

November 16, 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 No. ER15-861
Energy Imbalance Market – First Quarter 2017
Available Balancing Capacity Report**

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) hereby submits its quarterly informational report for the first quarter of 2017 (January 1 to March 31, 2017) on the Available Balancing Capacity (ABC) enhancement for the Energy Imbalance Market (EIM). The quarterly informational report is to provide the Commission with information on the performance of the ABC enhancement and to provide the same information the CAISO provides in its monthly informational reports submitted during an EIM entity's first six-month transition period.

Consistent with the Commission's directive in the December 17, 2015 order, the CAISO will continue to file such quarterly reports for at least the first year after implementation of the ABC enhancement, until the Commission finds the quarterly informational reports are no longer needed.

Please contact the undersigned with any questions.

Respectfully submitted

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California ISO

**Energy Imbalance Market
January 1 – March 31, 2017
Available Balancing Capacity Report**

November 16, 2017

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I. Background

On December 17, 2015, the Federal Energy Regulatory Commission (Commission) approved the California Independent System Operator Corporation's (CAISO) proposed tariff revisions to comply with the Commission's July 20, 2015 order in FERC Docket No. ER15-861-006.¹ The CAISO's proposed tariff provisions to enhance the Energy Imbalance Market (EIM) functionality so that the market systems automatically recognize and account for capacity an EIM entity has available to maintain reliable operations in its own balancing authority area (BAA), but has not been bid into the EIM.² This enhancement is referred to as the Available Balancing Capacity (ABC) enhancement. The CAISO implemented the ABC enhancement on March 23, 2016.

Consistent with the CAISO's commitments made in this proceeding, the Commission directed the CAISO to prepare and file with the Commission quarterly informational reports for at least the first year after implementation of the ABC enhancement, and until the Commission finds the quarterly informational reports are no longer needed.³ The quarterly informational reports are to provide information on the performance of the ABC enhancement and to provide the same information the CAISO provides in its monthly informational reports submitted during an EIM entity's first six-month transition period.⁴

¹ *Cal. Indep. Sys. Operator Corp.*, 152 FERC ¶ 61,060 (2015); and *Cal. Indep. Sys. Operator Corp.*, 153 FERC ¶ 61, 305 (2015) (December 17 Order).

² *Id.* at P 1.

³ *Id.* at P 99

⁴ *Id.* at P 39.

II. Highlights

- The CAISO implemented the ABC enhancement on March 23, 2016. During the first quarter of 2017, the transitional period or tariff provisions for price discovery applied to the Puget Sound Energy and Arizona Public Service balancing authority areas.
- NV Energy and Puget Sound Energy submitted ABC in all intervals of the first quarter of 2017; this is in contrast with the low frequency of the PacifiCorp West area submission of ABC.
- Overall, the EIM dispatched ABC, in either upward or downward direction, less than six percent of the time for the first quarter of 2017.
- A low number of resources continued to support submissions of ABC during the first quarter of 2017, with as few as one resource in the PacifiCorp West balancing authority area and as many as seven resources in the Arizona Public Service BAA.

III. Available Balancing Capacity

A. ABC Submitted to the Market

Each EIM entity can identify and set the amount of ABC they will make available to the CAISO and the resources supporting this capacity through its EIM entities resource plan. The EIM entity submits this capacity to the CAISO on an hourly basis, and it is available for both the fifteen-minute market (FMM) and the five-minute real-time dispatch (RTD). Figures 1 through 10 show the ABC made available in each of the EIM BAAs: PacifiCorp West (PAC West), PacifiCorp East (PAC East), NV Energy, Puget Sound Energy (PSE), and Arizona Public Service (APS). For each BAA, there are two plots to show the ABC dispatched in the FMM and RTD, separately. The blue bars and positive values illustrate the ABC upward capacity made available by the EIM entity, and the green bars and negative values illustrate the downward ABC made available.

Figure 1: Submitted and Scheduled ABC in the PAC West BAA – FMM

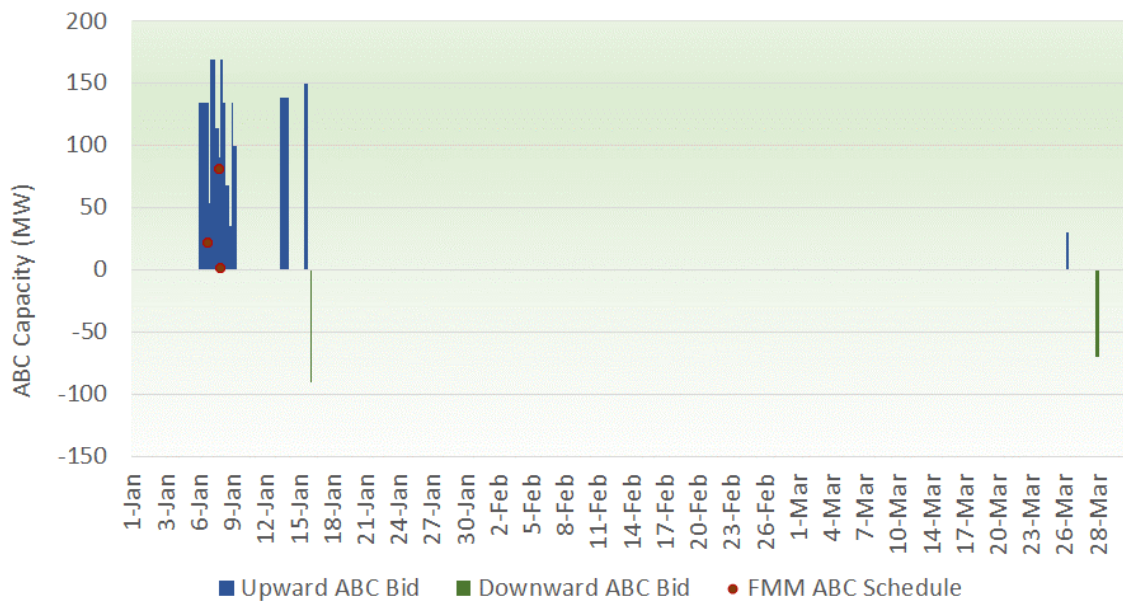


Figure 2: Submitted and Scheduled ABC in the PAC West BAA – RTD

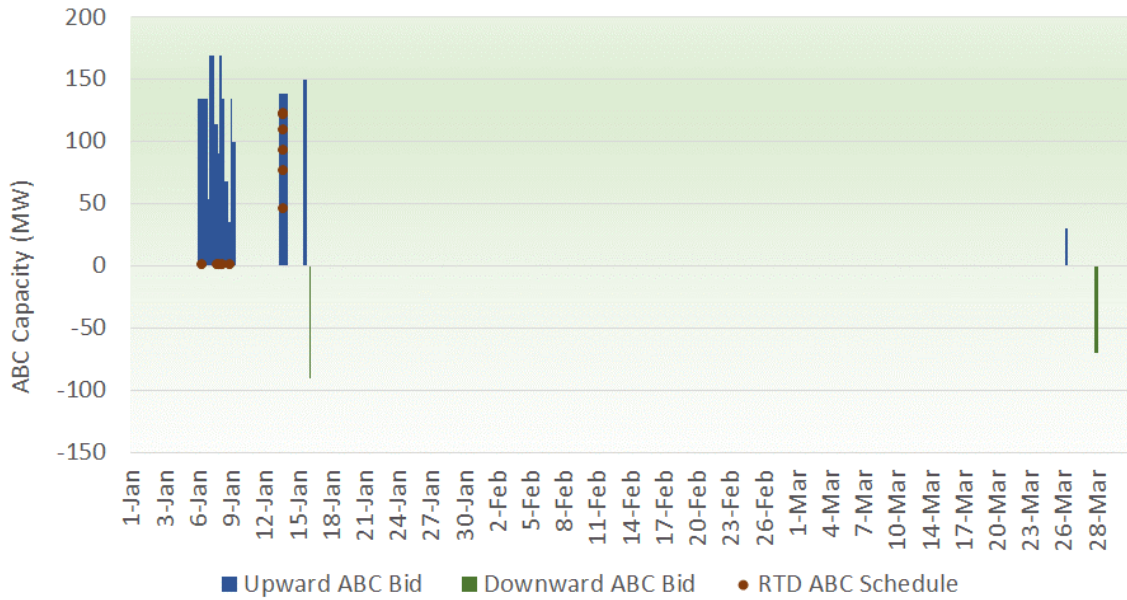


Figure 3: Submitted and Scheduled ABC in the PAC East BAA – FMM

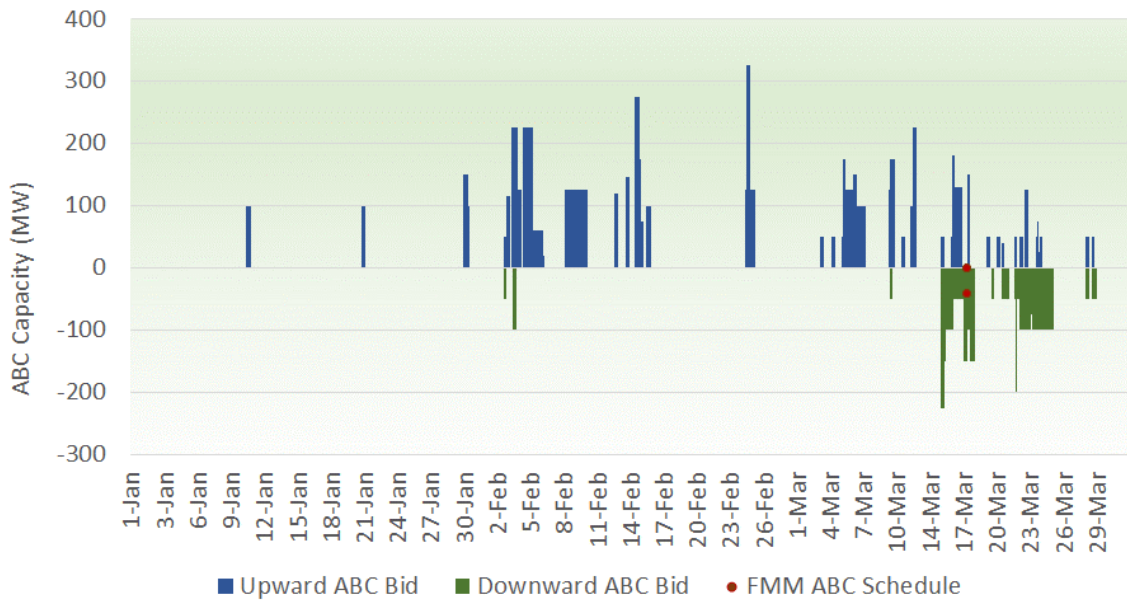


Figure 4: Submitted and Scheduled ABC in the PAC East BAA – RTD

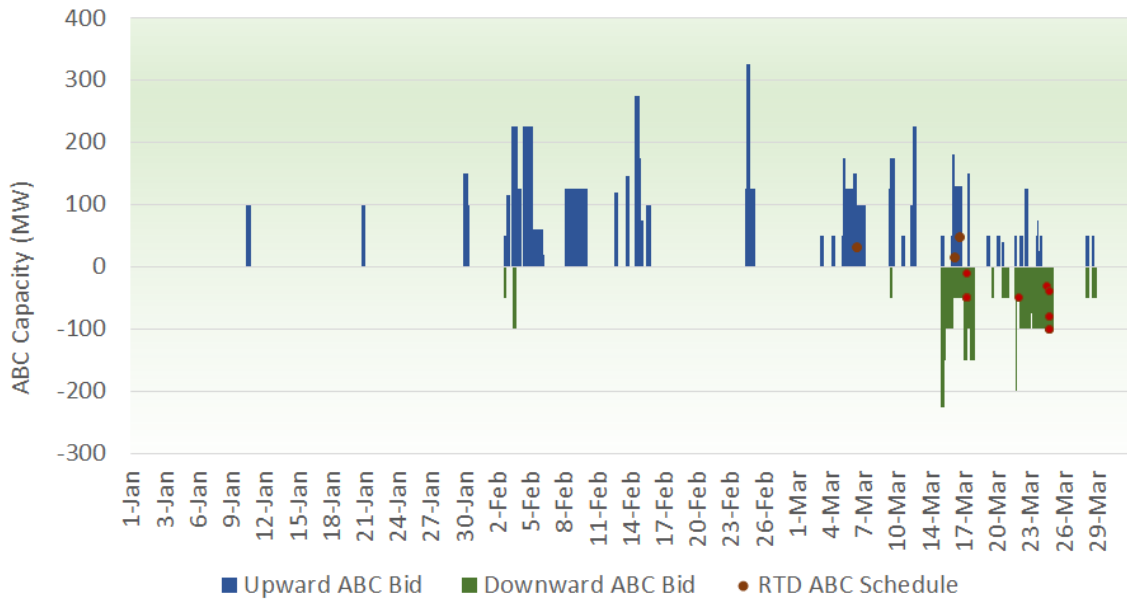


Figure 5: Submitted and Scheduled ABC in the NV Energy BAA – FMM

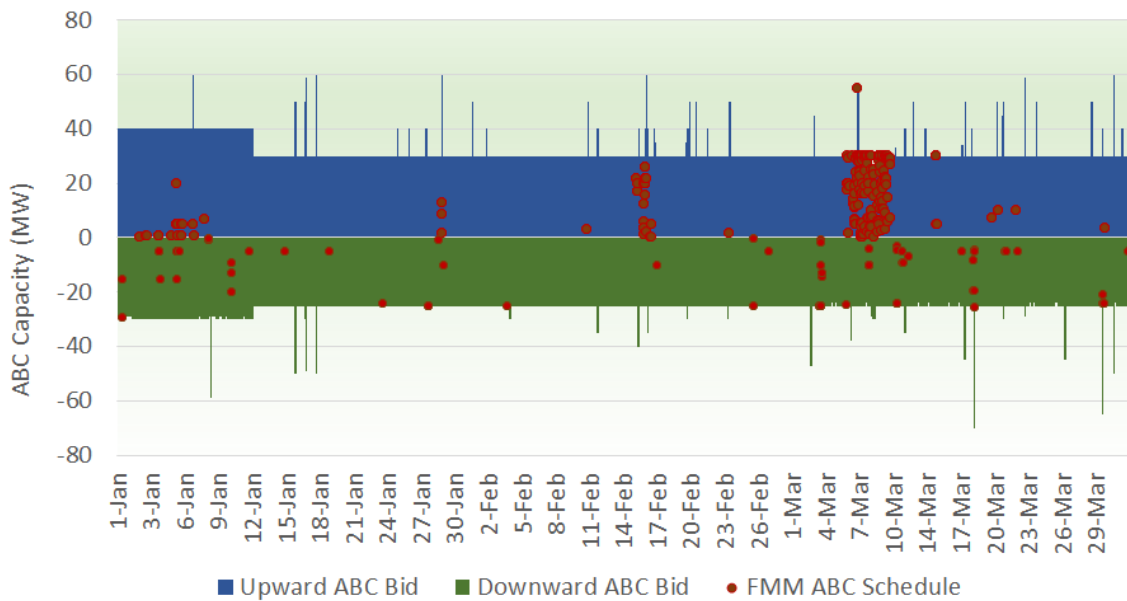


Figure 6: Submitted and Scheduled ABC in the NV Energy BAA – RTD

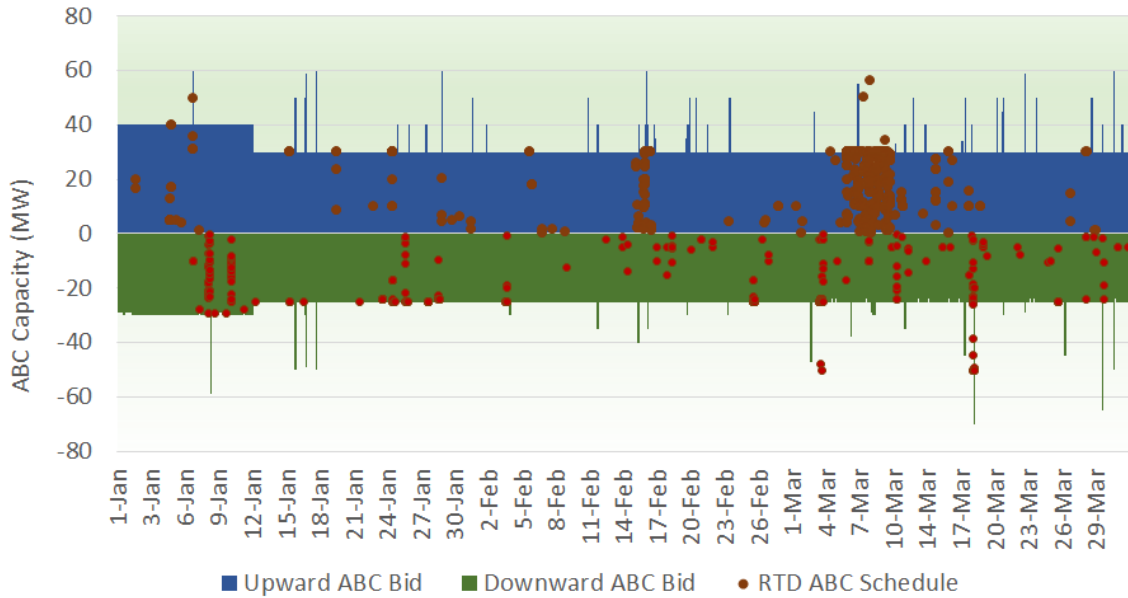


Figure 7: Submitted and Scheduled ABC in the APS BAA – FMM

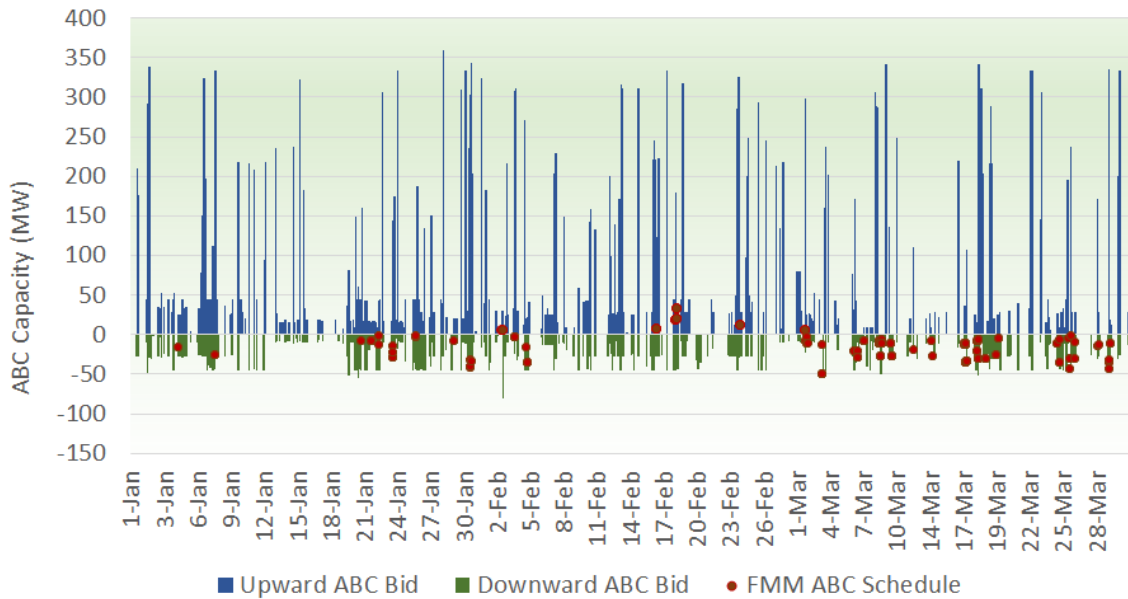


Figure 8: Submitted and Scheduled ABC in the APS BAA – RTD

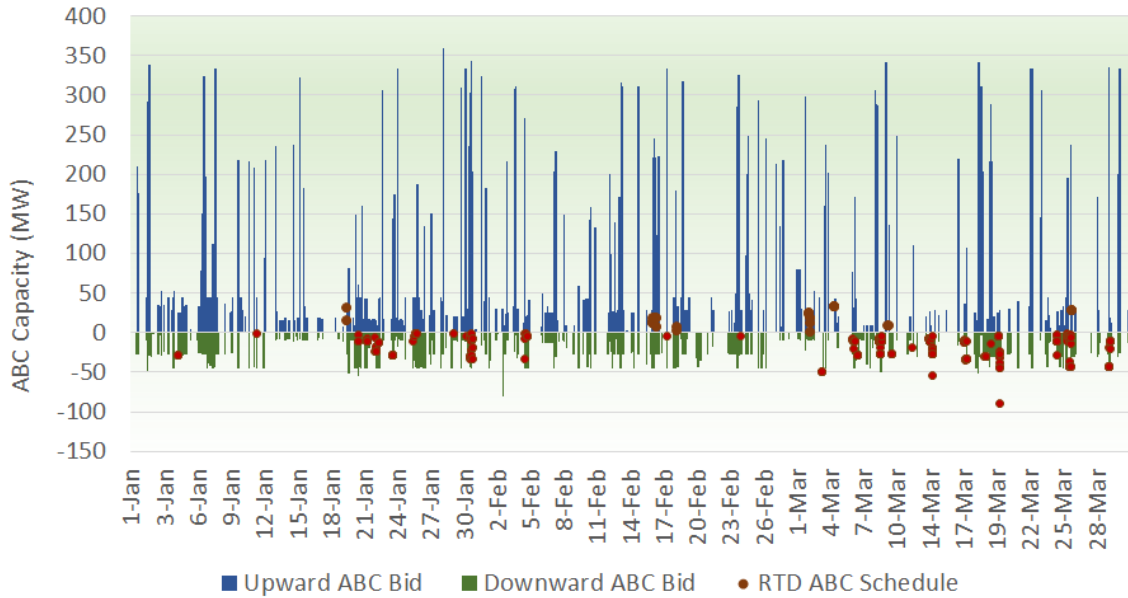


Figure 9: Submitted and Scheduled ABC in the PSE BAA – FMM

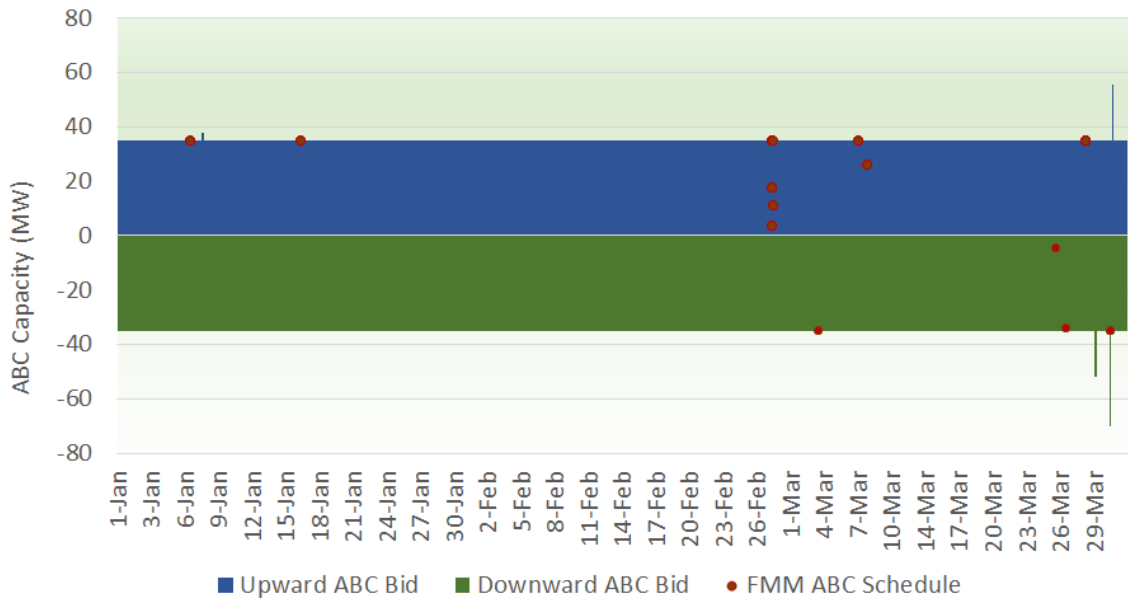


Figure 10: Submitted and Scheduled ABC in the PSE BAA – RTD

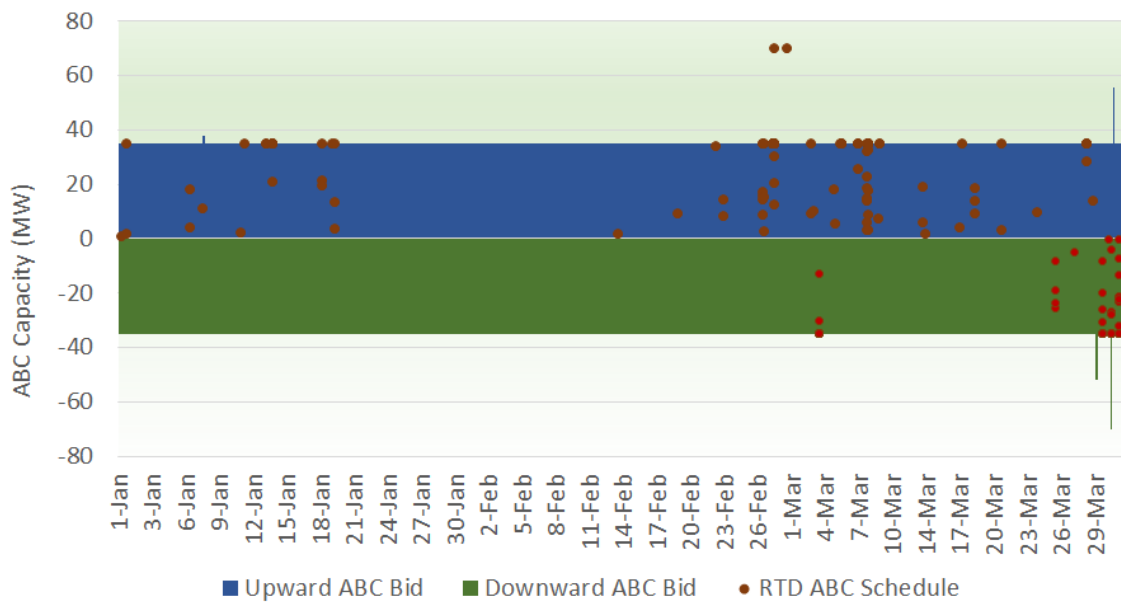


Table 1 summarizes the percentage of intervals in which each EIM Entity submitted ABC to the EIM. PAC West and PAC East submitted ABC infrequently to the EIM, while APS submitted slightly more. In contrast, NV Energy and PSE submitted ABC, both in upward and downward capacity, for the majority of the intervals.

Table 1: Frequency of ABC Submitted to the EIM

Balancing Authority Area	Upward Capacity	Downward Capacity
PAC West	4.36%	0.28%
PAC East	16.56%	8.57%
NV Energy	99.58%	99.58%
APS	26.21%	28.49%
PSE	99.81%	99.95%

Table 2 shows the frequency of each EIM entity's dispatched ABC, when the ABC was made available for both the FMM and RTD. Overall, the frequency of dispatched ABC was relatively low. APS had the highest frequency of dispatched ABC, which was under 10 percent. A low frequency of dispatched ABC is not on its own a negative outcome of the market. In many instances, a low frequency of dispatched ABC may only reflect that the market simply did not need the dispatched ABC. In other conditions, the ABC was submitted to the market, but it was not ramp accessible, and the ABC could not be dispatched.

Table 2: Frequency of EIM Dispatched ABC in the FMM and RTD

Balancing Authority Area	Upward Capacity		Downward Capacity	
	FMM	RTD	FMM	RTD
PAC West	0.8%	0.98%	0%	0%
PAC East	0%	0.07%	0.27%	0.68%
NV Energy	2.57%	2.40%	0.74%	1.29%
APS	0.31%	0.43%	5.84%	4.60%
PSE	0.16%	0.47%	0.06%	0.21%

B. Resources Supporting Available Balancing Capacity

Figures 11 through 15 show the number of different resources supporting the ABC the EIM entities submitted to the FMM and RTD. The NV Energy and APS BAAs had multiple resources supporting the submitted ABC, while the PAC West BAA had just one unit supporting the ABC.

Figure 11: Number of Resources Supporting the Submitted ABC in the PAC West BAA

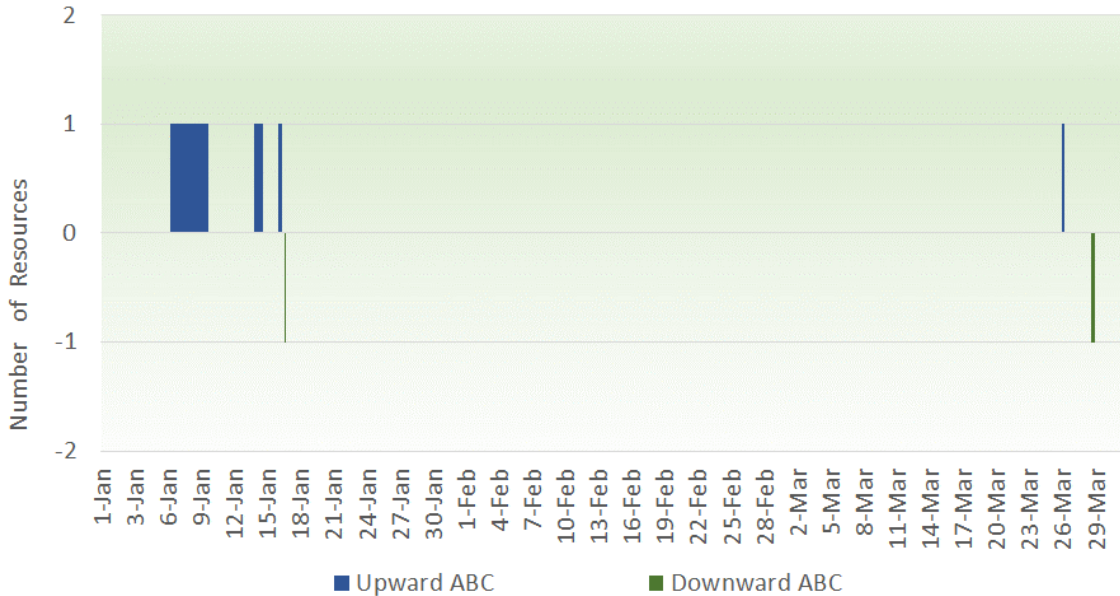


Figure 12: Number of Resources Supporting the Submitted ABC in the PAC East BAA

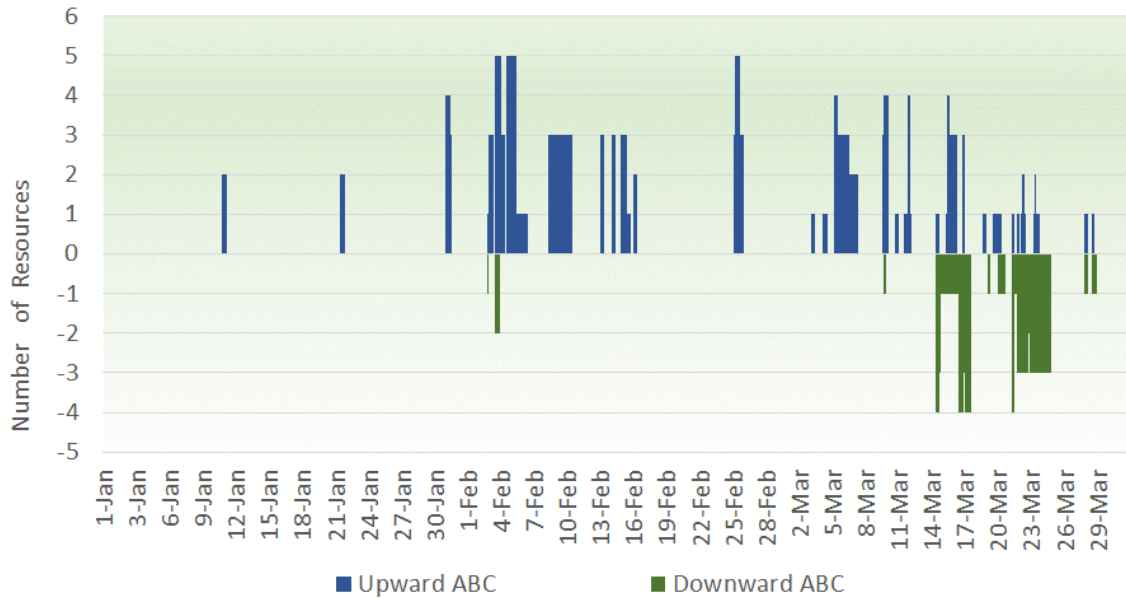


Figure 13: Number of Resources Supporting the Submitted ABC in the NV Energy BAA

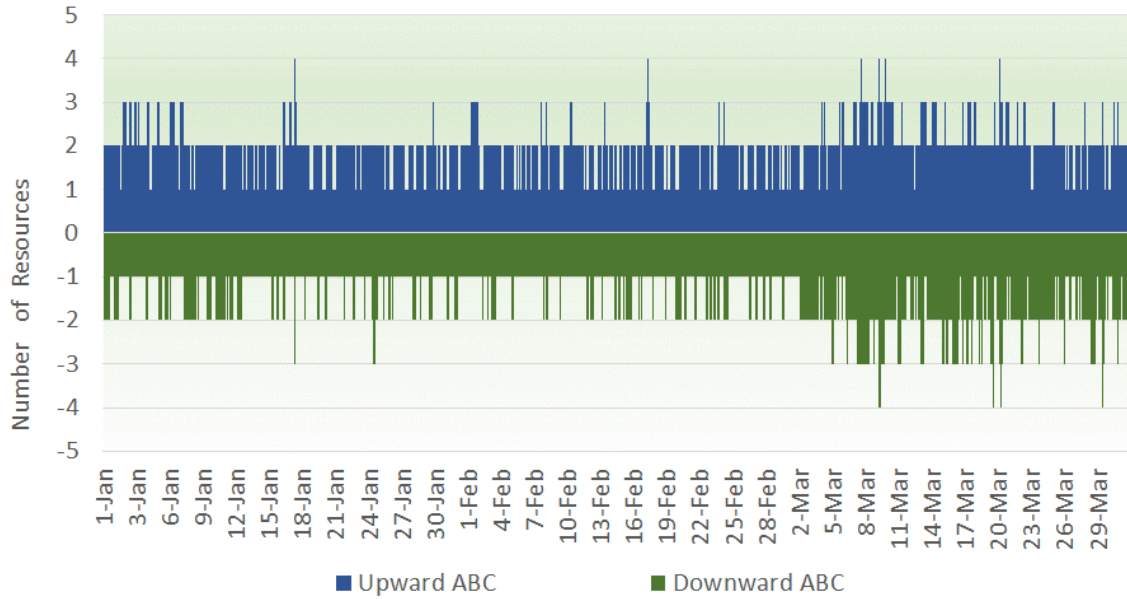


Figure 14: Number of Resources Supporting the Submitted ABC in the APS BAA

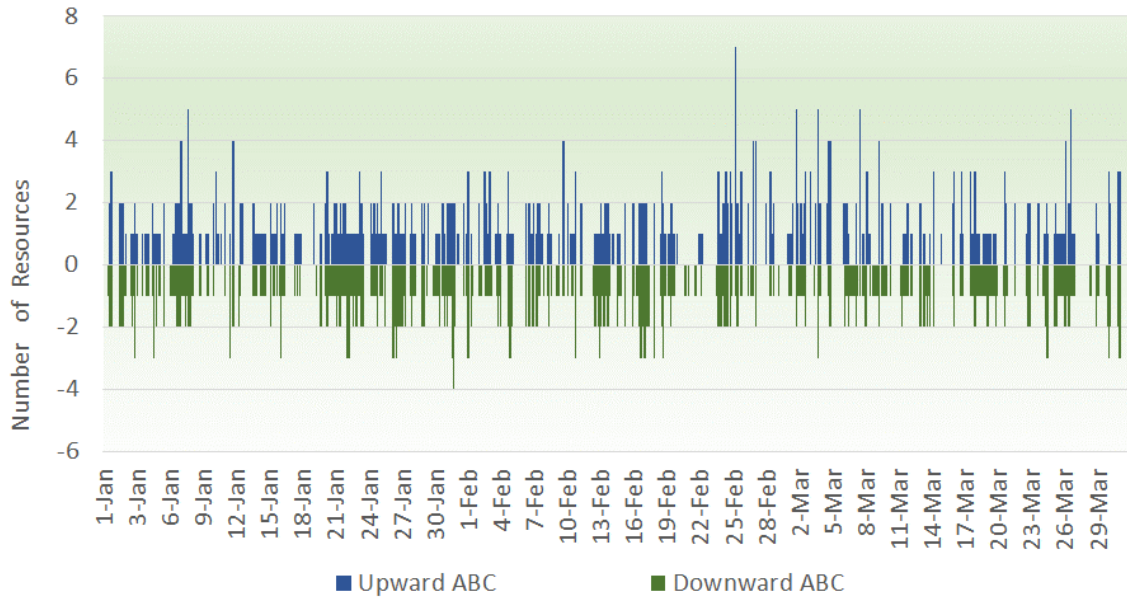
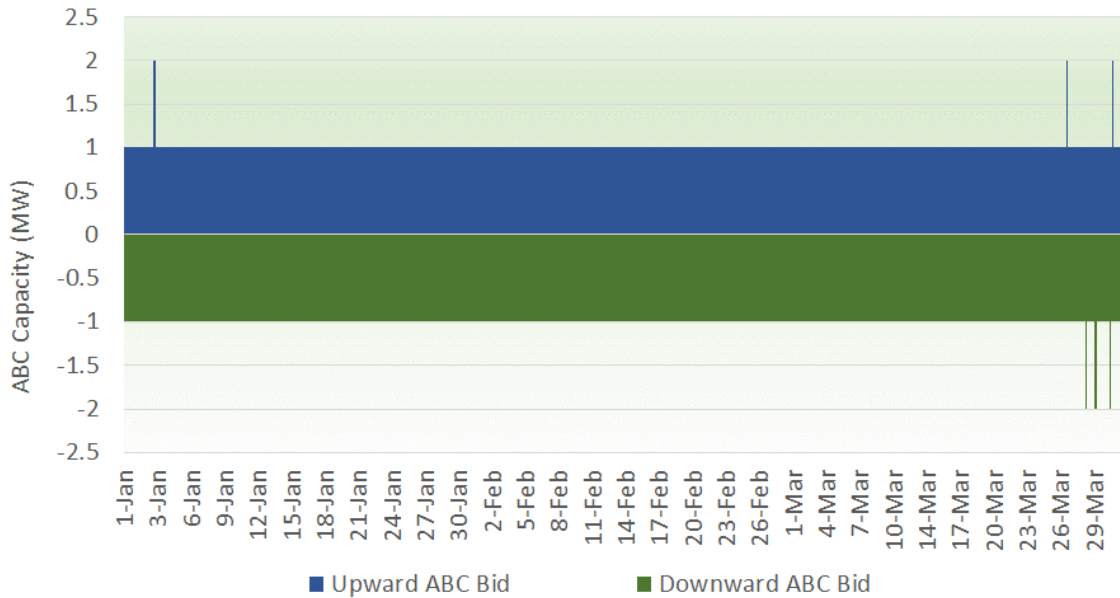


Figure 15: Number of Resources Supporting the Submitted ABC in the PSE BAA



C. Available Balancing Capacity and Power Balance Constraint Infeasibilities

The purpose of the ABC enhancement is to make capacity available to the market that otherwise would not be visible. The primary objective in making such capacity available is that the market can recognize and access that capacity when the conditions warrant its use, namely when the market is running out of capacity made available through economic bids. The ABC is capacity stacked above economic bids, but is below the power balance constraint relaxation penalty price. When the market is tight in supply and it has exhausted all effective economic bids, the market clearing process will go through the bid stack in economic order. The market clearing process will access the ABC. If there is sufficient ABC, the market will relax the power balance constraint to clear. As such, the market clearing process uses the ABC to resolve the power balance infeasibility. If instead the ABC identified is not sufficient to cure the infeasibility, the ABC may be exhausted and there may still be the need to relax the power balance constraint in order to clear the market.

Figures 16 through 25 show the amount of ABC submitted in the FMM and RTD, along with the power balance constraint infeasibilities, separately.

Figure 16: Submitted ABC and Power Balance Constraint Infeasibilities in the PAC West BAA – FMM

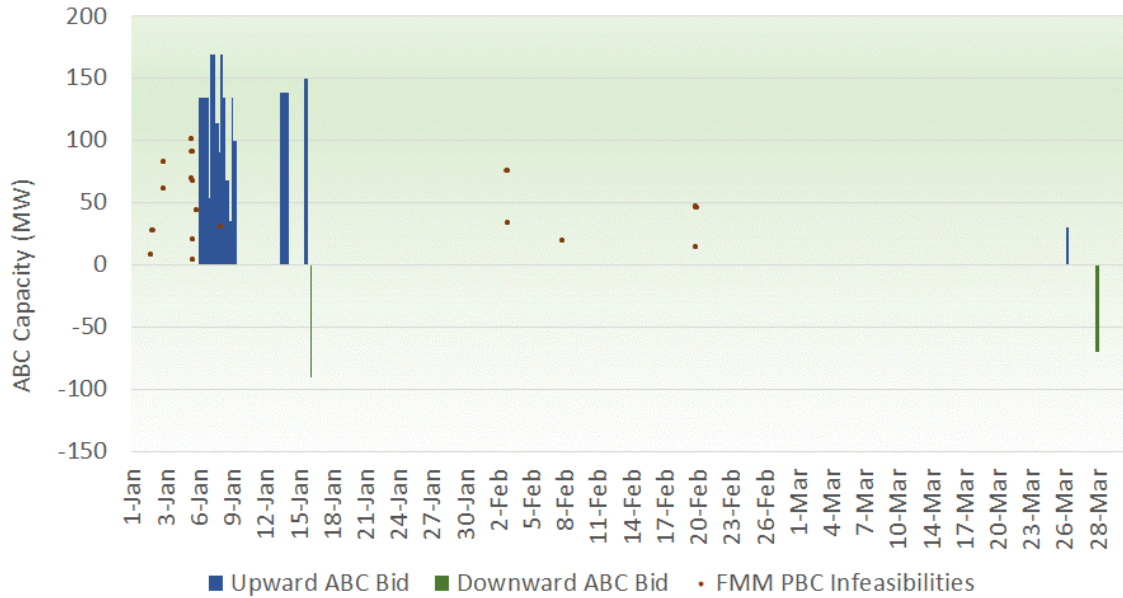


Figure 17: Submitted ABC and Power Balance Constraint Infeasibilities in the PAC West BAA – RTD

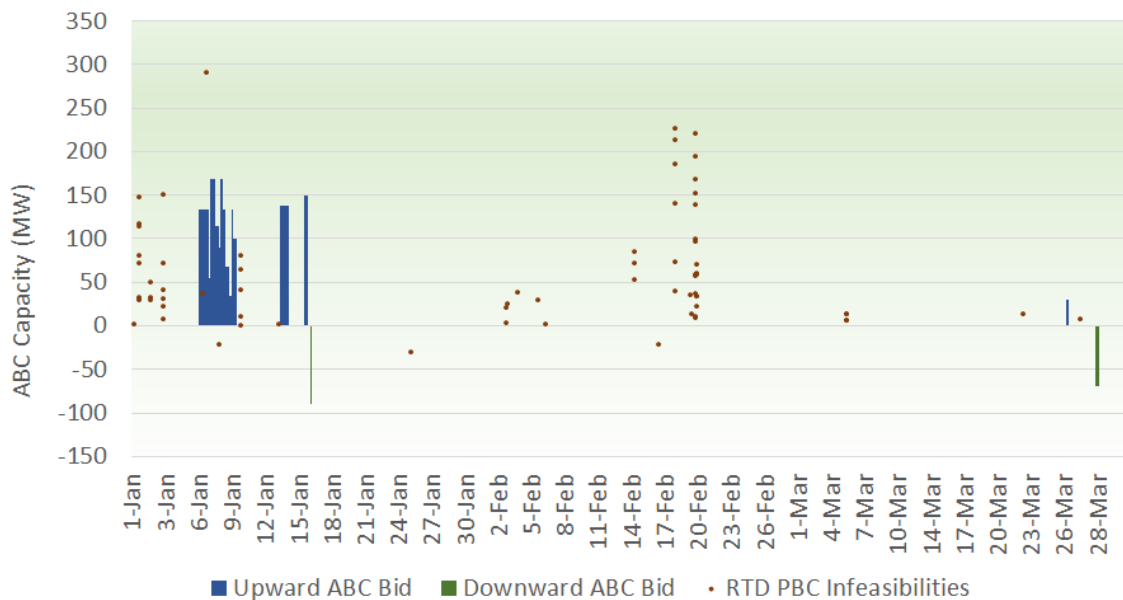


Figure 18: Submitted ABC and Power Balance Constraint Infeasibilities in the PAC East BAA – FMM

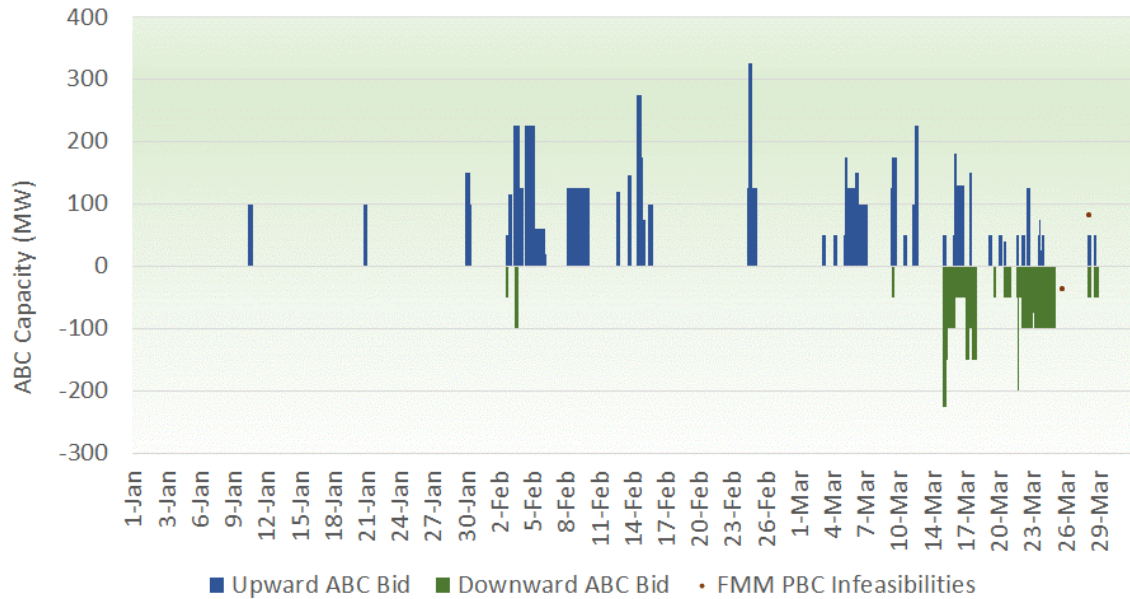


Figure 19: Submitted ABC and Power Balance Constraint Infeasibilities in the PAC East BAA – RTD

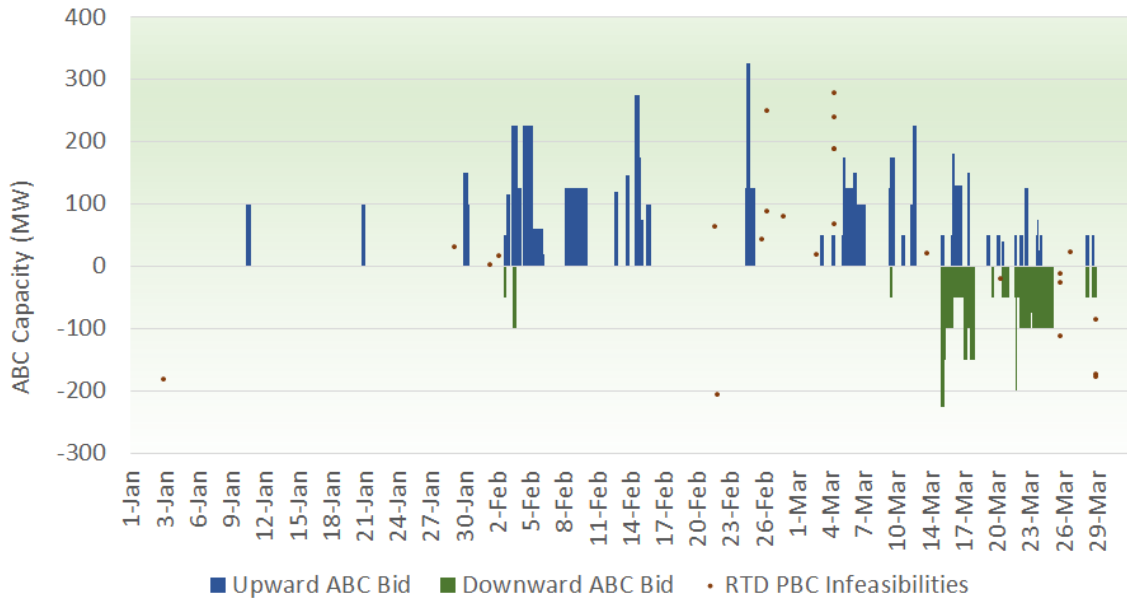


Figure 20: Submitted ABC and Power Balance Constraint Infeasibilities in the NV Energy BAA – FMM

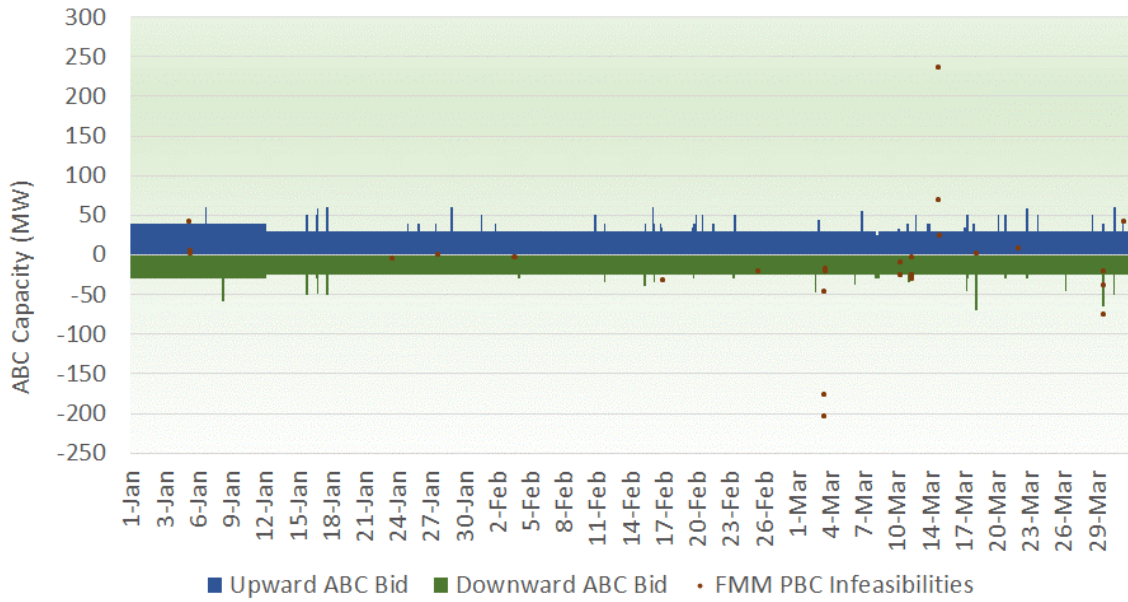


Figure 21: Submitted ABC and Power Balance Constraint Infeasibilities in the NV Energy BAA – RTD

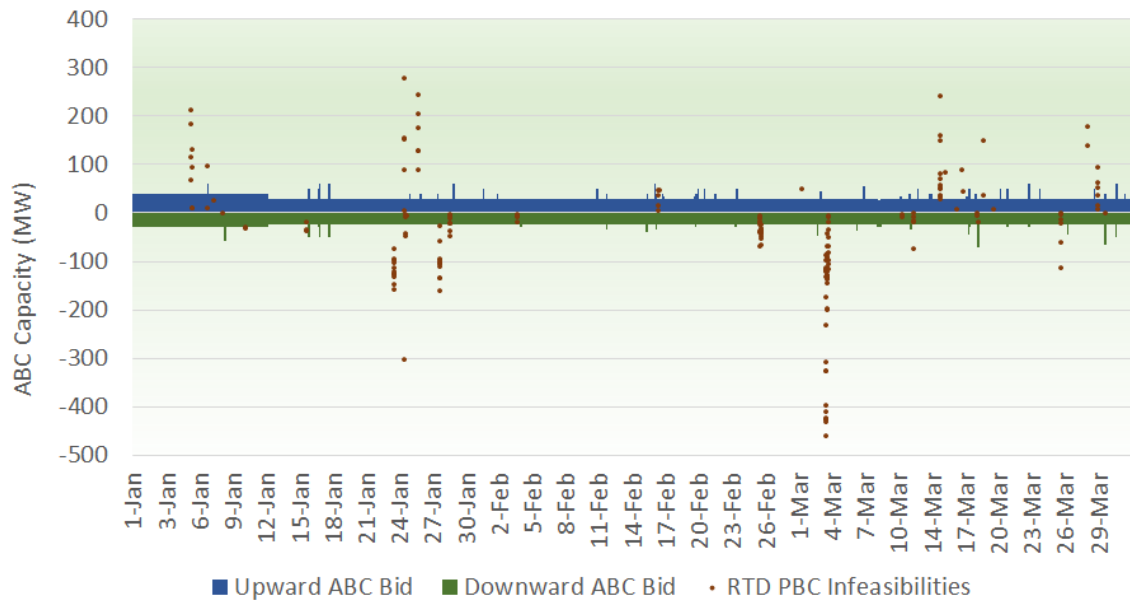


Figure 22: Submitted ABC and Power Balance Constraint Infeasibilities in the APS BAA – FMM

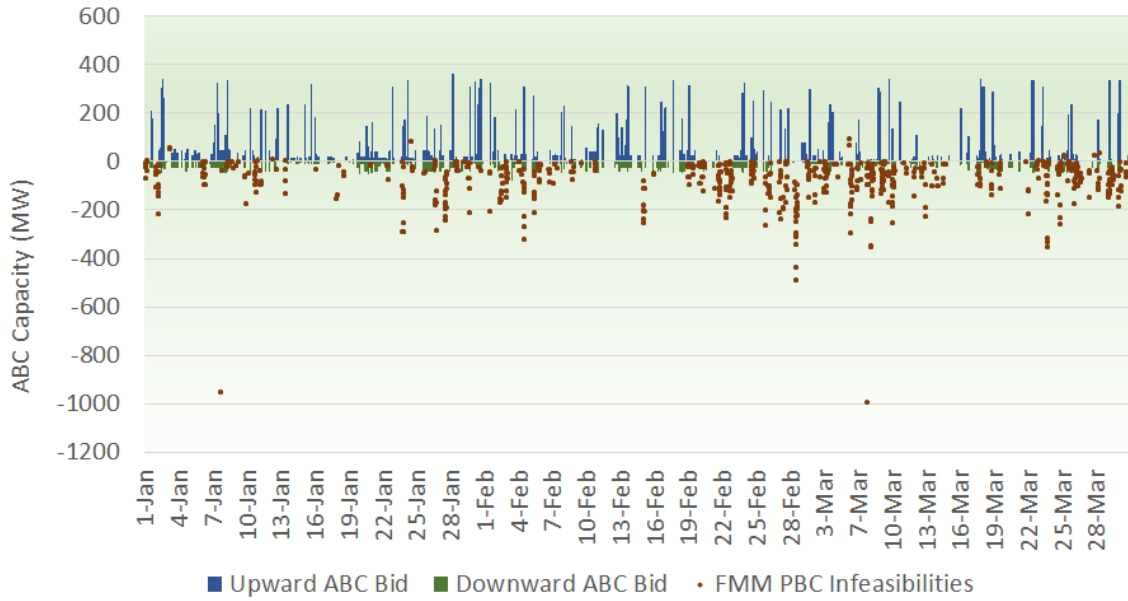


Figure 23: Submitted ABC and Power Balance Constraint Infeasibilities in the APS BAA – RTD

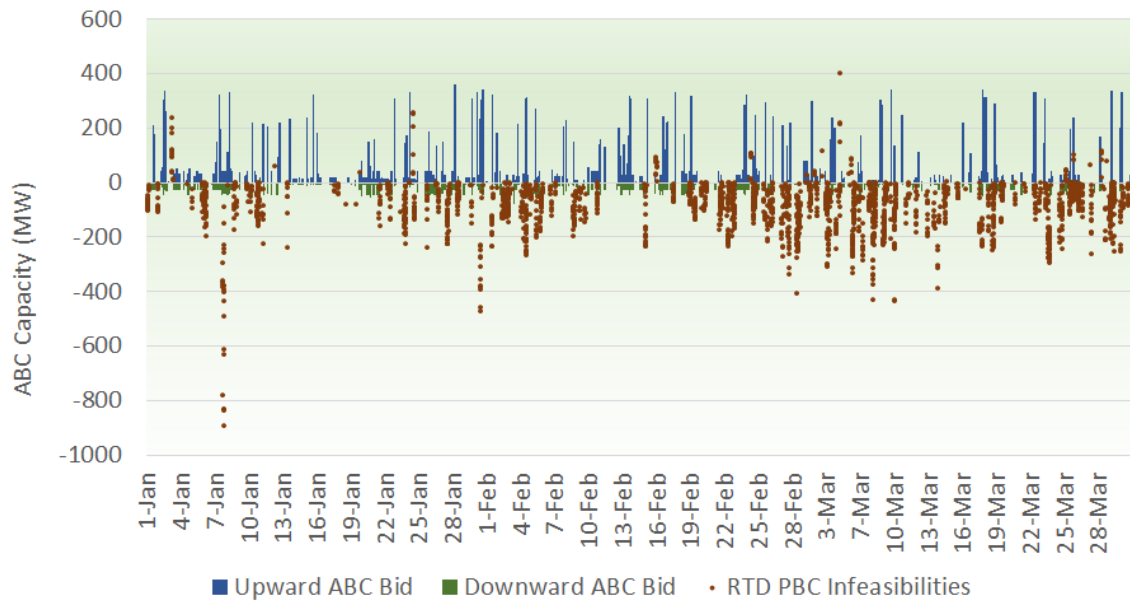


Figure 24: Submitted ABC and Power Balance Constraint Infeasibilities in the PSE BAA – FMM

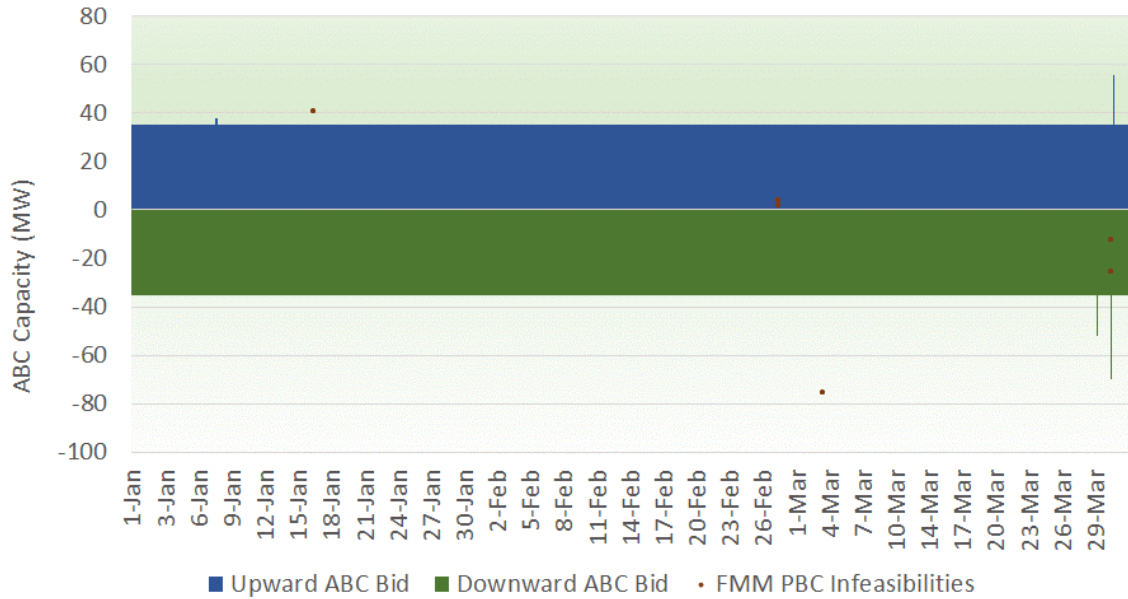
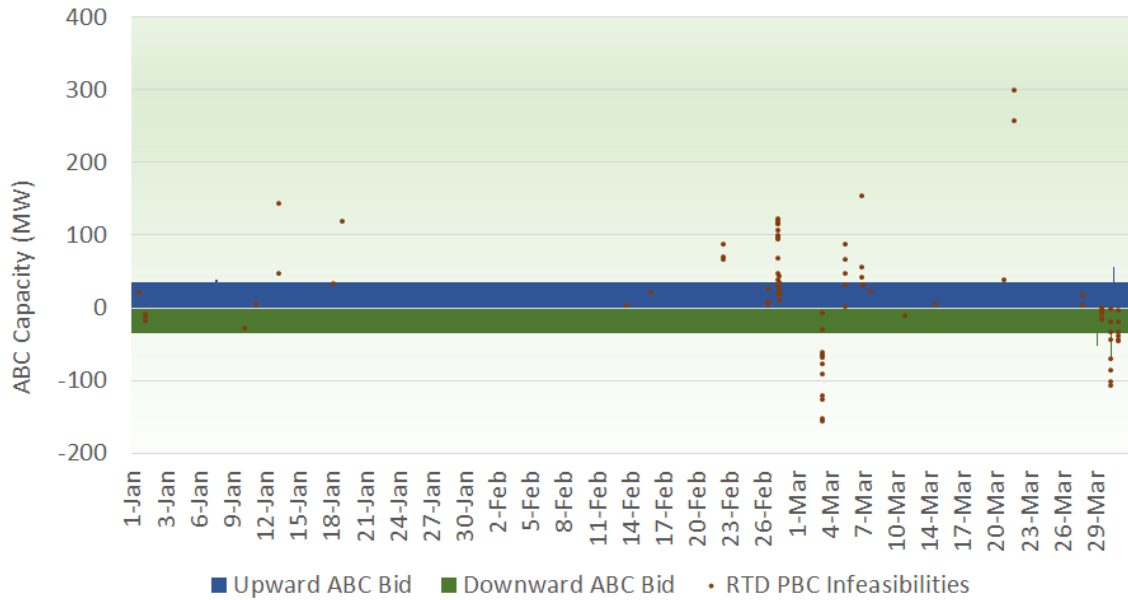


Figure 25: Submitted ABC and Power Balance Constraint Infeasibilities in the PSE BAA – RTD



Based on the data provided in the figures above, Table 3 shows the frequency of intervals in which there was no ABC made available in the market when the power balance constraint was relaxed. The data in Table 3 illustrates over-supply infeasibilities where ABC downward capacity was needed and for under-supply infeasibilities where ABC upward capacity was needed. For instance, for the BAA, both the FMM and RTD are zero percent for under-supply infeasibilities, indicating that in every interval when an under-supply infeasibility was observed, there was ABC upward capacity made available to the market.

Table 3: Frequency of Power Balance Infeasibilities When no ABC was Available in the Market

BAA	Over-supply		Under-supply	
	FMM	RTD	FMM	RTD
PAC West	0%	100%	94.55%	97.06%
PAC East	100%	88.9%	100%	100%
NV Energy	20.7%	3%	0%	0%
APS	72.1%	72.2%	100%	80.55%
PSE	0%	0%	0%	0%

Through validation of the ABC enhancement performance since its implementation, the CAISO has observed three additional scenarios that can occur.

1. Use of ABC related to resource constraints: The CAISO market optimization software recognizes the resource constraints and characteristics of capacity identified as ABC, just as it does of any other participating capacity in the market. Therefore, at times the market is constrained from utilizing the identified capacity due to the operational characteristics of the resources identified as such. The CAISO has observed that in several instances when there was a power balance constraint infeasibility, the ABC identified by the EIM entity was not sufficient to resolve the power balance infeasibility because of the operational ramp limitations of the resources. In some cases, the resources ramp rate may be very limited because of the resource's operating point at any given point in time. In other cases, the resource is not available because in that particular interval the resource must cross a forbidden region first in order to access the ABC and that may take several market intervals, thereby preventing the market optimization software from utilizing the identified capacity. In some instances, a resource is required to cross the operational range where the ABC is defined, and given its ramp rate, the only way

for the resource to reach an expected operating point is by dispatching it within the operating region with ABC.

2. Use of ABC related to congestion management: The CAISO market systems releases the ABC in the scheduling run based on the scheduling run's assessment of system conditions. However, the CAISO schedules and prices resources in the CAISO markets. The ABC is considered as part of the market clearing process in the pricing run. The pricing run will optimize the entire EIM area, which is the combination of all BAAs that participate in the EIM, including the CAISO's BAA. The market software will simultaneously consider the ABC in clearing the least-cost congestion management solution based on resource constraints and system conditions it observes. Consequently, in some instances the market clearing process released the ABC in the EIM BAA it was necessary to release the capacity to address congestion in either the EIM or elsewhere in the system. The ABC is considered part of the single market optimization for the entire EIM area, the need to redispatch resources to manage congestion efficiently would have resulted in the re-allocation of resources such that the ABC would need to be released to ensure the EIM entity could operate its system reliably.

However, because the CAISO aims to ensure that the EIM BAA can operate its system reliably with the use of the ABC it identifies, the CAISO enforces a constraint that ensures that when the market clearing process clears ABC, it stays within the EIM entity's BAA. While the CAISO is not able to isolate the electrons, the constraint ensures that EIM entity does not export the ABC to another BAA to the detriment of the specific EIM entity's BAA by ensuring that the exports from the EIM entity's BAA are net of the ABC released in an EIM entity's BAA.

3. Software defect. There were a few instances impacted by a software defect regarding the reported amount of ABC. In these cases, some MW schedules were incorrectly reported as ABC. This reporting issue was corrected on October 1, 2016.

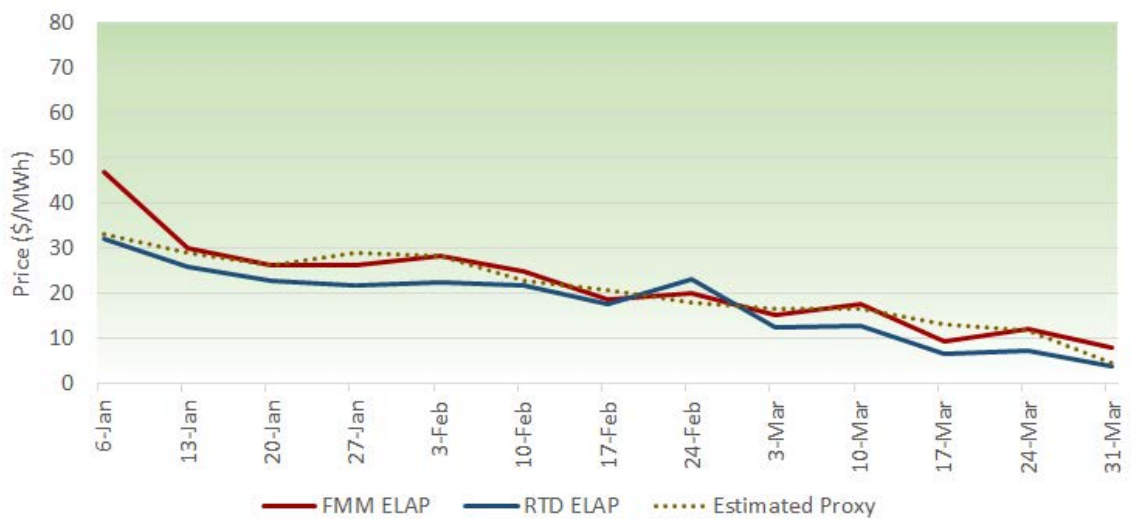
IV. EIM Performance

This section provides the information the CAISO previously provided in its monthly informational reports submitted during an EIM entity’s first six-month transition period. The performance for the APS and PSE BAAs is not provided in this report since that information has already been provided in the monthly informational reports as part of the transitional period requirements.

A. Prices

Figures 26 through 28 show the ELAP prices⁵ for the FMM and RTD in each EIM BAAs. These trends show only the factual prices, which are financially binding. In prior reports, the CAISO provided these factual prices in comparison to counterfactual prices in order to show the effect of using the pricing waiver of the price discovery mechanism.

Figure 26: Daily Average Price for the PAC West BAA ELAP



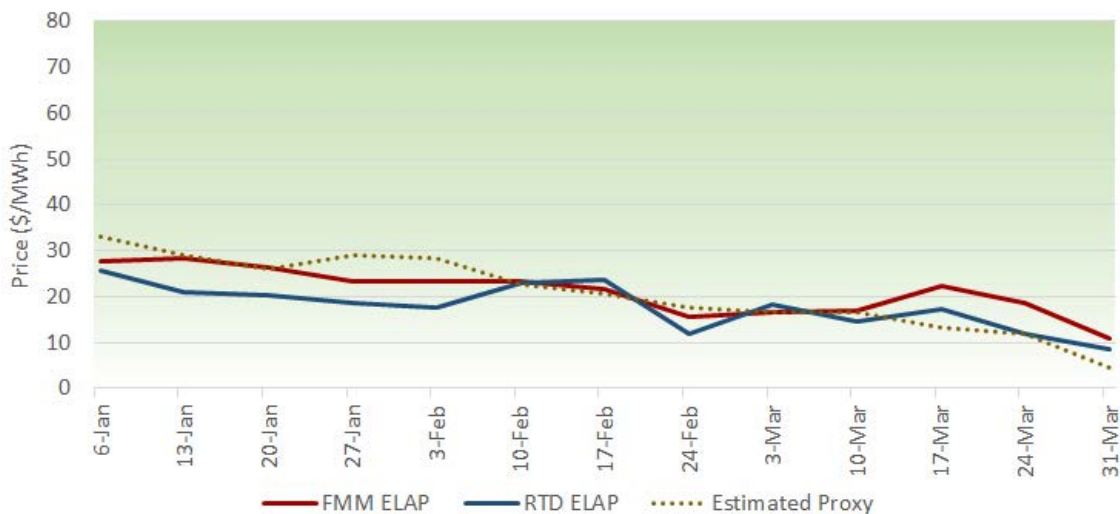
This comparison is no longer meaningful because the PAC West and PAC East BAAs tariff waiver ended with the activation of the ABC enhancement on March 23, 2016, and the NV Energy BAA transition period expired by the end of

⁵ The ELAP (EIM Load Aggregation Price) provides aggregate prices that are representative of pricing in the overall area of NV Energy.

May 2016.⁶ EIM transition period pricing reports were provided for the APS and PSE BAAs for the period covered under this report.

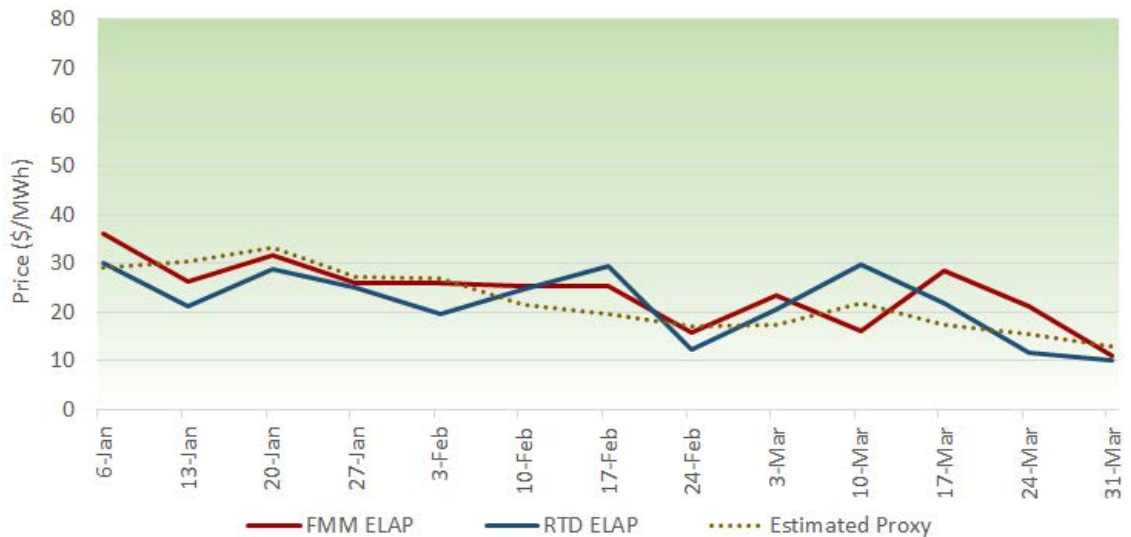
Under the CAISO’s price correction authority in section 35 of the CAISO tariff, the CAISO may correct prices posted on its Open Access Same-time Information System (OASIS) if it finds: (1) that the prices were the product of an invalid market solution; or (2) the market solution produced an invalid price due to data input failures, hardware or software failures; or (3) a result that is inconsistent with the CAISO Tariff. The prices presented in Figures 16 through 19 include all prices produced by the CAISO consistent with the CAISO tariff requirements. That is, the trends below represent: (1) prices as produced in the market for which the CAISO deemed valid; (2) prices that the CAISO could and did correct pursuant to section 35 of the CAISO tariff; and (3) any prices the CAISO adjusted pursuant to transition period pricing reflected in section 29.27 of the CAISO tariff.

Figure 27: Daily Average Price for the PAC East BAA ELAP



⁶ In Docket ER15-402, the CAISO reported on prices based on the price discovery mechanism in effect during the term of the Commission’s waiver granted in that docket and the prices as they would be if the waiver was not in effect, *i.e.*, what prices would have been had they been on the penalty prices in the CAISO tariff. Because pricing under the waiver pricing is based on the last economic bid price signal, these prices are a proxy of what the prices would have been absent the seven category of learning curve type issues experience in that market. The difference between the counterfactual pricing and the price in effect during the term of the reports in that docket illustrated the market impact of the waiver pricing. For the NV Energy BAA, the comparison is still useful for the months of April and May 2016. However, the CAISO has already provided such comparison in the corresponding monthly EIM informational previously submitted to FERC.

Figure 28: Daily average price for the NV Energy balancing authority area ELAP



For the period of January 1 through March 31, 2017, ELAP prices in the NV Energy BAA were on average \$24.6/MWh in the FMM and \$21.98/MWh in the RTD. Prices in the PAC West BAA were on average \$21.81/MWh in the FMM and \$17.71/MWh in the RTD, while prices in the PAC East BAA were on average \$21.16/MWh in the FMM and \$17.88/MWh in the RTD.

B. Frequency of Power Balance Constraint Infeasibility

Figures 29 through 34 show the frequency of intervals in which the power balance constraint was relaxed in each EIM entity's BAA for under-supply or over-supply conditions in the FMM and RTD, respectively. A bar with positive frequency represents an under-supply power balance constraint infeasibility, and a bar with negative frequency represents an over-supply power balance constraint infeasibility. These frequencies reflect only actual infeasibilities as invalid infeasibilities were excluded. Invalid infeasibilities are power balance constraint infeasibilities for intervals that were subject to a price correction under the provisions of the CAISO tariff.

The red bars in Figures 29 through 34 show the instances of infeasibilities covered with the load conformance limiter. The CAISO uses a load conformance limiter in the CAISO BAA to prevent over-adjustments through use of the load conformance, and thus prevent an artificial infeasibility – one that does not reflect actual scarcity. When the quantity of the infeasibility is less than the operator's adjustment, and the infeasibility is in the same direction as the adjustment, the load conformance limiter automatically limits the operator's adjustments to at least the feasibility level. In the pricing run, the limiter will remove an infeasibility that is less

than or equal to the operator’s adjustment, *i.e.*, the load conformance. The limiter will not apply to infeasibilities greater than or in the opposite direction of the load conformance. Use of the load conformance limiter in the CAISO BAA has avoided invalid constraints that arise through operations rather than because of real supply issues. This feature applies to either over-supply or under-supply infeasibilities.

Figure 29: Frequency of FMM Power Balance Infeasibilities in the NV Energy BAA

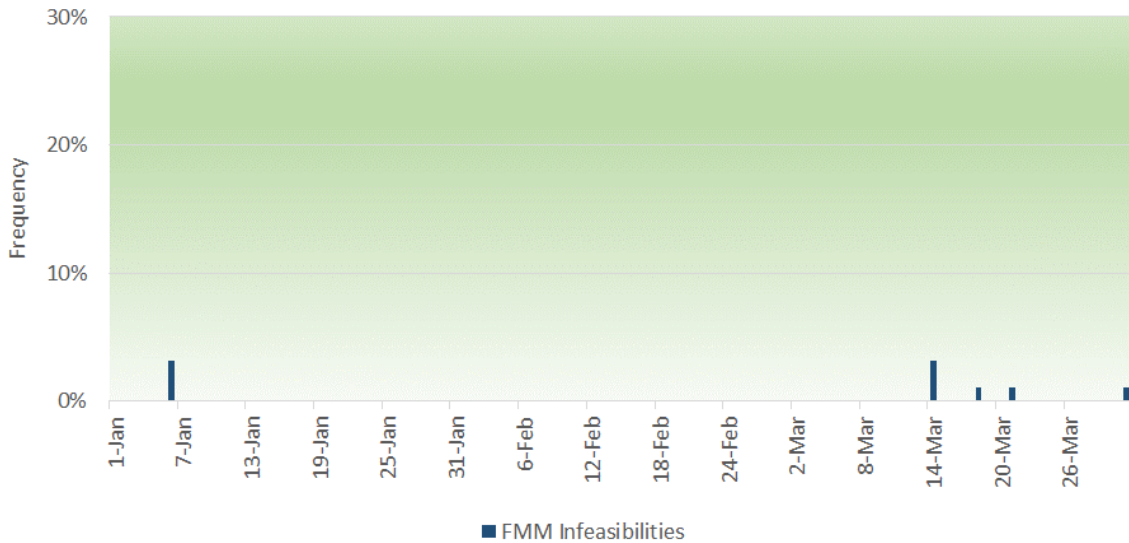
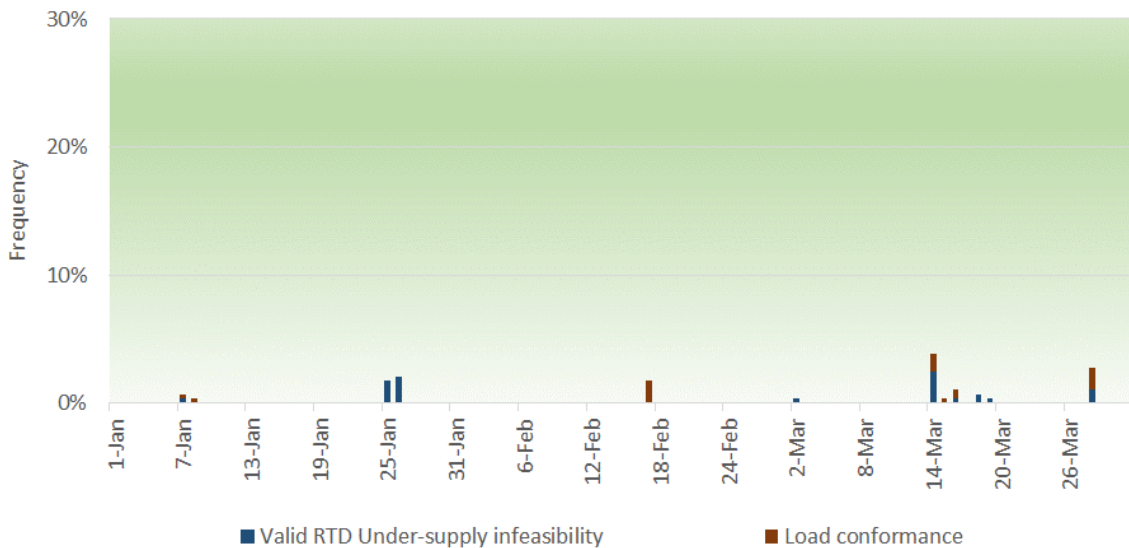


Figure 30: Frequency of RTD Power Balance Infeasibilities in the NV Energy BAA



For the NV Energy BAA, there were only nine (0.1 percent of the time) FMM under-supply infeasibilities in the reported three-month period. The RTD observed

54 (0.21 percent of the time) under-supply infeasibilities, while the load conformance limiter covered 20 (0.08 percent of the time) of the under-supply infeasibilities.

Figure 31: Frequency of FMM Power Balance Infeasibilities in the PAC West BAA

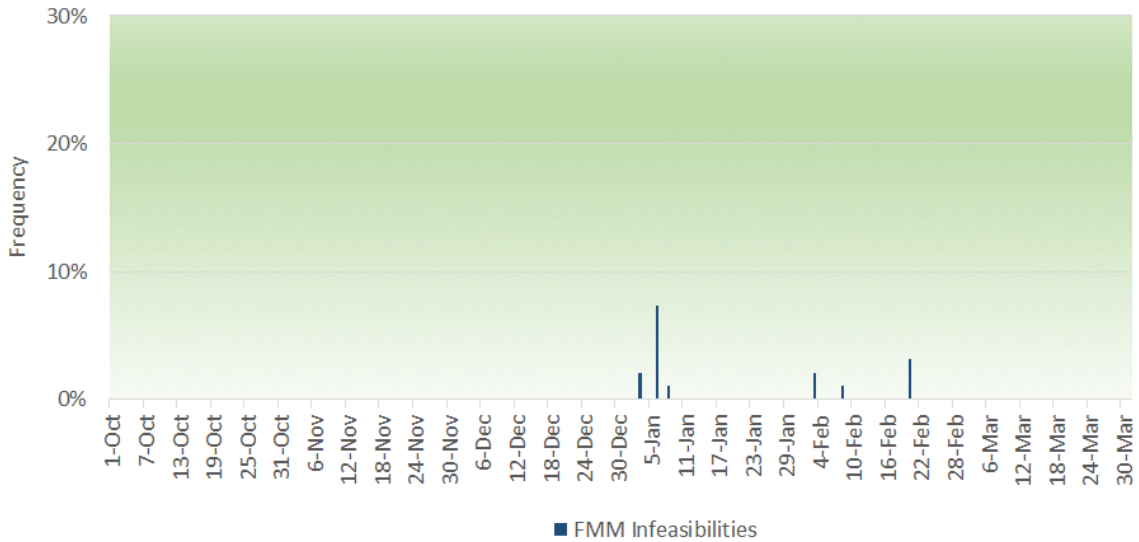
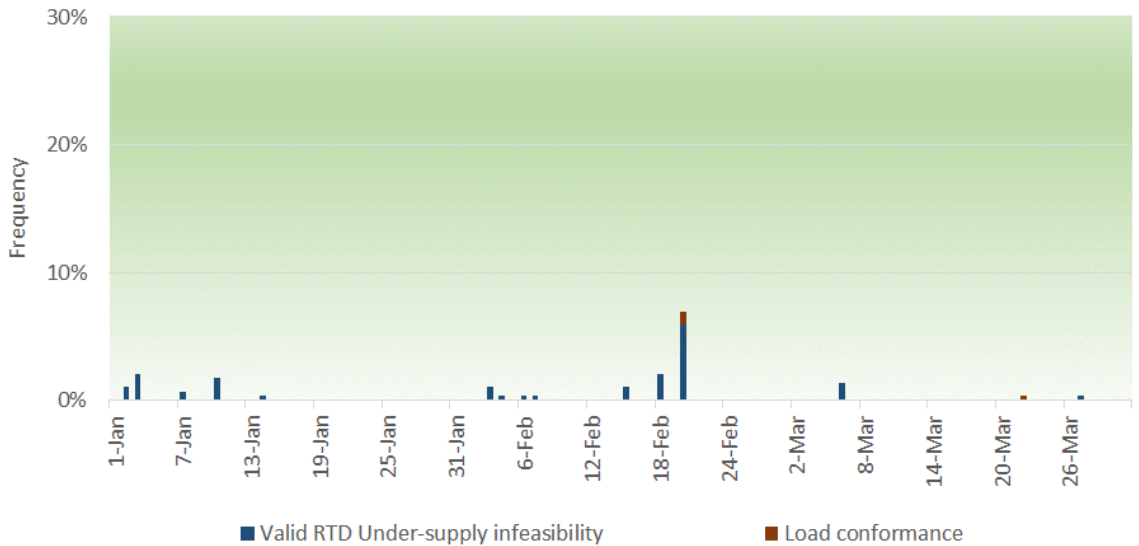


Figure 32: Frequency of RTD Power Balance Infeasibilities in the PAC West BAA



The PAC West BAA experienced 18 (0.21 percent of the time) under-supply infeasibilities in the FMM during the reported three-month period. The RTD

observed 67 (0.26 percent of the time) under-supply infeasibilities, while the load conformance limiter covered six of the under-supply infeasibilities.

Figure 33: Frequency of FMM Power Balance Infeasibilities in the PAC East BAA

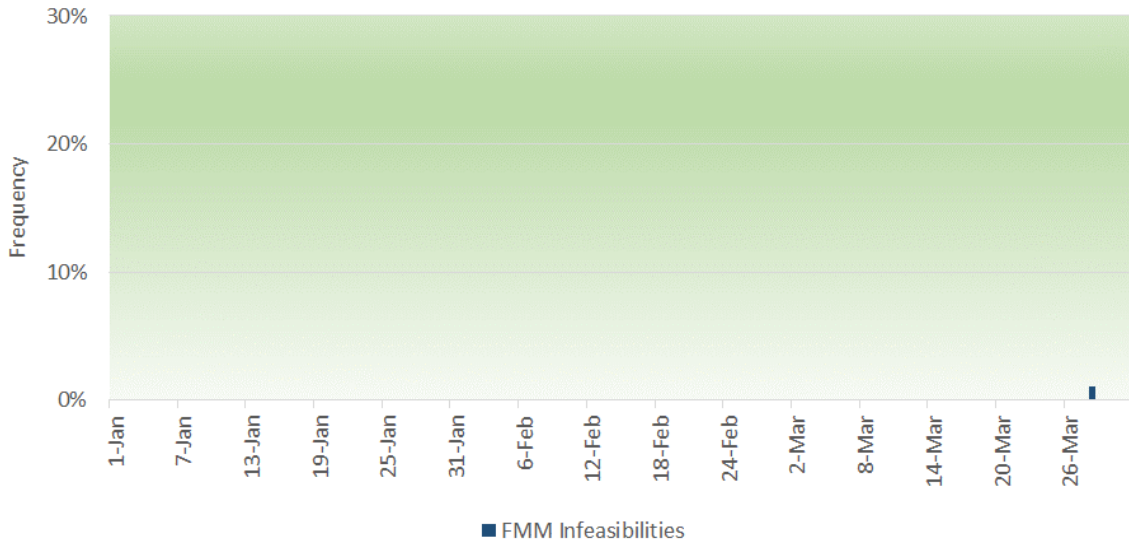
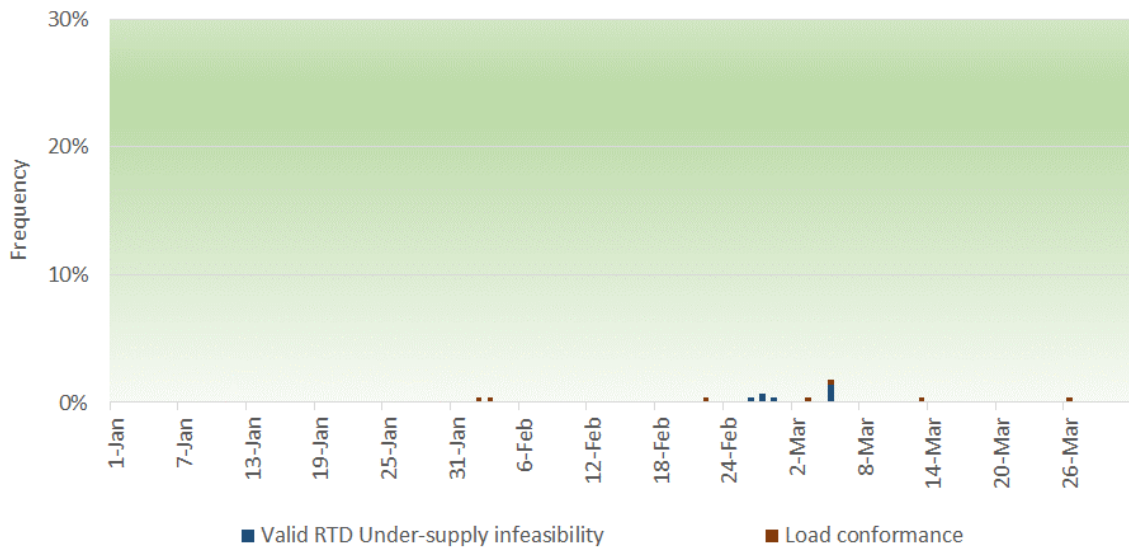


Figure 34: Frequency of RTD Power Balance Infeasibilities in the PAC East BAA



The PAC East BAA experienced one valid under-supply infeasibility in the FMM during the reported three-month period. In the RTD, there were 16 under-supply infeasibilities (0.06 percent of the time), and about a half of those instances were covered by the load conformance limiter.

C. Balancing and Flexible Ramping Sufficiency Test Failures

Figures 35 through 37 show the trend of balancing test failures for the period of January 1, 2017 through March 31, 2017 for each EIM entity’s BAA. This balancing test is performed pursuant to Section 29.34(k) of the CAISO tariff.

The NV Energy BAA passed the balancing test 98.87 percent of the time, where about a quarter of the failures were due to under-scheduling. These failures are within normal ranges and reflect the incidence of the forecasting and balancing process that has occurred at a frequency that is well within expected performance tolerances.

The PAC West BAA passed the balancing test for the reported period about 97.36 percent of the time, with about a half of the failures reflecting under-scheduling. Similarly, the PAC East BAA passed the balancing test about 99 percent of the time, with a about the half of the failures were associated with under-scheduling.

Figure 35: Frequency of Balancing Test Failures for the NV Energy BAA

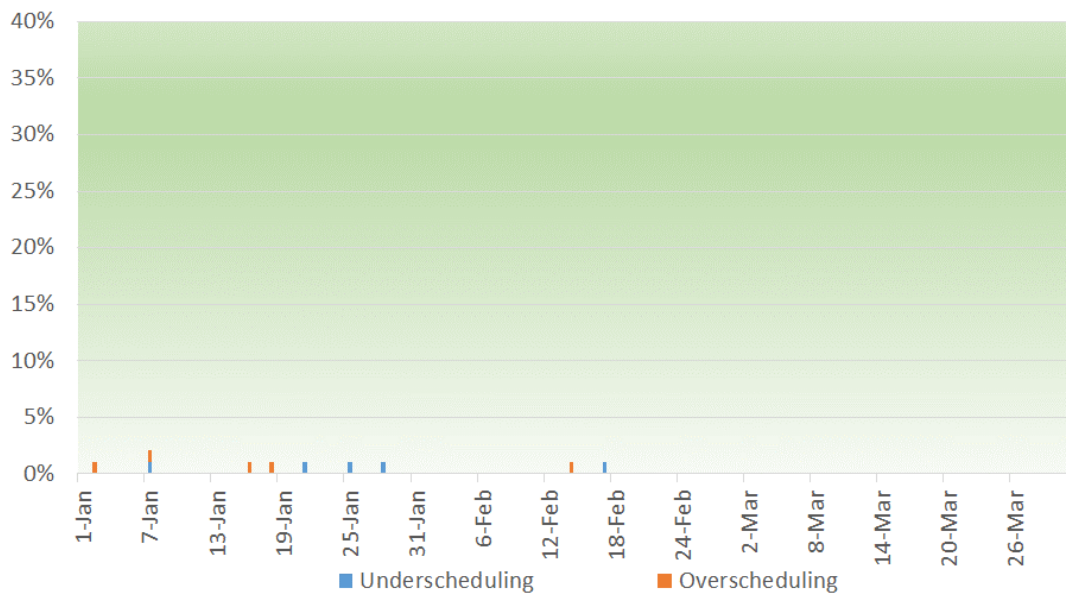


Figure 36: Frequency of Balancing Test Failures for the PAC West BAA

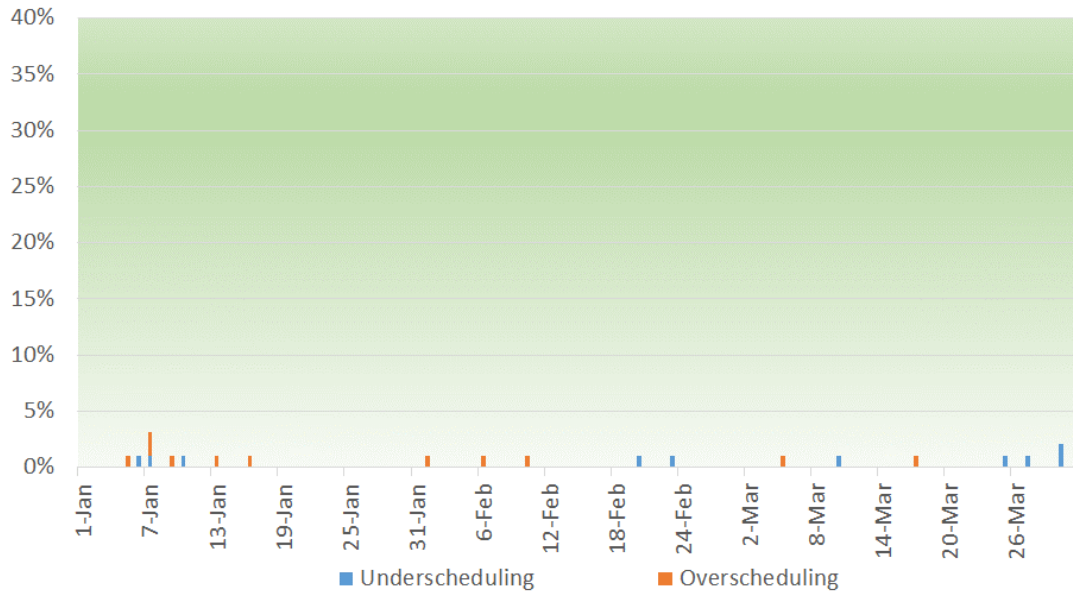
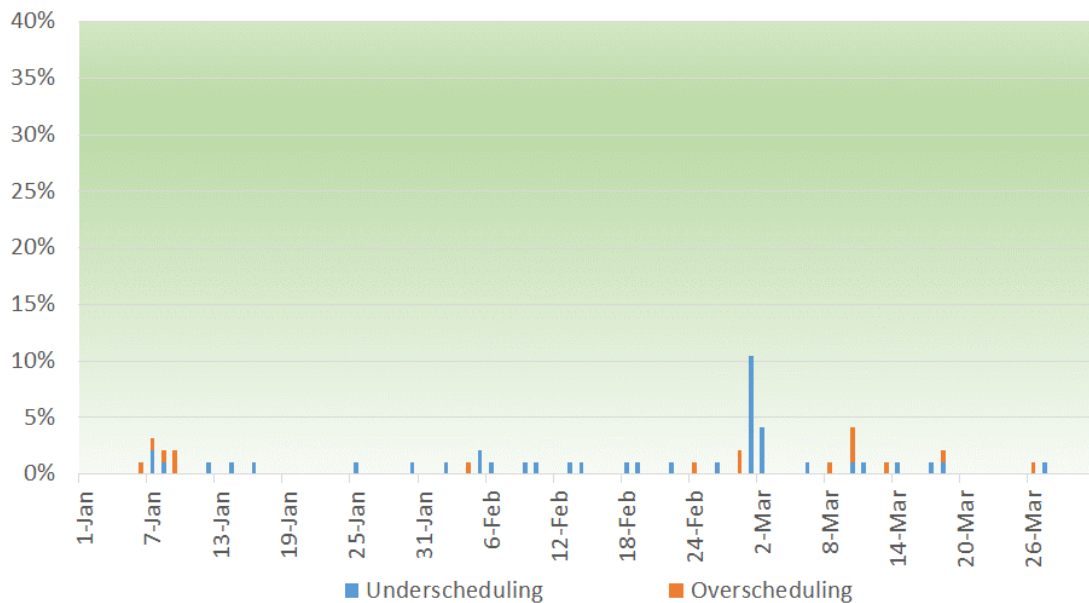


Figure 37: Frequency of Balancing Test Failures for the PAC East BAA



Figures 38 through 40 show the trend of failures for the flexible ramping sufficiency test in each EIM entity’s BAA for the period of January 1 through March 31, 2017. For the reported period, the NV Energy BAA passed the test about 99.68 percent of the hours; the PAC West BAA passed the balancing test about 99.22

percent of the hours; and the PAC East BAA passed the test 99.3 percent of the hours.

Figure 38: Frequency of Flexible Ramping Sufficiency Test Failures in the NV Energy BAA

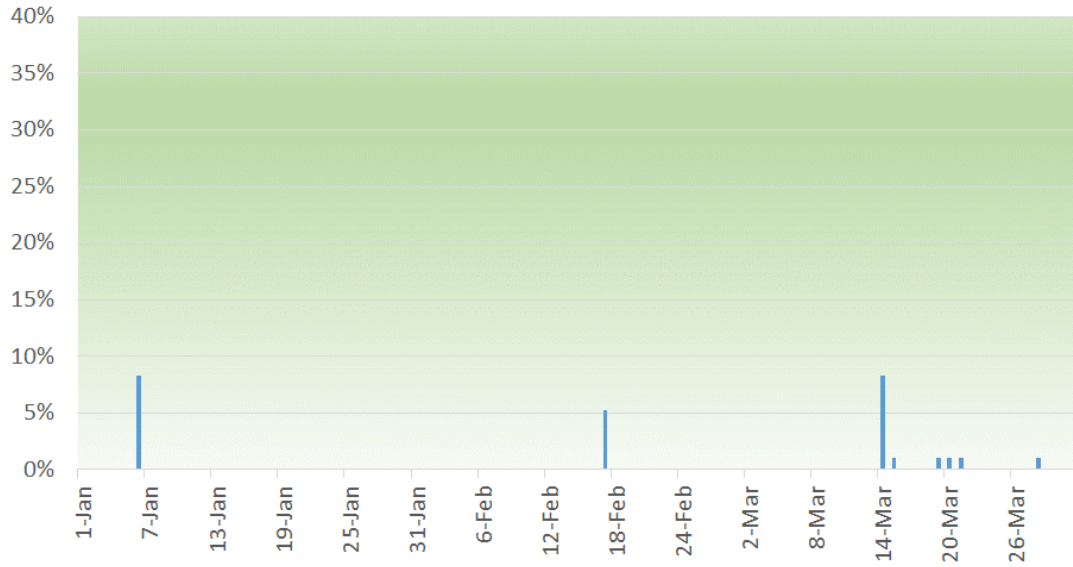


Figure 39: Frequency of Flexible Ramping Sufficiency Test Failures in the PAC West BAA

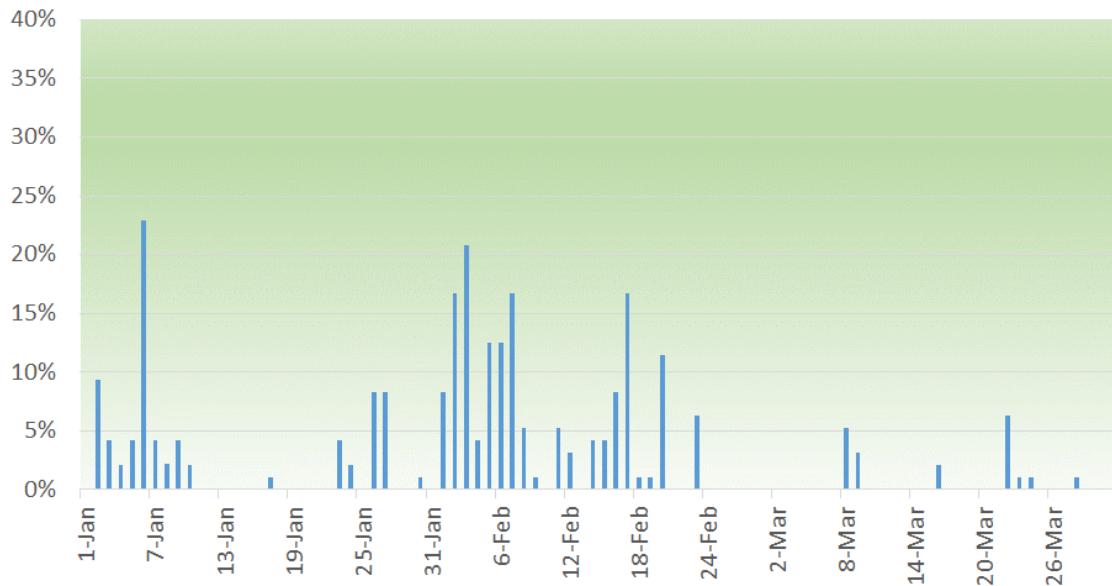
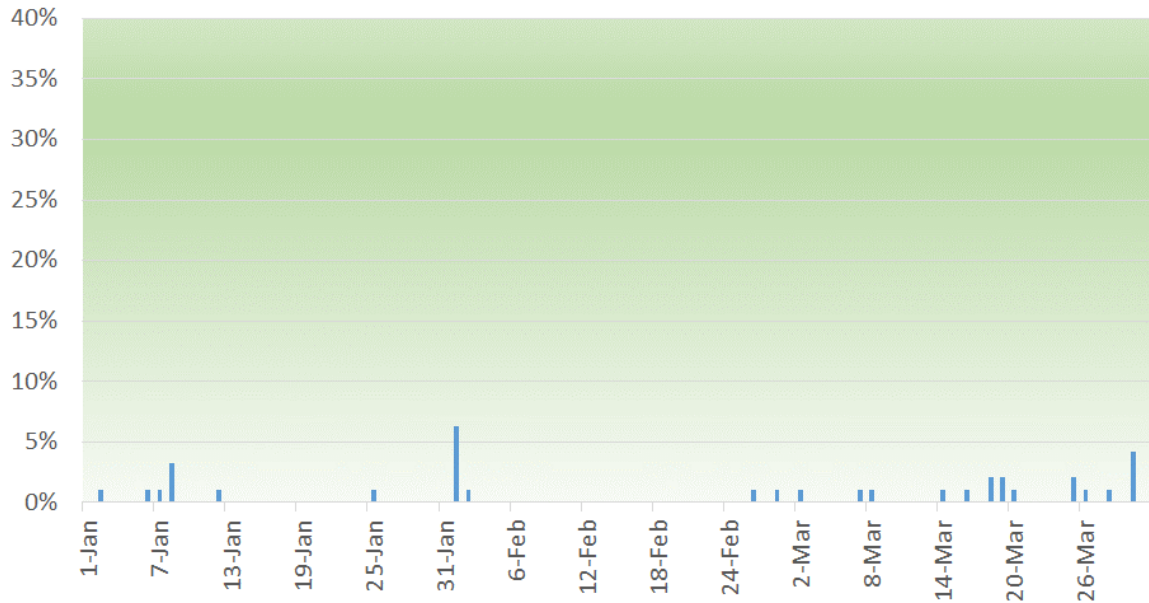


Figure 40: Frequency of Flexible Ramping Sufficiency Test Failures in the PAC East BAA



D. Flexible Ramping Constraint Infeasibilities

As described in the monthly EIM transitional period reports for the APS and PSE BAAs, the flexible ramping product was implemented on November 1, 2016. With the implementation of the flexible ramping product, there are no longer constraint infeasibilities related to flexible ramping constraint. Rather, the flexible ramping product uses a price-responsive demand curve. For this reason, there are no flexible ramping constraints to report.

E. Impact on Non-EIM Pricing Locations

With the implementation of the EIM with PacifiCorp’s BAAs (PAC East and PAC West) with the first trading day on November 1, 2014, there was an identified pricing reporting issue for shared locations between the CAISO markets and the EIM. These shared locations have associated mirror resources since they are used to schedule energy for CAISO BAA and are located in the EIM BAA. In late 2014 the CAISO worked on improving these shared locations’ modelling, and reported its progress in the corresponding transitional period reports for the PAC East and PAC West BAAs. Currently, there are no known issues impacting such locations that need to be discussed in this report.

CERTIFICATE OF SERVICE

I hereby 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 16th day of November 2017.

/s/ Grace Clark
Grace Clark