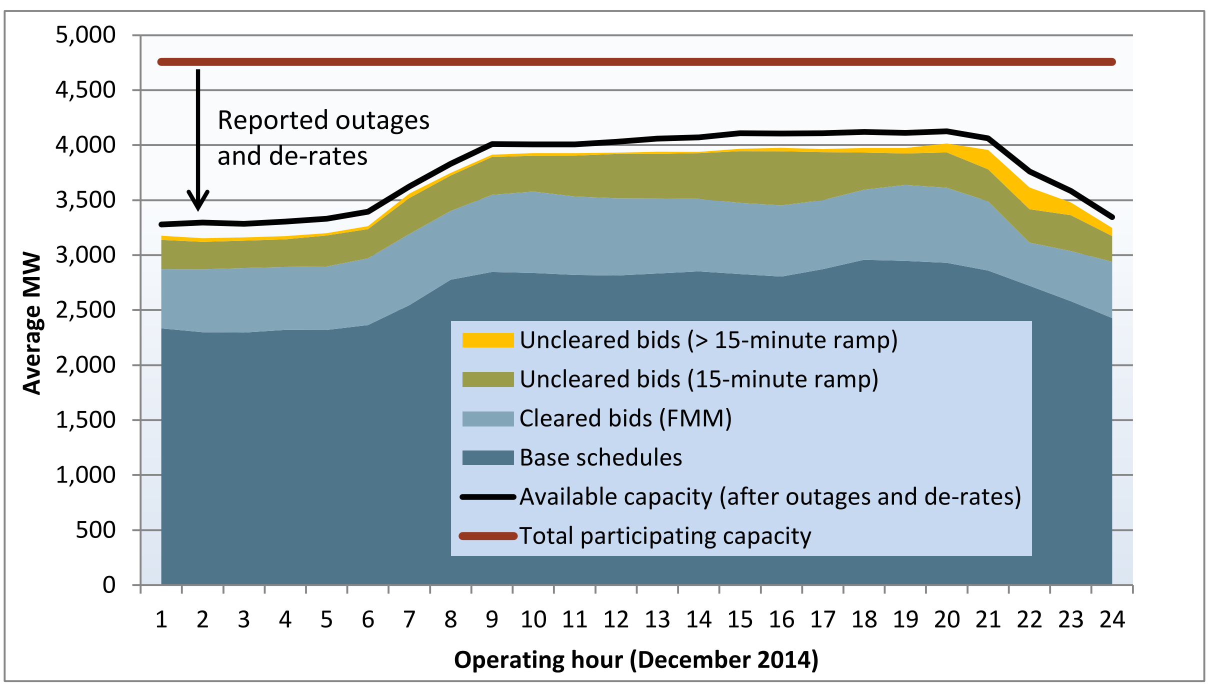


Figure 4.4 Average schedules, bids and dispatches by operating hour -December 2014 PacifiCorp West - 15-minute market (participating gas and coal units)



Data in this report incorporate outages and de-rates reported to the ISO. In most cases, it appears that capacity known to be unavailable due to an outage or de-rate prior to the deadline for bid submission are not bid into the EIM. In some cases, however, bids may be submitted for capacity that is unavailable due to subsequent outage or de-rate. This analysis excluded any bids from capacity that was reported to be unavailable based on ISO outage records.

Table 4.1 provides a numerical summary of several metrics derived from the data underlying Figure 4.1 and Figure 4.2. As shown by this analysis, the amount of capacity bid into the EIM continued to generally exceed the amount of energy dispatched by a substantial margin in most hours in December.

When compared to analysis presented in DMM's first report, results of this analysis show a very slight and non-significant drop in the portion of participating gas and coal capacity scheduled or bid in the EIM in Pacific Corp East and PacifiCorp West. However, the overall level of participating capacity has increased during this time so that the overall volume of energy scheduled or bid into the EIM increased.

Table 4.1 Summary of average schedules, bids and dispatches for gas and coal capacity participating in EIM (December 2014)

	Percent of nameplate capacity scheduled	Percent of nameplate capacity scheduled+bid	Percent of bids dispatched	Undispatched bids as percent of total scheduled+cleared MW
PacifiCorp East				
Peak	58%	80%	61%	12%
Off-peak	61%	72%	64%	11%
PacifiCorp West				
Peak	49%	84%	54%	23%
Off-peak	42%	83%	50%	33%

As shown in Figure 4.1 and Table 4.1, in PacifiCorp East:

- An average of about 60 percent of the nameplate rating of participating gas and coal capacity is scheduled to operate to meet base schedules during both peak and off-peak hours.
- During peak hours, about 20 percent of participating nameplate gas and coal capacity was also bid into the EIM, so that a total of about 80 percent of nameplate participating capacity was scheduled or bid into the EIM.
- Most of the remaining 20 percent of participating nameplate capacity from gas and coal units not bid into EIM during these peak hours represents capacity that was on outage or de-rates. About 97 percent of participating capacity that is available after accounting for outages and de-rates is scheduled or bid into EIM.
- During off-peak hours, the total amount of gas and coal capacity above base schedules bid into the EIM is somewhat lower, so that an average of about 72 percent of participating capacity in PacifiCorp East was scheduled or bid into the EIM. During these off-peak hours, some units are

cycled off-line during off-peak hours, and are not bid into the market since they are unavailable due to minimum down times.

- On average about half of the gas and coal capacity bid into the EIM above base schedules was dispatched in the EIM during both peak and off-peak hours. The amount of undispatched bids offered in EIM averaged 12 percent and 11 percent of the total amount of energy scheduled and dispatched in the EIM from participating capacity during peak and off-peak hours, respectively. This is approximately equal to results for November.

As shown in Table 4.1, in PacifiCorp West:

- An average of about 50 percent of participating gas and coal capacity is scheduled to operate to meet base schedules during peak and about 42 percent is scheduled during off-peak hours.

- During peak hours, an average of about 35 percent of participating gas and coal capacity was also bid into the EIM, so that a total of about 84 percent of participating capacity was scheduled or bid into the EIM on average.

- During off-peak hours, the amount of participating gas and coal capacity scheduled or bid into the EIM averaged about 83 percent.

- On average about 44 percent of the gas and coal capacity bid into the EIM above base schedules was dispatched in the EIM during both peak hours, with an average of about 29 percent being dispatched during off-peak hours.

- The amount of undispatched bids offered in PacifiCorp West averaged 23 percent and 33 percent of the total amount of energy scheduled and dispatched from gas and coal capacity participating in EIM during peak and off-peak hours, respectively.

5 Market bidding and mitigation

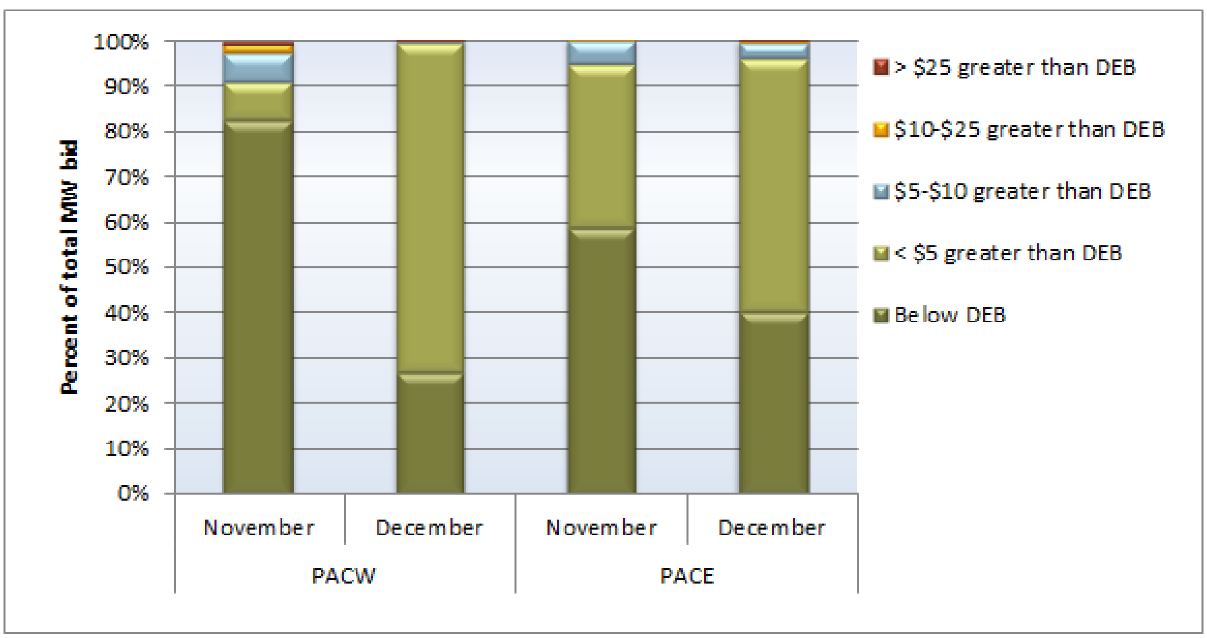
Bidding in the EIM has been highly competitive, with bids for most capacity slightly below or above default energy bids (DEBs) used in market power mitigation. Thus, when relatively high EIM prices have occurred, these prices reflect penalty prices for software constraints rather than bid prices. In addition, when bids are mitigated due to market power mitigation provisions, these procedures generally result in modest reductions in bid prices.

Figure 5.1 summarizes a comparison of bid prices in PacifiCorp East and PacifiCorp West for thermal and hydro units compared to default energy bids used in market power mitigation. These default energy bids are based on the marginal operating costs of thermal resources or opportunity cost for hydro resources with limited energy and energy storage capabilities.

In PacifiCorp East, during December about 40 percent of bids have been lower than the default energy bids, with another 55 percent of bids being not more than $5/MW above default energy bids. Almost all the remaining 5 percent of bids have been no more than $10/MW above default energy bids.

In PacifiCorp West, during December, about 27 percent of bids have been lower than the default energy bids, and almost all of the remaining bids have been no more than $5/MW above default energy bids.

Figure 5.1 Comparison of market bids compared to default energy bids



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 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 23rd day of January, 2015.

/s/ Anna Pascuzzo

Anna Pascuzzo