

March 14, 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
December 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 December 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

March 14, 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 March 2, 2017 covering the period from December 1 through December 31, 2016 (December 2016 Report) for the Puget Sound Energy area.¹ This report provides a review by the Department of Market Monitoring (DMM) of energy imbalance market performance in the Puget Sound Energy area during the period covered in the ISO's December report. 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 thus is indirectly connected to the ISO. As a result, settlement prices in Puget Sound Energy were \$28/MWh during December, and tracked closely to a benchmark of bilateral and PacifiCorp West prices.
- Valid power balance constraint shortage relaxations were relatively infrequent during December. These relaxations occurred during less than 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 one interval 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.
- Puget Sound Energy failed the upward and downward sufficiency test infrequently during December, during 8 hours in the upward direction and 7 hours in the downward direction, or about 1 percent of all hours during the month in each case.
- DMM reviewed the results and conclusions in the ISO's December 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 December 2016 Report was filed at FERC on March 2 and posted in the ISO website on March 3, 2017: http://www.caiso.com/Documents/Mar2_2017_EIMInformationalReport-TransitionPeriod_PugetSoundEnergy_Dec2016_ER15-2565.pdf.

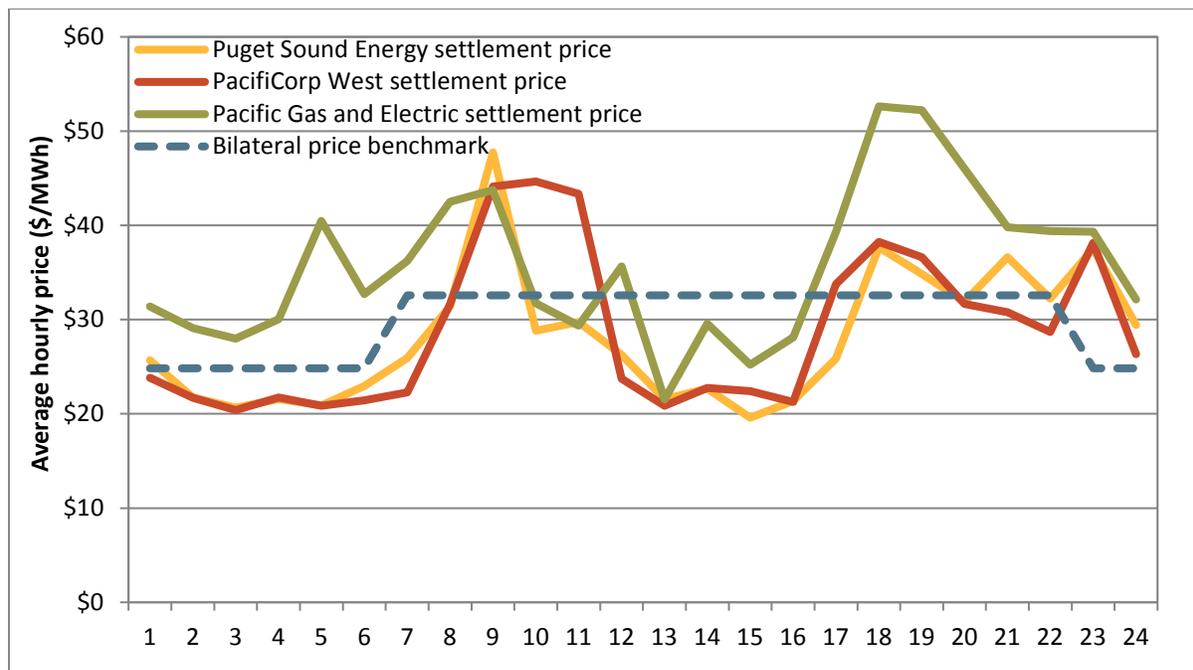
1 Energy imbalance market prices

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 energy imbalance market 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 forecast load in the 15-minute market, and the 5-minute prices are weighted by the imbalance between forecast load in the 15-minute market and forecast load in the 5-minute market.

Figure 1.1 shows hourly average settlement prices during December 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 energy imbalance market implementation.

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



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.

Settlement prices in Puget Sound Energy differed from ISO prices 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. The average settlement price in Puget Sound Energy was \$28/MWh in December and was just below the average bilateral benchmark price of \$30/MWh. The average settlement price in PacifiCorp West almost matched that in Puget Sound Energy during December. By comparison, Pacific Gas and Electric settlement prices averaged about \$36/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.⁵

Valid under-supply infeasibilities were relatively infrequent during December. Valid power balance constraint shortages occurred during no intervals in the 15-minute market in December, and only in 6 intervals (less than 1 percent) in the 5-minute market. During these periods, the transitional period pricing mechanism set prices at the highest cost supply bid dispatched to meet demand, rather than at the penalty parameter.⁶ Four of these shortages occurred on December 20 because of lower than expected scheduled interchanges which caused a small price separation between the average prices with and without price discovery during that week. Contrary to last month, there were no 5-minute market infeasibilities where prices would have been subject to corrections in December.

Figure 1.3 and Figure 1.5 show the average monthly 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.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 power balance relaxations during December, prices with and without price discovery converged closely in both real-

³ The figure reflects partial weeks, including the end of October, beginning of November, and end of December.

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 and in the same direction as the power balance constraint relaxation. In the event of a shortage, this causes prices to be set by the last economic bid instead of the \$1,000/MWh penalty parameter. Because transitional period pricing, also referred to as price discovery, is in place for the first six months for all new energy imbalance market areas, the load bias limiter does not impact prices. This is because transitional period pricing sets the price for *all* power balance constraint relaxations to the last price bid into the market by a unit.

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 a 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:
http://www.caiso.com/Documents/Apr2_2015_DMM_AssessmentPerformance_EIM-Feb13-Mar16_2015_ER15-402.pdf.

time markets. This indicates that the transitional period pricing mechanism had little impact on market prices in Puget Sound Energy in December.

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

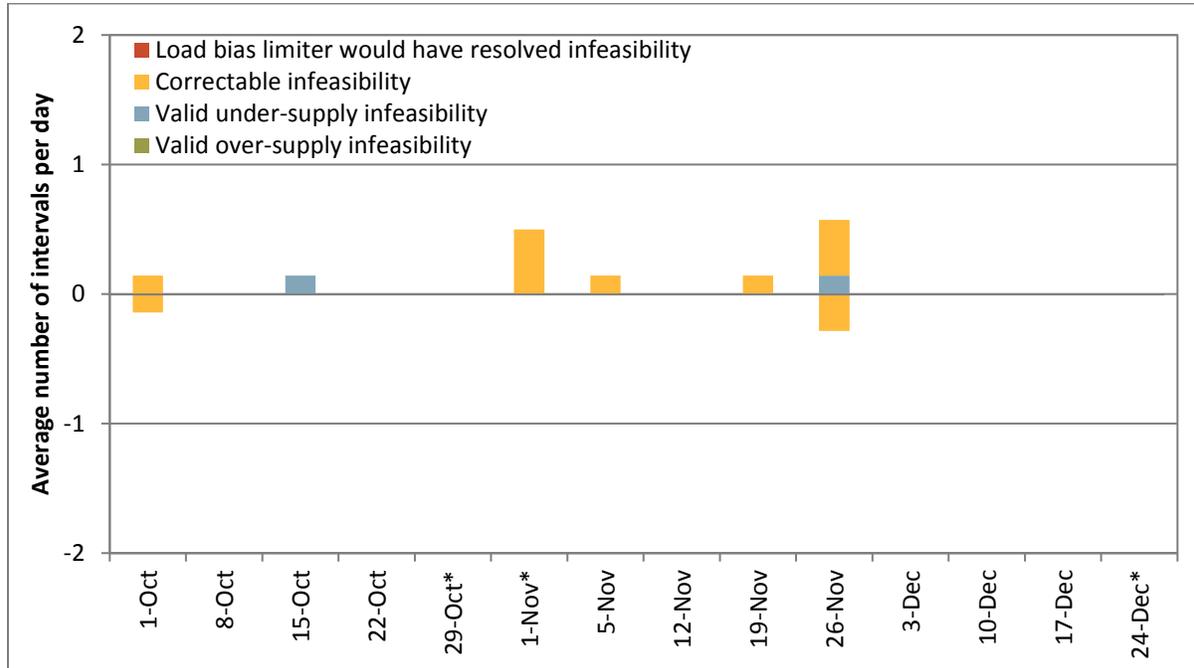


Figure 1.3 Average prices by week – Puget Sound Energy (15-minute market)

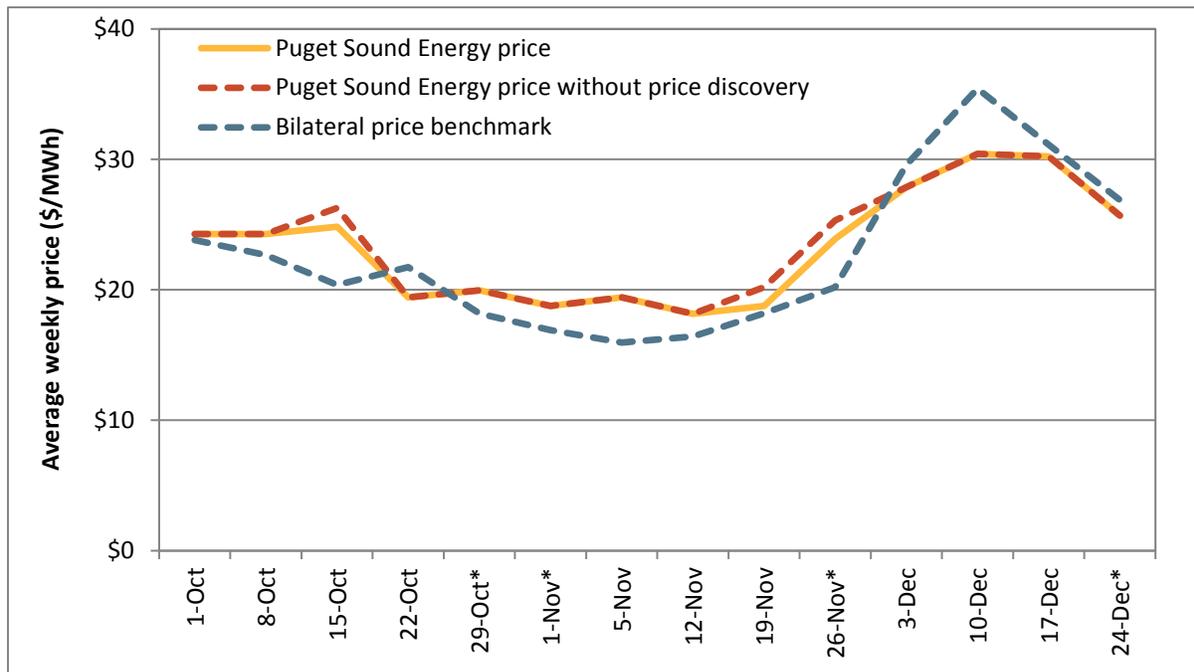


Figure 1.4 Frequency of constraint relaxation – Puget Sound Energy (5-minute market)

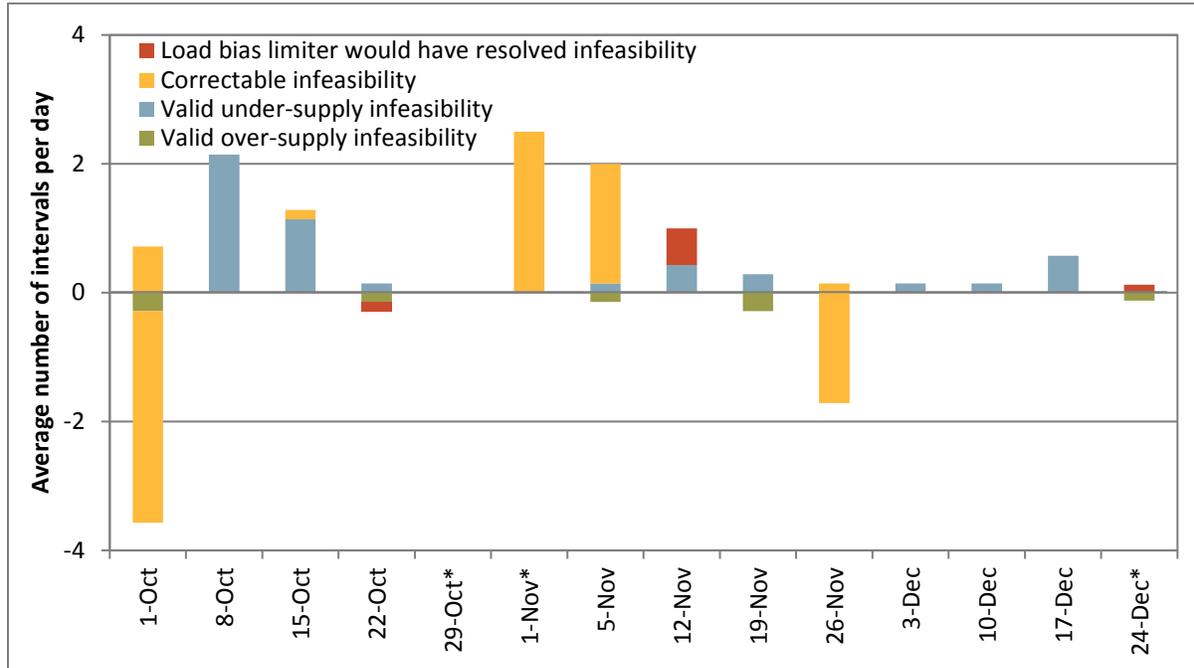
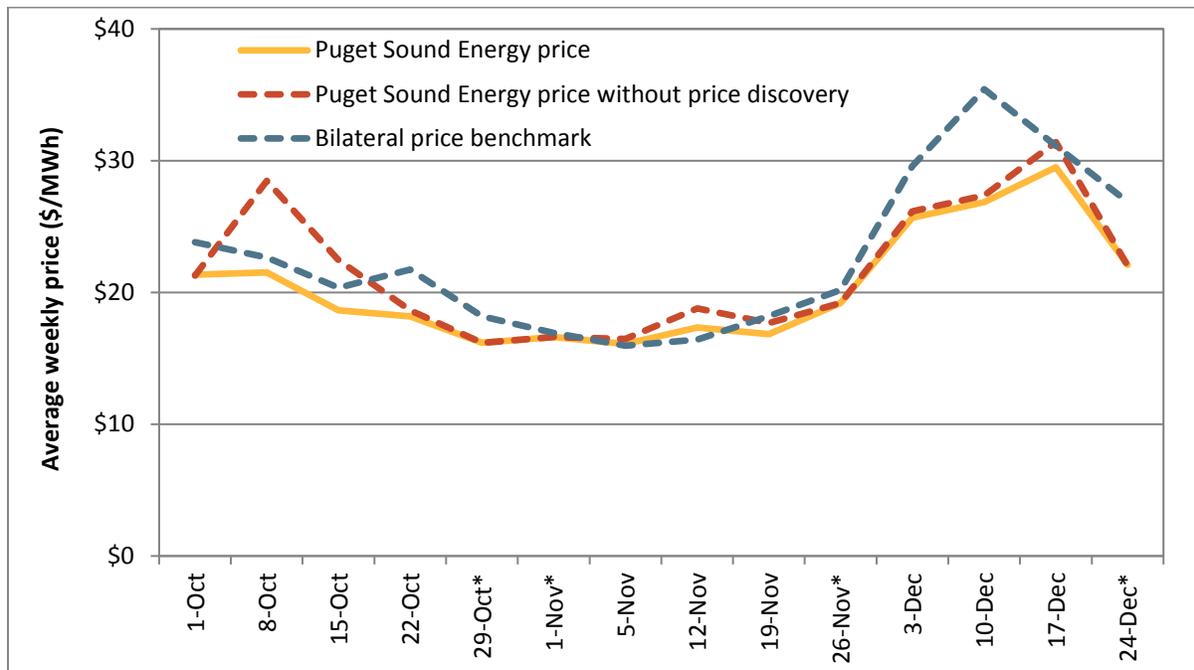


Figure 1.5 Average price by week – Puget Sound Energy (5-minute market)



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 shortage relaxations. A more detailed description of the load bias limiter is included in DMM’s April 2015 report.⁸ The ISO also included a discussion of the load bias limiter in its answer to comments regarding available balancing capacity in November 2015.⁹

The frequency of intervals when the power balance constraint was relaxed was very limited during December 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 one interval to resolve an under-supply infeasibility.

Had transitional prices not been in effect, the load bias limiter would have lowered prices in the 5-minute market by about \$0.11/MWh (less than 1 percent).

Table 2.1 Impact of load bias limiter on Puget Sound Energy prices (December 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)	\$29.99	\$28.49	\$28.49	\$28.49	\$0.00	0.0%
5-minute market (RTD)	\$29.99	\$25.51	\$26.14	\$26.25	-\$0.11	-0.4%

⁸ 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

⁹ 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 2016, the ISO implemented an additional downward ramping sufficiency test in the market, with the introduction of the flexible ramping product. These tests are designed to ensure that there is sufficient resource capacity available to meet forecasts and net exports for any given hour.¹⁰ Therefore, the test is implemented so that if an area fails the upward sufficiency test, energy imbalance market transfers are frozen and cannot be increased above base schedules.¹¹ Similarly, if an area fails the downward sufficiency test exports cannot be increased. In addition to the sufficiency test, each area is also subject to a capacity test. If an area fails the capacity test, then the flexible ramping sufficiency test fails as a result.

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 the implementation of the flexible ramping product. Unlike the flexible ramping constraint, the demand for flexible ramping was no longer set at a single target, but rather with 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.¹² DMM has asked the ISO to reconsider how it uses the requirement from the demand curve and how the flexible ramping credit is calculated.

Limiting transfers can impact the frequency of power balance constraint relaxations and thus price separation across balancing areas. Constraining transfer capability may also impact the efficiency of the energy imbalance market by limiting transfers into and out of a balancing area that could potentially provide benefits to other balancing areas.

Figure 3.1 shows the number of hours in which Puget Sound Energy failed the sufficiency test in the upward or downward direction. During December, Puget Sound Energy failed the upward sufficiency test during 8 hours and failed the downward sufficiency test during 7 hours, or about 1 percent of all hours in the month each. The upward failures included 7 consecutive hours on December 1 because of

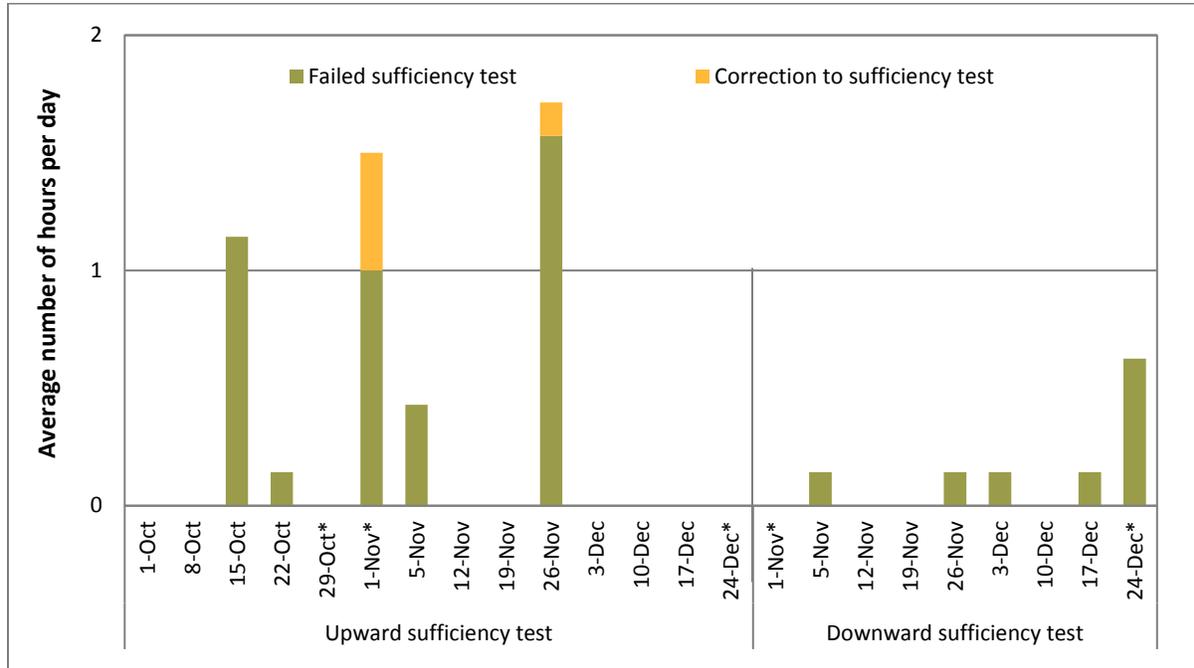
¹⁰ Business Practice Manual for the Energy Imbalance Market, August 30, 2016, p. 45.

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 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.

limited upward ramping capacity. The majority of the downward sufficiency test failures were because of failed capacity tests.

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 14th day of March, 2017.

/s/ Grace Clark
Grace Clark