June 2, 2016

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. ER15-2565___
Independent Assessment by the Department of Market Monitoring
March 2016 Energy Imbalance Market Transition Period Report – NV Energy

Dear Secretary Bose:

The Department of Market Monitoring hereby submits its independent assessment on the transition period of Nevada Energy during its first six months of participation in the Energy Imbalance Market for March 2016.

Please contact the undersigned with any questions.

Respectfully submitted,

By: */s/ Anna A. McKenna*
Roger E. Collanton
General Counsel
Anna A. McKenna
Assistant General Counsel
John C. Anders
Lead Counsel
California Independent System
Operator Corporation
250 Outcropping Way
Folsom, CA 95630
Tel: (916) 608-7287
Fax: (916) 608-7222
janders@caiso.com

California Independent
System Operator Corporation

California ISO

Report on energy imbalance market issues and performance: NV Energy balancing authority area

June 2, 2016

Prepared by: Department of Market Monitoring

Executive summary

Pursuant to the Commission's October 29, 2015, Order on the ISO Energy Imbalance Market (EIM), the ISO filed a report on May 17, 2016, covering the period from March 1 through March 31, 2016, (March Report) for the NV Energy area.[1] This report provides a review by the Department of Market Monitoring (DMM) of EIM performance in the NV Energy area during the period covered in the ISO's March report. Key findings in this report include the following:

- Overall EIM performance was good during March in the NV Energy area. Significant transfer capability continues to be available between NV Energy, PacifiCorp East and the ISO since the addition of the NV Energy area to EIM in December 2015. High transfer capacity and low congestion continues to result in NV Energy area prices set at the competitive system marginal price effective throughout the ISO footprint during most intervals.

- Prices in the NV Energy area tracked closely with real-time energy prices in the SCE area within the ISO. The average price in the NV Energy area used for load settlement, which combines 15-minute and 5-minute market prices, was about $17/MWh for the month and about $16/MWh in the SCE load aggregation area for the same period. Settlement prices in NV Energy were about $4/MWh more than the bilateral trading hub price range that DMM uses as an additional benchmark for EIM prices.[2]

- The percentage of intervals when the energy power balance constraint was relaxed to allow the market software to balance modeled supply and demand was very low in NV Energy in the 15-minute and 5-minute markets during March. Without the price discovery feature, which prevents prices from being set by the $1,000/MWh penalty price during power balance shortages, prices in NV Energy would have remained almost unchanged in the 15-minute market and increased by only about $0.60/MWh in the 5-minute market.

- During March, the percentage of intervals when the flexible ramping constraint was relaxed decreased to just above 1 percent of intervals. During these intervals, when there is a shortage of flexible ramping capacity, the energy price in the 15-minute market includes the $60/MWh penalty price for the flexible ramping constraint.[3] In March the flexible ramping constraint increased monthly average 15-minute prices by about $1/MWh.

- The flexible ramping constraint continued to bind frequently in March. The constraint was binding, but not relaxed, during almost 70 percent of intervals during the month. During periods when the constraint bound, the shadow price for the constraint often reflected opportunity costs of lower priced resources in the NV Energy area providing flexible ramping capacity rather than generating

[1] The ISO's March Report was filed at FERC and posted on the ISO website on May 17, 2016: http://www.caiso.com/Documents/May17_2016_March2016_EIM_TransitionPeriodReport_NVEnergy_ER15-2565.pdf.

[2] The difference in settlement prices between NV Energy and SCE in March was largely driven by the settlement price calculation methodology, where average prices are weighted by real-time load imbalances that can differ significantly between the two areas.

[3] When price discovery provisions are triggered by relaxation of the energy power balance constraint, the penalty price for the flexible ramping constraint is changed from $60/MWh to $0/MWh in the pricing run, so that the shadow price of this constraint does not impact prices.

energy. This result is consistent with efficient and competitive market outcomes given market conditions within the NV Energy area relative to the adjacent ISO.

- The resource sufficiency and flexible ramping sufficiency tests were met in all but a handful of hours in the NV Energy area during March. This helped keep supply insufficiencies very low, and prices to be relatively low and close to benchmark prices.
- Without special price discovery provisions in effect, the load bias limiter feature would have been triggered infrequently in the NV Energy market during March and would have had a minimal impact on prices. This is largely driven by infrequent power balance constraint relaxations in the 15-minute and 5-minute markets. If the price discovery feature had not been in effect the load bias limiter would have reduced 15-minute market prices by $0.30/MWh and 5-minute market prices by $0.60/MWh.

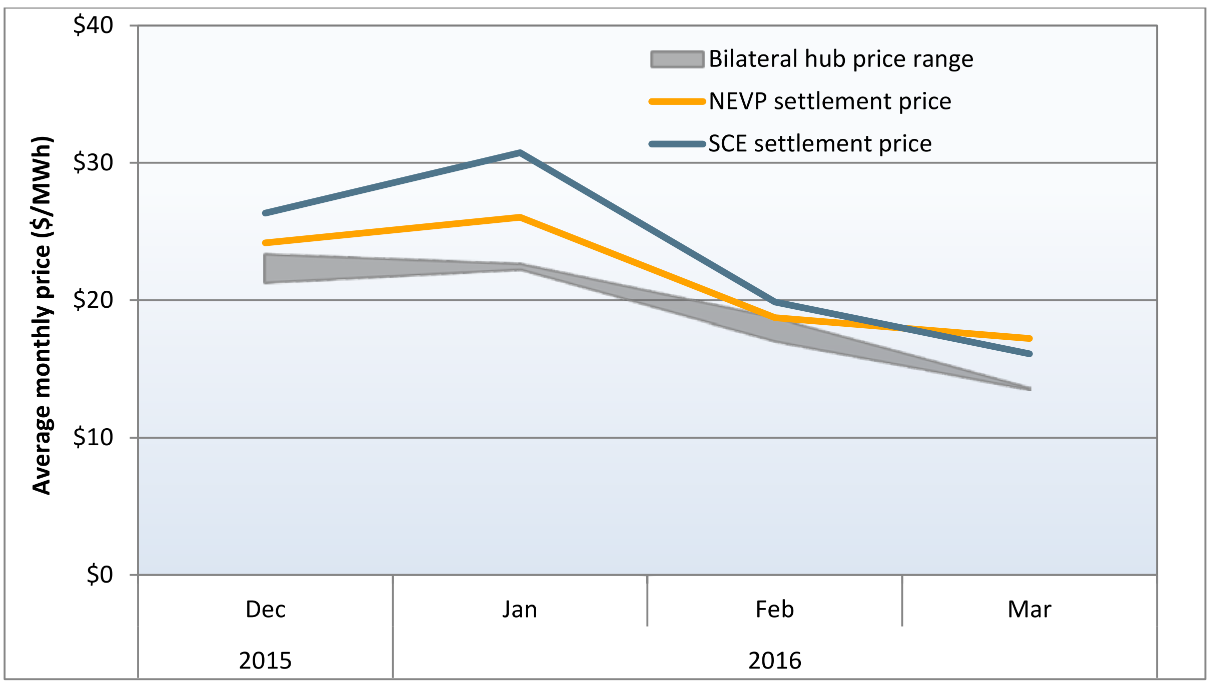
The remainder of this report is organized as follows. The summary section highlights key findings and trends occurring in March 2016. Section 1 provides a description of prices in the market and impacts from the power balance and flexible ramping market constraints. Section 2 provides information regarding the flexible ramping constraint. Section 3 provides details on the impact of the load bias limiter.

1 Energy imbalance market prices

Figure 1.1 shows monthly average prices used in the settlement of loads in the NV Energy and SCE (Southern California) load aggregation areas as well as the range of bilateral trading hub prices DMM uses as an additional benchmark for EIM prices.[4]

The load settlement price is an average of the 15-minute and 5-minute prices, weighted by the amount of estimated load imbalance in each of these markets.[5] 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 difference between forecasted load in the 15-minute market and forecasted load in the 5-minute market. The hourly shape and level of these settlement prices track most closely with 15-minute prices. This occurs because settlement prices are weighted more heavily on prices in the 15-minute market as imbalance is generally greater between base load and forecasted load in the 15-minute market than between forecasted load in the 15-minute and 5-minute markets.

Figure 1.1 Settlement and bilateral trading hub prices – NV Energy[6]



[4] The bilateral trading hub price range is calculated using the range of index price results between ICE and Powerdex indices. For NV Energy, the bilateral hub price represents average of prices for two major western trading hubs (Mead and Mid-Columbia).

[5] Business Process 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.

[6] Settlement prices are computed using 15-minute and 5-minute prices weighted by respective real-time imbalance energy. Because real-time imbalances vary, settlements prices may differ somewhat from 15-minute and 5-minute prices discussed throughout this report.

Prices in March continued to decline because of modest loads and increased renewable generation not only in NV Energy, but in the ISO as well. High transfer capacity available from the entry of NV Energy into EIM and infrequent congestion continues to set prices in the NV Energy area at the same competitive system marginal prices effective throughout the ISO footprint during most intervals.

In March, relatively high prices in NV Energy during peak ramping hours on a few days drove settlement prices for NV Energy were above both the bilateral price range and settlement prices in SCE for the first month since NV Energy joined EIM in December. The average monthly settlement price in NV Energy for March was about $17/MWh, compared with $14/MWh at the upper bound of the bilateral price range and about $16/MWh in the SCE.

Figure 1.2 and Figure 1.3 show the average daily frequency of constraint relaxation in the 15-minute and 5-minute markets, respectively, for each month since NV Energy joined EIM. These figures also show the average monthly prices in NV Energy in the 15-minute and 5-minute markets *with* and *without* the special price discovery mechanism applied to mitigate prices. These figures also include monthly average ranges of firm bilateral trading hub market prices for comparison to EIM market prices, represented by the grey shaded region.

Prices in both the 15-minute and 5-minute markets during March continued to remain relatively low at less than $20/MWh. Prices in the 15-minute and 5-minute markets were slightly above the bilateral hub range. The flexible ramping constraint bound in about 1 percent of 15-minute intervals during March, compared with almost 3 percent in February. During intervals when the flexible ramping constraint is relaxed, market prices with and without price discovery are impacted by the $60/MWh flexible ramping penalty price.

The overall monthly frequency of power balance relaxations is shown in Figure 1.2 and Figure 1.3 by the blue bars. The power balance constraint bound very infrequently in both markets, and therefore convergence was significant between prices observed both with and without the special price discovery mechanism in place.

Figure 1.2 Frequency of constraint relaxation and average prices by month NV Energy (15-minute market)

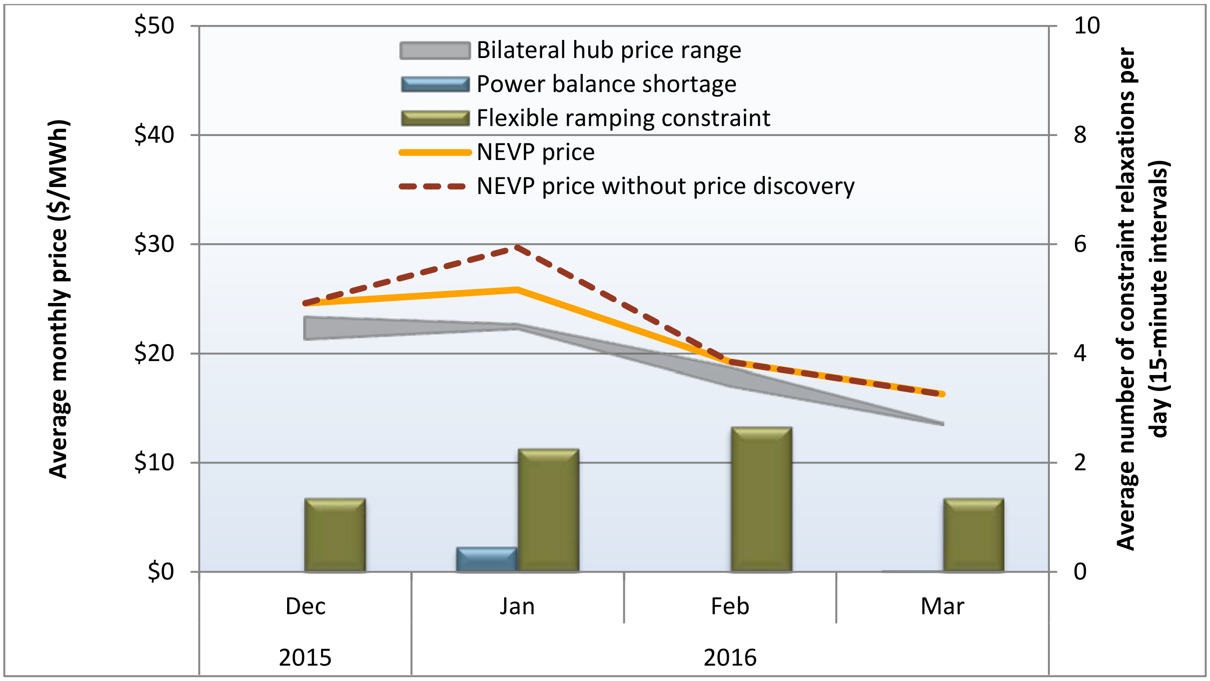
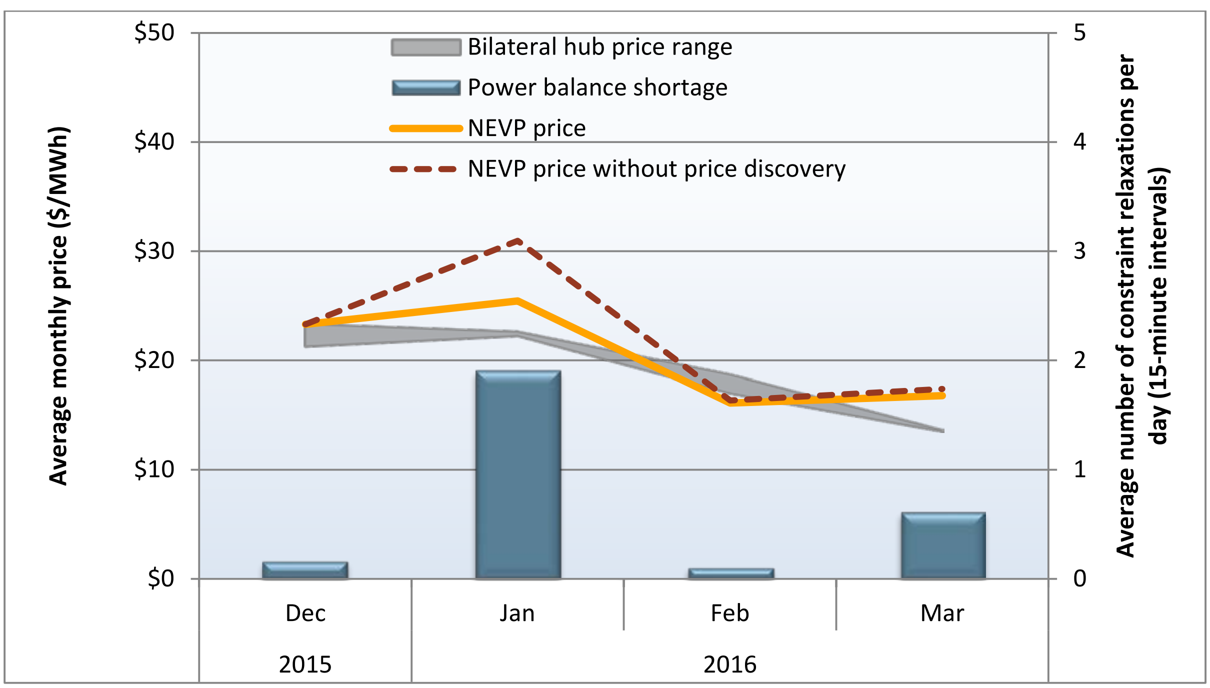


Figure 1.3 Frequency of constraint relaxation and average prices by month NV Energy (5-minute market)



2 Flexible ramping capacity

This section provides a summary of the number of flexible ramping constraint relaxations and associated impact in NV Energy.

As shown in Table 2.1, the flexible ramping requirement averaged about 86 MW in the NV Energy area during March. As described in prior reports, flexible ramping constraint requirements are calculated based on historical ramping levels for each 15-minute interval by comparing the preceding 40 intervals.[7] DMM has expressed concern about this approach since it is based on a very limited sample size and tends to result in highly volatile requirements. The ISO addressed the volatility from this methodology by imposing upper and lower bounds after the requirement is calculated.

As shown in Table 2.1, during most intervals the requirements calculated continued to fall outside of the upper and lower bounds imposed by the ISO, and consequently the requirements were frequently set to the minimum and maximum limits. In March, the requirement calculated by this tool fell below the minimum bound established by the ISO during about 65 percent of intervals. The requirement was set to the minimum level of 80 MW during these intervals. Meanwhile, the requirement calculated by the tool exceeded the maximum level established by the ISO during about 21 percent of intervals, with the requirement set to the maximum level of 100 MW during these intervals. The requirement fell between 80 and 100 MW during only 14 percent of intervals in March, when the calculated requirement was unchanged by the imposed boundary.

Table 2.1 Flexible ramping constraint requirements for NV Energy

		Requirement (MW)				Percent of intervals		
Year	Month	Avg	Min	Max	Volatility	Req = Lower bound	Req = Upper bound	Req = bounds
2015	Dec	85	80	100	8%	69%	24%	94%
2016	Jan	84	80	100	9%	77%	14%	91%
	Feb	84	80	100	9%	78%	15%	93%
	Mar	86	80	100	10%	65%	21%	86%

Table 2.2 shows that the flexible ramping constraint was relaxed because of a shortage of ramping capacity, with a resulting positive shadow price set at just over $60/MWh, during about 1 percent of 15-minute intervals in March. This drove the monthly average 15-minute prices up by about $1/MWh. The table also shows that the flexible ramping constraint bound, but was not relaxed, during about 70 percent of intervals in March. Because the constraint was not relaxed, the shadow price for the flexible ramping constraint was not set at the $60/MWh penalty price, but to a smaller amount. This level of flexible ramping constraint activity exceeds levels in the ISO and other energy imbalance market areas and arises because of circumstances in the NV Energy area, as described below.

[7] Q3 2015 Report on Market Issues and Performance, Department of Market Monitoring, November 16, 2016, pp. 34-36. http://www.caiso.com/Documents/2015ThirdQuarterReport-MarketIssuesandPerformance-November2015.pdf.

Table 2.2 Flexible ramping constraint requirements and market impacts in NV Energy[8]

		Average flex ramp requirement (MW)	Binding flexible ramping constraint (no shortage)		Flexible ramping constraint (shortage)	
			Percent of intervals	Average shadow price	Percent of intervals	Average shadow price
2015	December	85	74%	$9.41	1%	$60.00
2016	January	84	90%	$8.86	2%	$60.00
	February	84	82%	$7.90	3%	$60.21
	March	86	69%	$9.74	1%	$62.30

During March, prices for the NV Energy area continue to frequently be set by system marginal prices across the combined footprint, inclusive of PacifiCorp and NV Energy, and ISO. This is due to the high amount of transfer capability and limited amount of congestion observed between NV Energy, PacifiCorp and the ISO.

Under these conditions, when flexible ramp requirements are fulfilled by less expensive units within the NV Energy area, shadow prices for the flexible ramping constraint equal the opportunity cost for the unit providing flexible ramping capacity instead of generating energy. This occurred frequently in NV Energy and is not inconsistent with efficient and competitive market outcomes.

[8] The percent of intervals where the flexible ramping constraint was relaxed due to shortage in Table 2.2 reflects intervals that resulted in a positive shadow price in the pricing run, typically equal to the $60/MWh penalty price. These intervals do not include periods when the power balance constraint was also relaxed, and both penalty prices were set to $0/MWh because of the price discovery mechanism.

3 Load bias limiter

When triggered, the load bias limiter would have the same effect as the price discovery feature by causing 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 2, 2015, report.[9] The ISO included discussion of the load bias limiter in its recent answer to the comments regarding the ISO's response to the Commission's September 24, 2015, letter requesting additional information on the ISO's August 19, 2015, filing to implement its available balancing capacity proposal in the EIM.[10]

As highlighted in Section 1, the power balance constraint was relaxed during few intervals in the NV Energy area during March. As shown in Figure 3.1, there was one interval in the 15-minute market during March when the power balance constraint was relaxed. This interval would have also been resolved by the load bias limiter. During the few intervals when power balance constraint shortages existed in the 5-minute market, the load bias limiter would have resolved about half of the shortages. However, because of the infrequency of power balance constraint relaxations the load bias limiter would have had a very small impact on market prices. In the 15-minute market, prices would have decreased by about $0.30/MWh in the absence of the price discovery mechanism. Prices in the 5-minute market would have decreased by about $0.60/MWh.

The estimates of EIM prices without price discovery in Section 1 of this report assume that price discovery provisions are not in place, but energy prices would not be set by the $1,000/MWh penalty price when the power balance constraint was relaxed and the criteria for triggering the load bias limiter are met. This reflects that the ISO indicated that the load bias limiter would have been triggered under these criteria, if price discovery provisions were no longer in effect.

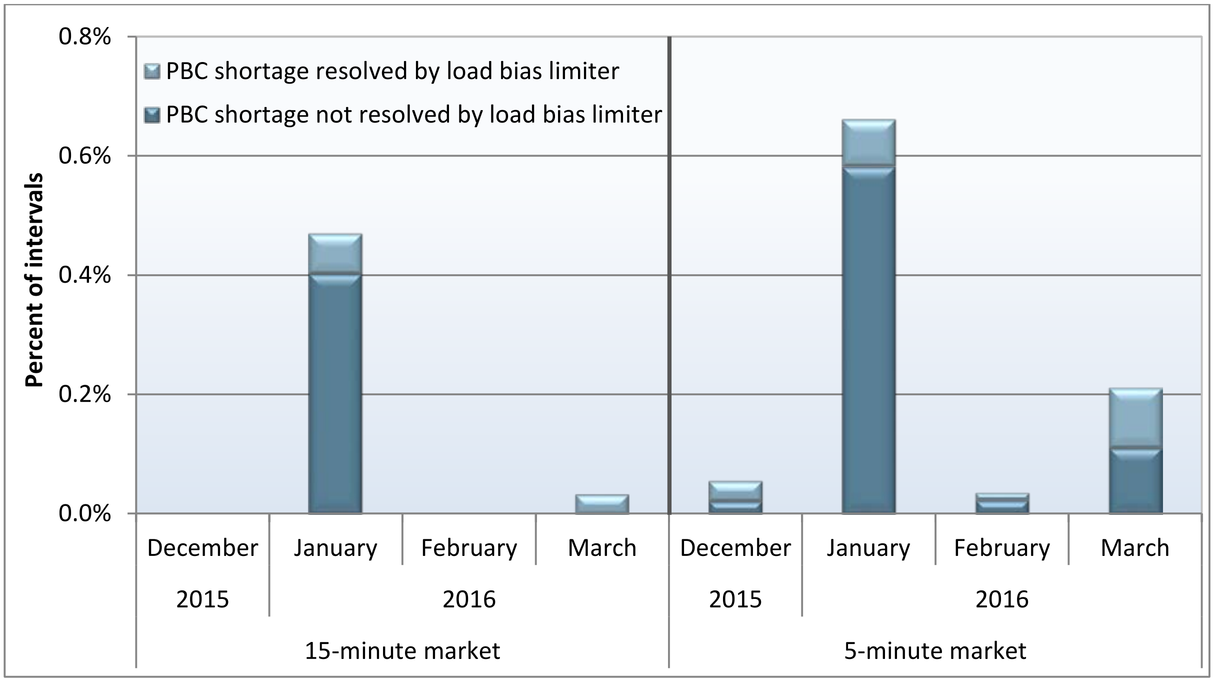
Table 3.1 Impact of load bias limiter on NV Energy prices (March 2016)

	Bilateral trading hub range		Average EIM price	EIM price without price discovery	EIM price without price discovery or load bias limiter	Potential impact of load bias limiter	
	Low	High				Dollars	Percent
NV Energy							
15-minute market (FMM)	$13.37	$13.52	$16.28	$16.28	$16.60	-$0.32	-2%
5-minute market (RTD)	$13.37	$13.52	$16.77	$17.38	$18.02	-$0.64	-4%

[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.

Figure 3.1 Mitigation of power balance relaxation by load bias limiter NV Energy



CERTIFICATE OF SERVICE

I certify that I have served the foregoing document upon the parties listed on the official service list in the above-referenced proceeding, 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 2nd day of June, 2016.

/s/ Anna Pascuzzo

Anna Pascuzzo