August 15, 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
February 2017 Energy Imbalance Market Transition Period Report
– Puget Sound Energy

Dear Secretary Bose:

The Department of Market Monitory (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 February 2017. 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 Independent
System Operator Corporation

California ISO

Report on energy imbalance market issues and performance: Puget Sound Energy for February 2017

July 5, 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 May 4, 2017 covering the period from February 1 through February 28, 2017 (February report) for the Puget Sound Energy area in the energy imbalance market.[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 February report. Key findings in this report include the following:

- Real-time 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 and PacifiCorp West prices were similar during most hours, a result of little real-time congestion between these areas. When prices separated between these two areas it was mostly during hours that PacifiCorp West failed the upward flexible ramping sufficiency test, which limited transfers.
- The frequency of valid under-supply infeasibilities in Puget Sound Energy increased during February, but remained relatively infrequent. Because of the low number of under-supply infeasibilities the transition 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. There were no over-supply infeasibilities during February in Puget Sound Energy.
- Without special transition pricing provisions in place, the load bias limiter feature would have resolved only four under-supply infeasibilities 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 transition period pricing mechanism.
- Puget Sound Energy failed the upward and downward sufficiency test infrequently during February. This included just two hours in the upward direction and one hour in the downward direction, significantly less than 1 percent of all hours.
- DMM reviewed the results and conclusions in the ISO's February report and found that they are largely consistent with the results we report in this document.

Section 1 of this report provides a description of prices and power balance constraint impacts, section 2 discusses the load bias limiter, and section 3 discusses the flexible ramping sufficiency test.

[1] The ISO's February 2017 Report was filed at FERC on May 4, 2017 and posted on the ISO website on May 5, 2017, http://www.caiso.com/Documents/May4_2017_EIMInformationalReport-TransitionPeriod_PugetSoundEnergy_Feb2017_ER15-2565.pdf.

1 Energy imbalance market prices

Figure 1.1 and Figure 1.2 show hourly average 15-minute and 5-minute prices during February in Puget Sound Energy, PacifiCorp West, and Pacific Gas and Electric (PG&E), as well as the bilateral prices DMM used as an additional benchmark for energy imbalance market prices.

The bilateral price benchmark for Puget Sound Energy includes day-ahead peak and off-peak energy prices at the Mid-Columbia hub collected from InterContinental Exchange (ICE) indices. These are representative of prices used for settling imbalance energy in the Puget Sound Energy area prior to energy imbalance market implementation.

Settlement prices in Puget Sound Energy were often lower than 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 system price. In the Puget Sound Energy area during the month, prices averaged about $20/MWh and $17/MWh in the 15-minute and 5-minute market, respectively. Average PacifiCorp West prices were significantly higher than Puget Sound Energy prices during multiple hours when PacifiCorp West failed the upward flexible ramping sufficiency test and the power balance constraint was relaxed imposing the $1,000/MWh penalty parameter on their prices. However, in most hours Puget Sound Energy and PacifiCorp West prices were similar.

Figure 1.1 Average hourly 15-minute price – Puget Sound Energy

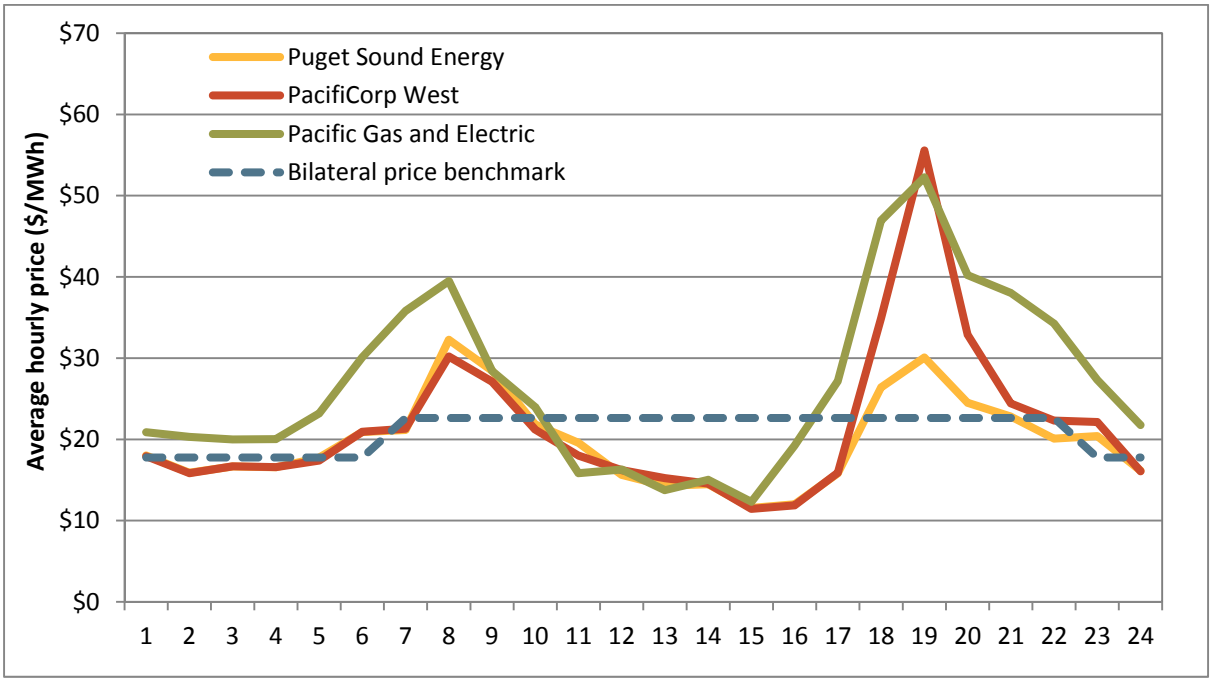


Figure 1.2 Average hourly 5-minute price – Puget Sound Energy

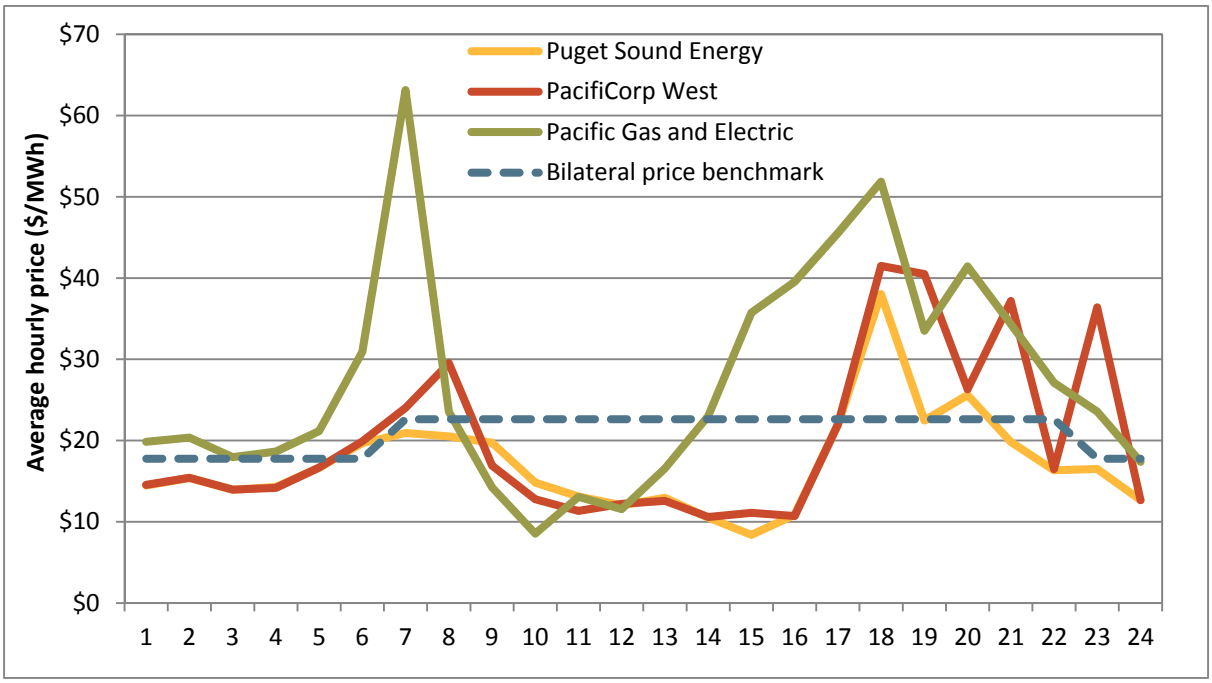
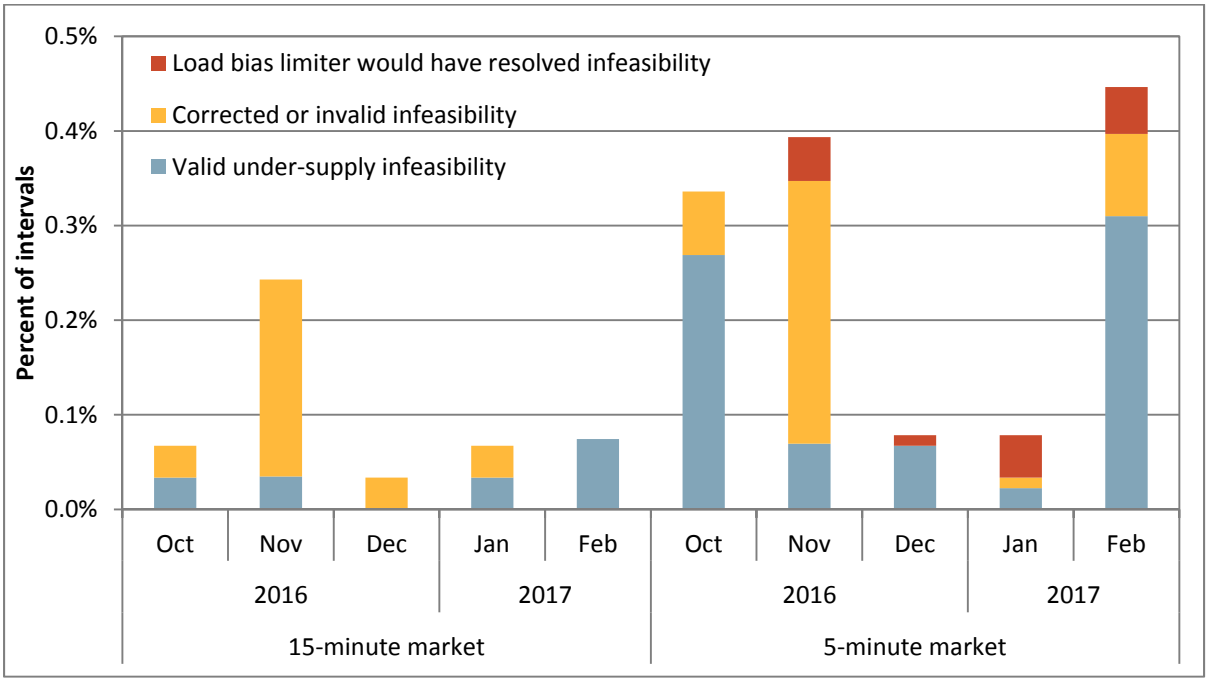


Figure 1.3 and Figure 1.4 show the frequency of power balance constraint relaxations in the 15-minute and 5-minute markets by month. All power balance constraint relaxations that occurred in February were subject to the six-month transition period pricing that expired in April 2017. This feature sets prices equal to the last economic unit dispatched instead of the $1,000/MWh penalty parameter while relaxing the constraint for shortages or the -$155/MWh penalty parameter while relaxing the constraint for excess energy. Power balance constraint relaxations can be grouped in the following categories:

- **Valid under-supply infeasibility** (power balance constraint shortage). These occurred when the power balance constraint was relaxed because load exceeded available generation. The ISO validated that ISO software was working appropriately during these instances.
- **Valid over-supply infeasibility** (power balance constraint excess). These occurred when the power balance constraint was relaxed because generation exceeded load. The ISO validated that ISO software was working appropriately during these instances.
- **Load bias limiter would have resolved infeasibility.** These occurred when a load adjustment entered by Puget Sound Energy exceeded the amount of power balance constraint relaxation and the load adjustment was in the same direction. During the transition period, the load bias limiter did not change price outcomes because transition period pricing was applied during these intervals. However, in these cases, the load bias limiter would have reduced the operator adjustment in the pricing run to prevent the infeasibility had transition period pricing not been in effect.

- **Correctable infeasibility.** These occurred when the ISO software relaxed the power balance constraint because of either a software error or data error. These required a price correction or would have triggered price correction if transition period pricing were not active.[2]

Figure 1.3 Frequency of under-supply power balance infeasibilities by month Puget Sound Energy



As shown in Figure 1.3, the frequency of valid under-supply infeasibilities in Puget Sound Energy increased during February in both real-time markets, but remained relatively infrequent overall, occurring during significantly less than 1 percent of all intervals. The majority of these under-supply infeasibilities occurred during several hours on February 28. During this period, there was net schedule interchange and renewable generation deviation as well as consecutive failures of the upward flexible ramping sufficiency test.

In the 15-minute market, valid under-supply infeasibilities occurred in less than 0.1 percent of intervals. In the 5-minute market, valid under-supply infeasibilities occurred during around 0.3 percent of intervals. During these periods, the transition period pricing mechanism set prices at the highest cost supply bid dispatched to meet demand rather than at the penalty parameter.[3] Alternatively, there were no over-supply infeasibilities in Puget Sound Energy during February.

[2] 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 transition period 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.

[3] When transition period 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.

Figure 1.4 Frequency of over-supply power balance infeasibilities by month
Puget Sound Energy

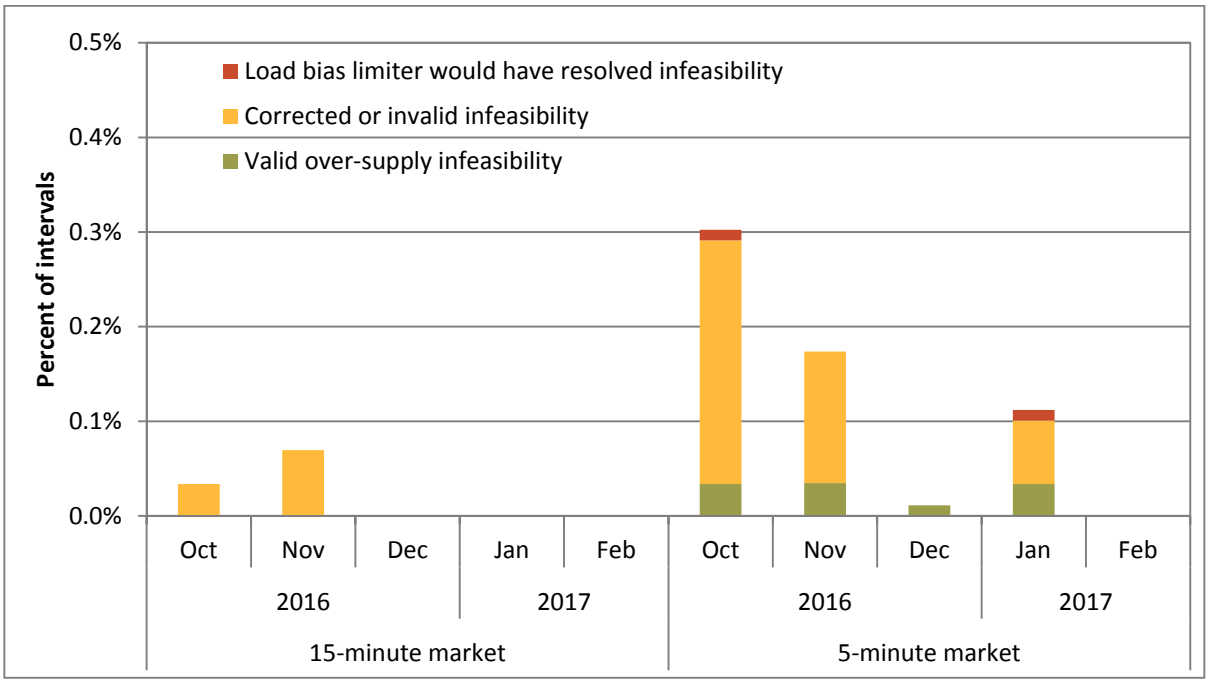


Figure 1.5 and Figure 1.6 show the average weekly prices in the 15-minute market and 5-minute market *with* and *without* the special transition period pricing provisions applied to mitigate prices in Puget Sound Energy during February.[4] These figures also include the average bilateral price benchmark for comparison to Puget Sound Energy prices, depicted by the dashed blue lines.

Because of the low frequency of power balance constraint relaxations during February, prices with and without transition period pricing were mostly converged. They also tended to be below the bilateral price benchmark. In the 15-minute market, transition period pricing decreased average prices by less than $1/MWh. In the 5-minute market, transition period pricing decreased average prices by about $3/MWh (15 percent).

[4] A detailed description of the methodology used to calculate these counterfactual prices that would result without transition period pricing was provided on p. 7 of the January 2017 report for Arizona Public Service from DMM: https://records.oa.caiso.com/sites/GCA/legal/mm/Records/EIM/FERC%20Report/2017-01%20Arizona/EIM%20Special%20Report%20January%20APS.pdf.

Figure 1.5 Average prices by month – Puget Sound Energy (15-minute market)

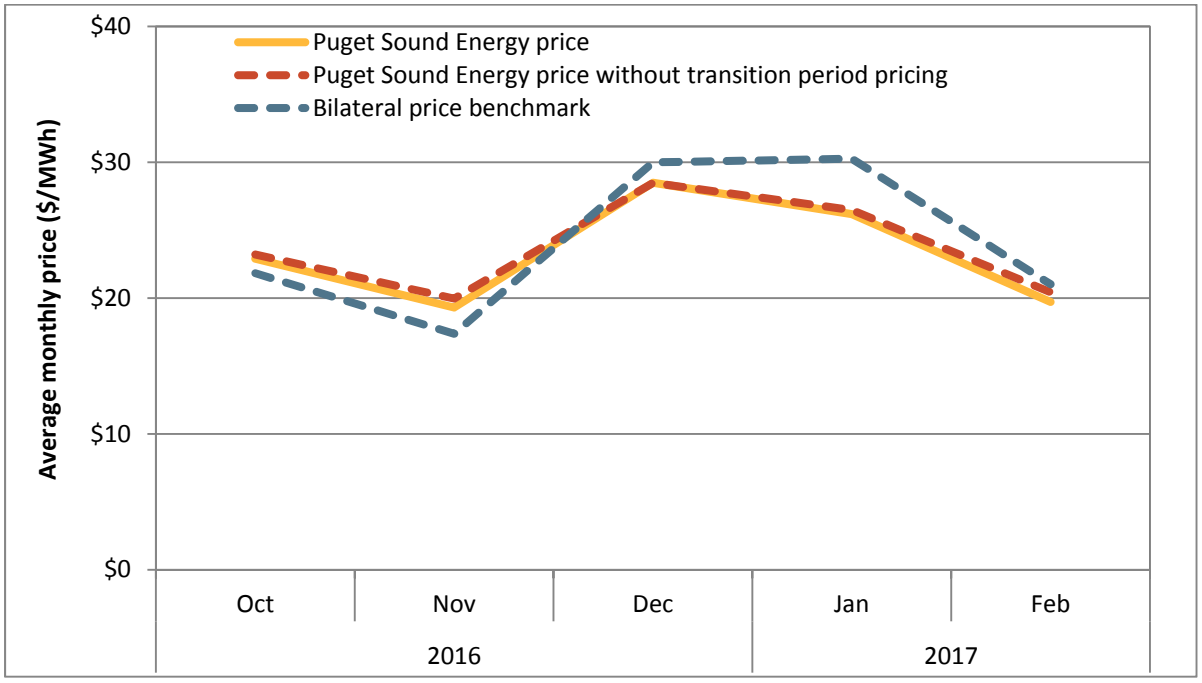
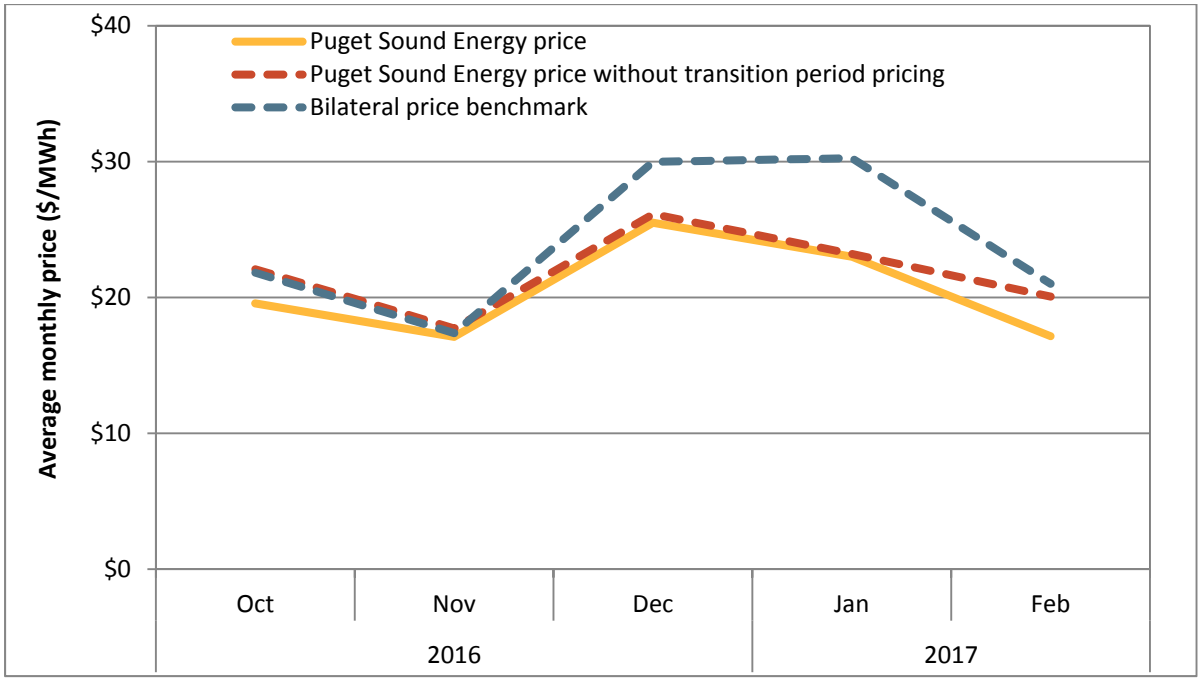


Figure 1.6 Average prices by month – Puget Sound Energy (5-minute market)



2 Load bias limiter

When the load bias limiter is triggered it has the same effect as the transition period pricing feature and causes prices to be set by the last economic bid dispatched rather than the $1,000/MWh penalty price for under-supply power balance relaxations and the -$155/MWh penalty price for over-supply power balance relaxations. A more detailed description of the load bias limiter is included in DMM's April 2015 report.[5] The ISO also included a discussion of the load bias limiter in its answer to comments regarding available balancing capacity on November 24, 2015.[6]

Table 2.1 shows the average 15-minute and 5-minute market price with transition period pricing as well as counterfactual estimates for prices without transition period pricing and without either transition period pricing or the load bias limiter.

The frequency of intervals that the power balance constraint was relaxed was relatively low during February in Puget Sound Energy in both real-time markets. Without special transition 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 transition period pricing not been in effect, the load bias limiter would have lowered prices in the 5-minute market by $0.47/MWh (2 percent).

Table 2.1 Impact of load bias limiter on Puget Sound Energy prices (February 2017)

	Average proxy price	Price with transition period pricing	Estimated price without transition period pricing	Estimated price without transition period pricing or load bias limiter	Potential impact of load bias limiter	
					Dollars	Percent
Puget Sound Energy						
15-minute market (FMM)	$21.02	$19.72	$20.44	$20.44	$0.00	0.0%
5-minute market (RTD)	$21.02	$17.15	$20.07	$20.55	-$0.47	-2.3%

[5] *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.

[6] 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 during 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. Beginning November 2016, the ISO implemented an additional downward ramping sufficiency test in the market with the introduction of the flexible ramping product, which replaced the flexible ramping constraint. These tests are designed to ensure that there is sufficient resource capacity available to meet forecasts and net exports for any given hour. 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.[7] 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.

Unlike the flexible ramping constraint, the demand for the flexible ramping product is set by a demand curve, rather than a single target. With the implementation of the flexible ramping product the ISO began using the maximum requirement from the demand curve for the sufficiency test, instead of the old targets.[8] DMM asked the ISO to reconsider how it uses the requirement from the demand curve and how the flexible ramping credit is calculated.

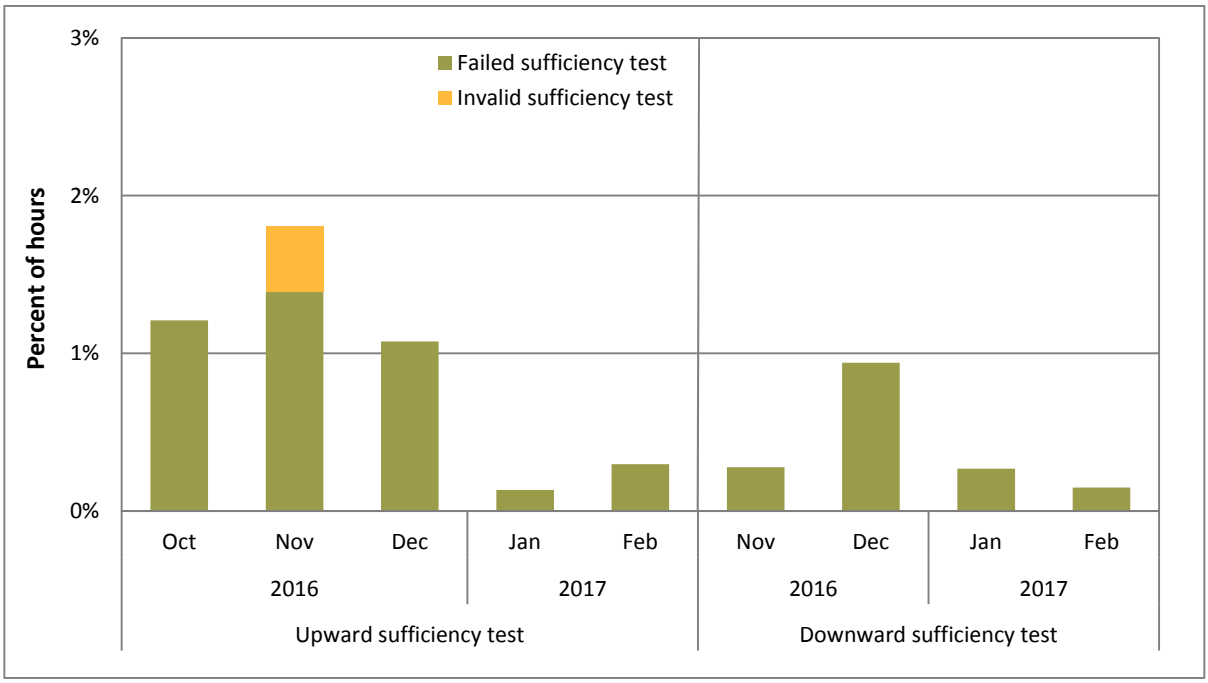
Limiting transfers can impact the frequency of power balance constraint relaxations, prices within energy imbalance areas, and price separation across balancing areas. Most of the power balance constraint relaxations during February in the Puget Sound Energy area occurred during hours when the area failed the flexible ramping sufficiency test. Constraining transfer capability may also impact the efficiency of the energy imbalance market by limiting transfers to and from a balancing area that could potentially provide efficiency improvements to neighboring areas.

Figure 3.1 shows the frequency that Puget Sound Energy failed the sufficiency test in the upward or downward direction. As shown in Figure 3.1, Puget Sound Energy failed the sufficiency test infrequently during February, during only two hours in the upward direction and just one hour in the downward direction, or less than 0.5 percent of all hours.

[7] 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.

[8] For further detail, see DMM's presentation on January 18, 2017 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.

Figure 3.1 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 15th day of August, 2017.

/s/ Grace Clark
Grace Clark