

February 23, 2017

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

**Re: California Independent System Operator Corporation
Docket: ER15-2526-_____
Independent Assessment by the Department of Market Monitoring
November 2016 Energy Imbalance Market Transition Period
Report – Puget Sound Energy**

Dear Secretary Bose:

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

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

Respectfully submitted,

By: /s/ Eric Hildebrandt

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California ISO

Report on energy imbalance market issues and performance: Puget Sound Energy

February 23, 2017

Prepared by: Department of Market Monitoring

Executive summary

Pursuant to the Commission's October 29, 2015 Order on the ISO's Energy Imbalance Market (EIM), the ISO filed a report on February 10, 2017 covering the period from November 1 through November 30, 2016 (November 2016 Report) for the Puget Sound Energy area.¹ This report provides a review by the Department of Market Monitoring (DMM) of EIM performance in the Puget Sound Energy area during the period covered in the ISO's November report. During our review of the ISO's November report DMM worked with the ISO to reconcile inconsistencies within reported data. DMM will continue to work to identify and resolve issues going forward. Key findings in this report include the following:

- Settlement prices in Puget Sound Energy differed from ISO prices largely because of congestion on transmission from PacifiCorp West to the ISO and PacifiCorp East. Puget Sound Energy is only connected to the energy imbalance market with transfer capability to and from PacifiCorp West, and therefore indirectly connected to the ISO. As a result, settlement prices in Puget Sound Energy were \$19/MWh during November, and tracked closely to a benchmark of bilateral prices in PacifiCorp West.
- Valid power balance constraint shortages were relatively infrequent during November. These relaxations occurred during about 0.1 percent of intervals in the 15-minute and 5-minute markets. Because of the low number of power balance constraint relaxations, the transitional period pricing feature, which prevents prices from being set by the \$1,000/MWh penalty price during power balance shortages, had minimal impact on prices during the month.
- Without special transitional pricing provisions in place, the load bias limiter feature would have triggered during only four intervals in the 5-minute market in Puget Sound Energy. Therefore, the load bias limiter would have had little effect on prices had it been in place and not the transitional period pricing mechanism.
- In November, the ISO implemented a downward sufficiency test in addition to the existing upward sufficiency test, coinciding with the release of the flexible ramping product. During the month, Puget Sound Energy failed the tests infrequently. Puget Sound Energy failed the downward sufficiency test during 2 hours and the upward sufficiency test in 10 hours, or about 2 percent of all hours in November.
- DMM reviewed the results and conclusions in the ISO's November report and found that they are largely consistent with the results we report in this document.

This report is organized as follows:

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

¹ The ISO's November 2016 Report was filed at FERC on February 10 and posted in the ISO website on February 13, 2016: http://www.caiso.com/Documents/Feb10_2017_EIMInformationalReport-TransitionPeriod_PugetSoundEnergy_Nov_2016_ER15-2565.pdf.

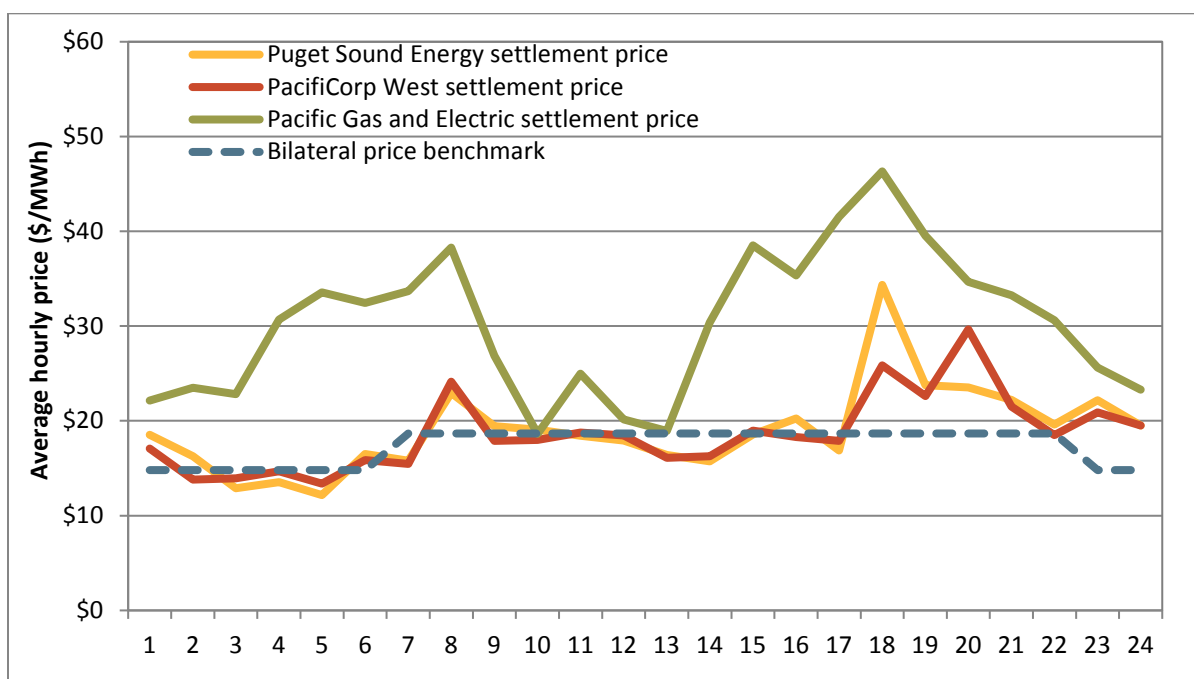
1 Energy imbalance market prices

This section reviews the prices in the Puget Sound Energy area and compares them to benchmark bilateral prices as well as prices in other areas of the EIM using load settlement prices. The load settlement price is an average of 15-minute and 5-minute prices, weighted by the amount of estimated load imbalance in each of those markets.² The 15-minute market prices are weighted by the imbalance between base load and forecasted load in the 15-minute market, and the 5-minute prices are weighted by the imbalance between forecasted load in the 15-minute market and forecast load in the 5-minute market.

Figure 1.1 shows hourly average settlement prices during November in the Puget Sound Energy, PacifiCorp West, and Pacific Gas and Electric (PG&E) areas, as well as the bilateral prices DMM uses as an additional benchmark for energy imbalance market prices.

The bilateral price benchmark for Puget Sound Energy is an average of peak and off-peak prices at Mid-Columbia using day-ahead InterContinental Exchange (ICE) indices. These are representative of the price for settling imbalance energy in the Puget Sound Energy area prior to EIM implementation.

Figure 1.1 Settlement prices and bilateral price benchmark – Puget Sound Energy (November)



Settlement prices in Puget Sound Energy did not reflect prices in the ISO because of limited transmission from PacifiCorp West to the ISO and PacifiCorp East. This resulted in local resources setting the price in a combined Puget Sound Energy and PacifiCorp West region during many intervals, instead of local prices reflecting the overall energy imbalance market system price. Settlement prices in Puget Sound

² Business Practice Manual Configuration Guide: Real-Time Price Pre-calculation, Settlements and Billing, October 29, 2015: https://bpmcm.caiso.com/BPM%20Document%20Library/Settlements%20and%20Billing/Configuration%20Guides/Pre-Calcs/BPM%20-%20CG%20PC%20Real%20Time%20Price_5.13.doc.

Energy tracked closely to the bilateral price benchmark and averaged about \$19/MWh during November, the same as PacifiCorp West. In comparison, Pacific Gas and Electric settlement prices averaged about \$30/MWh for the month.

Figure 1.2 and Figure 1.4 show the average daily frequency of power balance constraint relaxations in the 15-minute and 5-minute markets by week. Relaxations for under-supply (shortage) conditions are shown as positive blue bars and relaxations for over-supply (excess) conditions are shown as negative green bars.³ The red bars in these figures show infeasibilities that would have been resolved by the load bias limiter had the special transitional period pricing not been in place.⁴ Finally, the yellow bars show the infeasibilities that required a price correction or would have triggered price correction if transitional pricing was not active (yellow bars).⁵

Valid under-supply infeasibilities were relatively infrequent during November. These power balance constraint relaxations occurred during about 0.1 percent of intervals in the 15-minute and 5-minute markets. During these periods, transitional period pricing sets prices at the highest cost supply bid dispatched to meet demand, rather than at the penalty parameter.⁶ As shown in Figure 1.2 and Figure 1.4, the number of infeasibilities that required (or would have required) a price correction increased during the month. During some of these intervals, an invalid market solution was detected as a result of issues with the transitional period pricing mechanism or the flexible ramping sufficiency test.

Figure 1.3 and Figure 1.5 show the average weekly prices in the 15-minute and 5-minute markets *with* and *without* the special transitional period pricing provisions being applied to mitigate prices in Puget Sound Energy during November.⁷ These figures also include the average bilateral price benchmark for comparison to EIM market prices, depicted by the dashed blue lines. Because of the low frequency of infeasibilities during November, prices with and without price discovery converged closely in both real-time markets.

³ Some weeks shown in the figure reflect partial weeks, including a partial week at the end of October and beginning of November.

⁴ The load bias limiter, also referred to as the load conformance limiter, is a market mechanism that sets power balance constraint penalty prices at the last economic bid dispatched, rather than the power balance constraint penalty parameter if the load adjustment is larger than the power balance constraint relaxation. In the event of an under-supply infeasibility, this causes prices to be set by the last economic bid instead of the \$1,000/MWh penalty parameter. However, the outcomes from this mechanism do not impact the market because of the transitional period pricing, which is in place for the first six months of new energy imbalance market areas, and sets the price for *all* power balance constraint relaxations to the last price bid into the market by a unit. Transitional pricing is sometimes referred to as price discovery.

⁵ Section 35 of the ISO tariff provides the ISO authority to correct prices if it detects an invalid market solution or issues due to a data input failure, occurrence of hardware or software failure, or a result that is inconsistent with the ISO tariff. During erroneous intervals, the ISO determined that prices resulting under transitional pricing were equivalent to prices that would result from price correction, so no further price adjustment was appropriate.
http://www.caiso.com/Documents/Section35_MarketValidationAndPriceCorrection_May1_2014.pdf.

⁶ When transitional pricing provisions are triggered by relaxation of the power balance constraint, any shadow price associated with the flexible ramping product is set to \$0/MWh to allow the market software to use the last economic bid.

⁷ A detailed description of the methodology used to calculate these counterfactual prices that would result without price discovery was provided on p. 6 of the April 2, 2015 report on the Energy Imbalance Market from DMM (link below). When estimating prices without price discovery, it is assumed that when the load bias limiter would have been triggered, the resulting price would have been equal to the actual price that resulted with price discovery in effect. DMM has also adjusted its analysis to be consistent with the data in the ISO report.
http://www.caiso.com/Documents/Apr2_2015_DMM_AssessmentPerformance_EIM-Feb13-Mar16_2015_ER15-402.pdf.

Figure 1.2 Frequency of constraint relaxation – Puget Sound Energy (15-minute market)

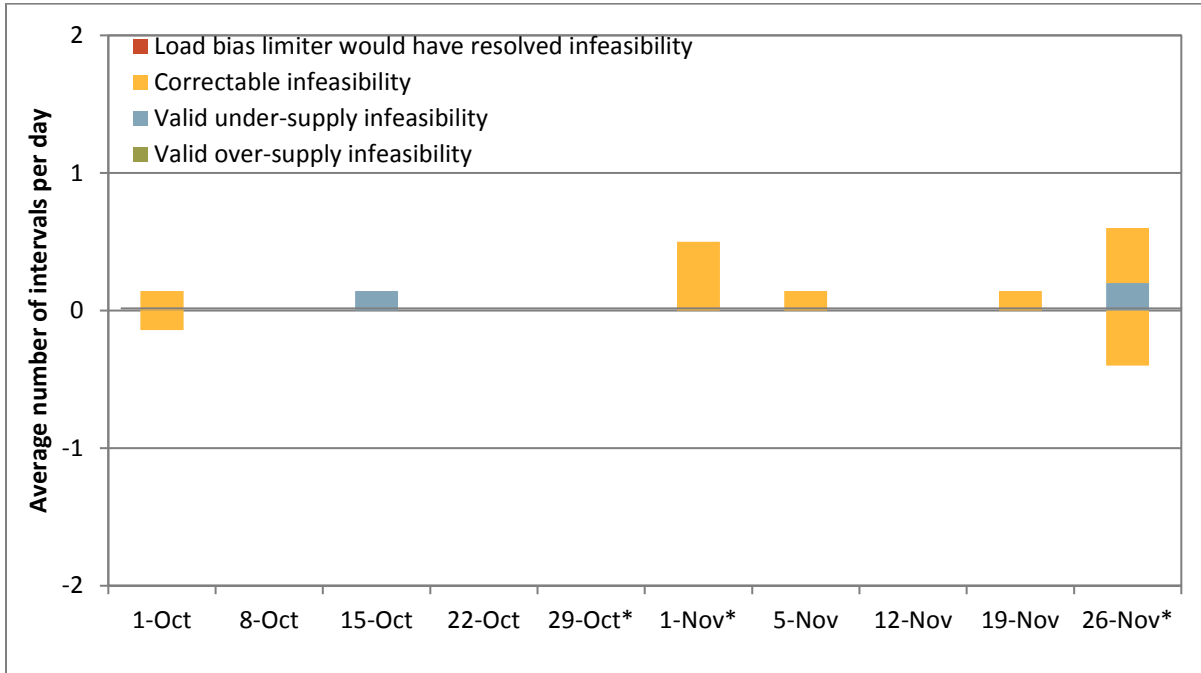


Figure 1.3 Average prices by week – Puget Sound Energy (15-minute market)

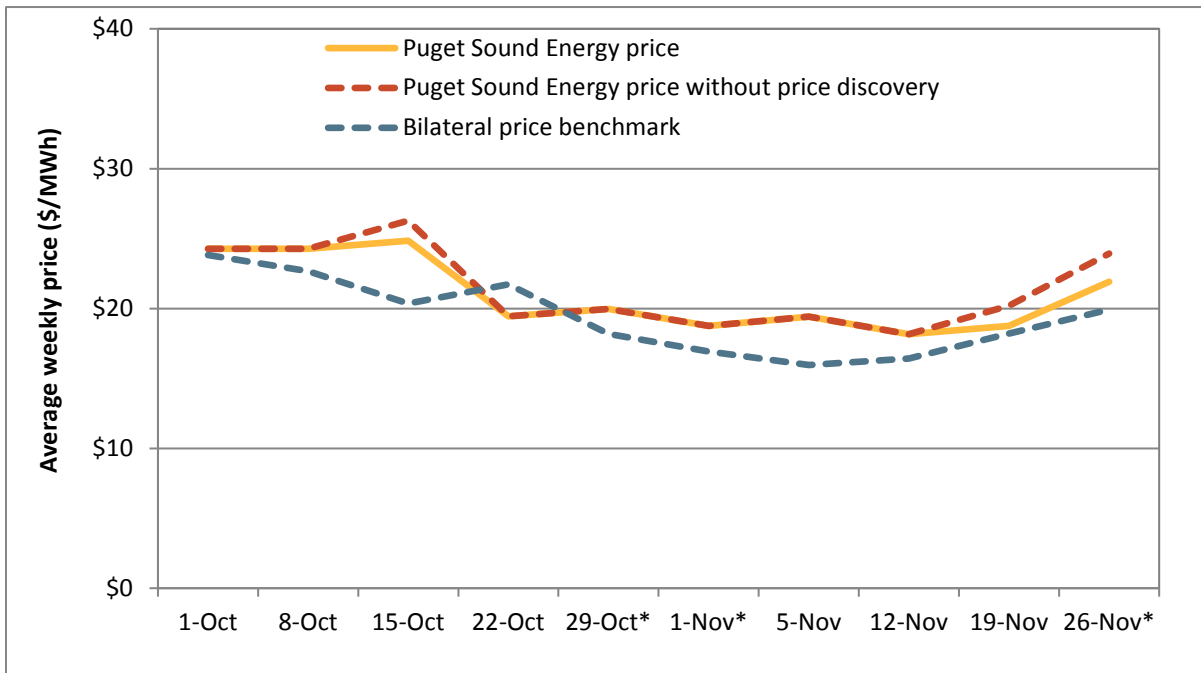


Figure 1.4 Frequency of constraint relaxation – Puget Sound Energy (5-minute market)

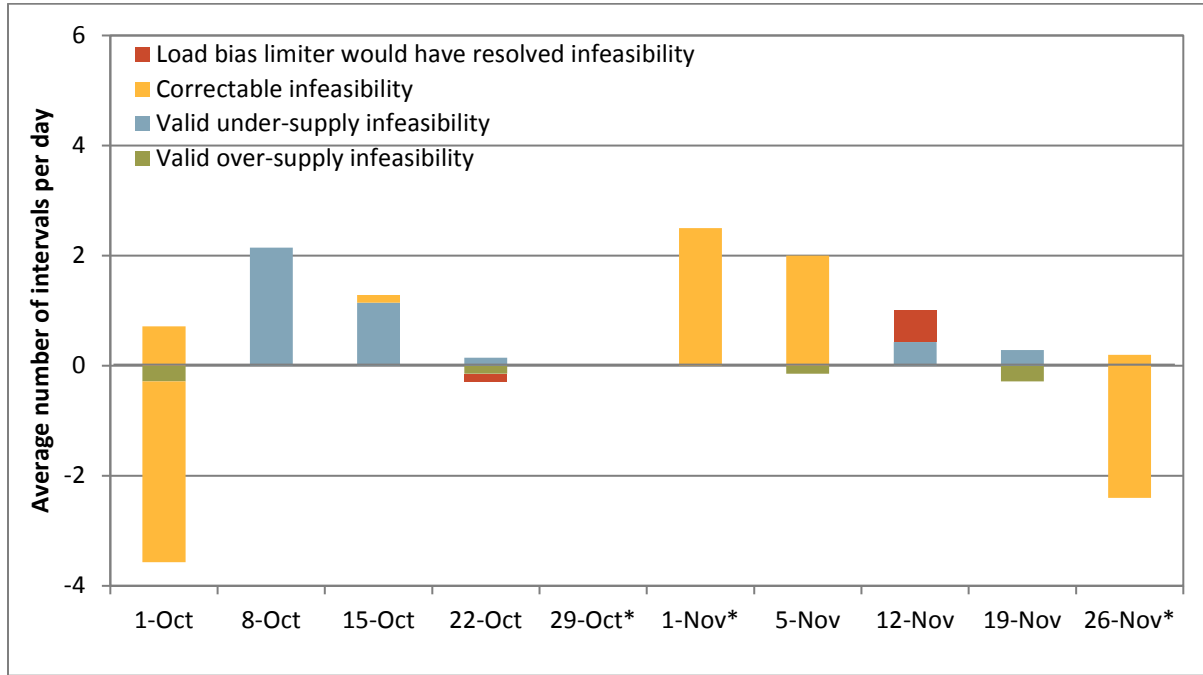
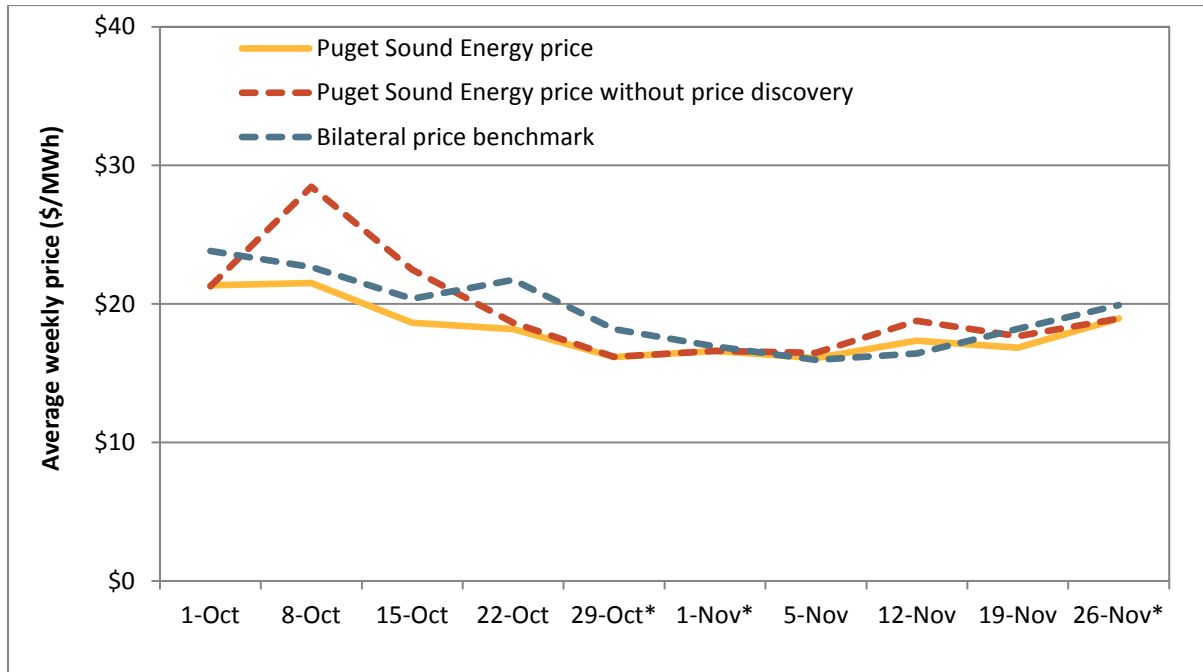


Figure 1.5 Average price by week – Puget Sound Energy (5-minute market)



Weekly prices in Puget Sound Energy did not reflect prices in the ISO as closely and tracked near to or below the bilateral price benchmark because of limited transmission between the two areas.⁸ However, prices in Puget Sound Energy closely tracked prices in PacifiCorp West, as there was little congestion between these areas. These figures also show that the transitional period pricing mechanism, approved under the Commission’s October 29, 2015 Order, had little impact on market prices in Puget Sound Energy in November 2016. This was because of the very low number of valid power balance relaxations during the month.

⁸ As noted earlier, the primary transmission limitation is between PacifiCorp West and the ISO. This also limits transfers from Puget Sound Energy to the ISO as power from Puget Sound Energy must wheel through PacifiCorp West to get to the ISO.

2 Load bias limiter

When triggered, the load bias limiter would have the same effect as the transitional period pricing feature and cause prices to be set by the last economic bid dispatched, rather than the \$1,000/MWh penalty price for energy power balance shortages. A more detailed description of the load bias limiter is included in DMM's April 2015 report.⁹ The ISO also included a discussion of the load bias limiter in its answer to comments regarding available balancing capacity on November 24, 2015.¹⁰

The frequency of intervals in which the power balance constraint was relaxed was relatively low during November in Puget Sound Energy in both real-time markets. Without special transitional pricing provisions in effect, the load bias limiter feature would not have been triggered in the 15-minute market. In the 5-minute market, the load bias limiter would have been triggered during four intervals to resolve under-supply infeasibilities.

Had transitional prices not be in effect, the load bias limiter would have lowered prices in the 5-minute market by about \$0.43/MWh (2 percent).

Table 2.1 Impact of load bias limiter on Puget Sound Energy prices (November 2016)

	Average proxy price	Average EIM price	EIM price without price discovery	EIM price without price discovery or load bias limiter	Potential impact of load bias limiter	
					Dollars	Percent
<i>Puget Sound Energy</i>						
15-minute market (FMM)	\$17.38	\$19.30	\$19.97	\$19.97	\$0.00	0.0%
5-minute market (RTD)	\$17.38	\$17.10	\$17.73	\$18.15	-\$0.43	-2.3%

⁹ 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.

¹⁰ 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.

3 Flexible ramping sufficiency test

The flexible ramping sufficiency test ensures that each balancing area has enough ramping resources over an hour to meet expected upward and downward ramping needs. The test is designed to ensure that each energy imbalance market area has sufficient ramping capacity to meet real-time market requirements without relying on transfers from other balancing areas. This test is performed prior to each operating hour.

When the energy imbalance market was initially implemented there was an upward ramping sufficiency test. In November, the ISO implemented an additional downward ramping sufficiency test in the market. If an area fails the upward sufficiency test, energy imbalance market transfers into that area cannot be increased above base schedules.¹¹ Similarly, if an area fails the downward sufficiency test exports cannot be increased. This effect on transfers can impact the feasibility of market solution as well as price separation across balancing areas.

An area will also fail the flexible ramping sufficiency test for any hour when the capacity test fails. During November, Puget Sound Energy failed the capacity test infrequently, during only 2 hours. The capacity test is a test designed to ensure that there is sufficient resource capacity available to meet forecasts and net exports for any given hour.¹²

In November, the ISO implemented the flexible ramping product, which replaced the flexible ramping constraint, as a new mechanism to ensure that there is sufficient upward and downward ramping capability available to meet forecast net load changes and ramping uncertainty. The ramping requirement also changed with implementation of the flexible ramping product. Unlike the flexible ramping constraint, the demand for flexible ramping was no longer a point, but rather a demand curve. As such, the ISO changed the input to the flexible ramping sufficiency test requirement. Specifically, the ISO began to use the maximum requirement from the demand curve.^{13,14}

Figure 3.1 shows the number of hours in which Puget Sound Energy failed the sufficiency test in the upward or downward direction. In addition, the chart shows the number of hours where an underlying issue caused the sufficiency test to fail. As shown in Figure 3.1, Puget Sound Energy failed the sufficiency test relatively infrequently during the month, during 10 total hours in the upward direction and 2 hours in the downward direction, or about 2 percent of all hours.

¹¹ Business Practice Manual for the Energy Imbalance Market, August 30, 2016, p. 45-52:

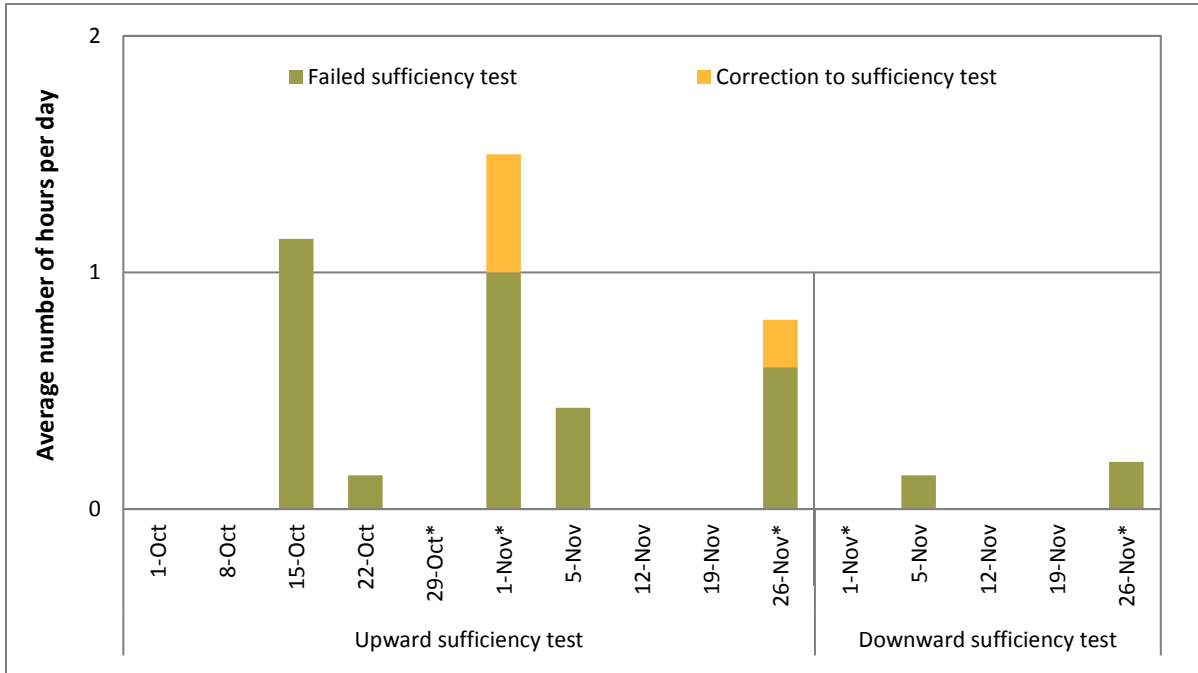
https://bpmcm.caiso.com/BPM%20Document%20Library/Energy%20Imbalance%20Market/BPM_for_Energy%20Imbalance%20Market_V6_clean.docx.

¹² Business Practice Manual for the Energy Imbalance Market, August 30, 2016, p. 45.

¹³ For further detail, see DMM's presentation on January 18, 2017 by Keith Collins to the Market Performance and Planning forum on the calculation of the flexible ramping sufficiency requirement: http://www.caiso.com/Documents/Agenda-Presentation-MarketPerformance-PlanningForum_Jan18_2017.pdf.

¹⁴ DMM has asked the ISO to reconsider how it uses the requirement from the demand curve and how the flexible ramping credit is calculated.

Figure 3.1 Weekly Puget Sound Energy flexible ramping sufficiency test results



CERTIFICATE OF SERVICE

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

Dated at Folsom, California this 23rd day of February, 2017.

/s/ Grace Clark
Grace Clark