January 22, 2018

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-___
December 2017 Informational Report
Energy Imbalance Market – Transition Period Report – Portland General Electric

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) hereby submits its report on the transition period of Portland General Electric (PGE) during its first six months of participation in the western energy imbalance market (EIM) for December 2017.

The CAISO will continue filing such reports, consistent with the Commission's order, through the six-month reporting period.

Please contact the undersigned with any questions.

Respectfully submitted

By: *<u>/s/ Anna A. McKenna</u>*

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Energy Imbalance Market
December 1 – December 31, 2017

Transition Period Report
Portland General Electric Entity

January 22, 2018

California ISO Department of Market Quality and Renewable Integration

I. Introduction and Background

On October 29, 2015, the Federal Energy Regulatory Commission (Commission) approved the California Independent System Operator Corporation's (CAISO) proposed tariff amendments to allow a transition period for new Energy Imbalance Market (EIM) entities during the first six months of EIM participation, effective November 1, 2015.[1] Portland General Electric (PGE) entered the EIM on October 1, 2017, and the transition period will apply to the PGE balancing authority area (BAA) until April 1, 2018.

During the six-month transition period, the pricing of energy in the new EIM entity's BAA is not subject to the pricing parameters that normally apply when the market optimization relaxes a transmission constraint or the power balance constraint. Instead, during the six-month transition period, the CAISO will clear the market based on the marginal economic energy bid (referred to herein as "transition period pricing"). In addition, during the six-month transition period, the CAISO sets the flexible ramping constraint relaxation parameter for the new EIM entity's BAA between $0 and $0.01, but only when the power balance or transmission constraints are relaxed in the relevant EIM BAA. This is necessary to allow the market software to determine the marginal energy bid price.

Consistent with the Commission's October 29 Order, the CAISO and the Department of Market Monitoring (DMM) will file informational reports at 30-day intervals during the six-month transition period for any new EIM entity. The CAISO provides this report for PGE to comply with the Commission's requirements in the October 29 Order. The CAISO anticipates filing these reports on a monthly basis. However, because the complete set of data is not available immediately at the end of the applicable month,[2] and depending on the market performance each month, along with the need to coordinate with the EIM entity, the CAISO expects to continue to file the monthly reports approximately 25 days after the end of each month in order to provide the prior full month's data.

[1] *California Indep. Sys. Operator Corp*., 153 FERC ¶ 61,104 (2015) (October 29 Order).

[2] The earliest the CAISO can start gathering the data is 10 business days after the last day for the reporting month since this is when the price correction window expires.

II. Highlights

Overall, PGE's transition into the EIM was smooth and without significant consequence, with the exception of some transitional data issues. Since the PGE's EIM implementation on October 1, 2017, the market results have been uneventful. The third month's market performance highlights are as follows:

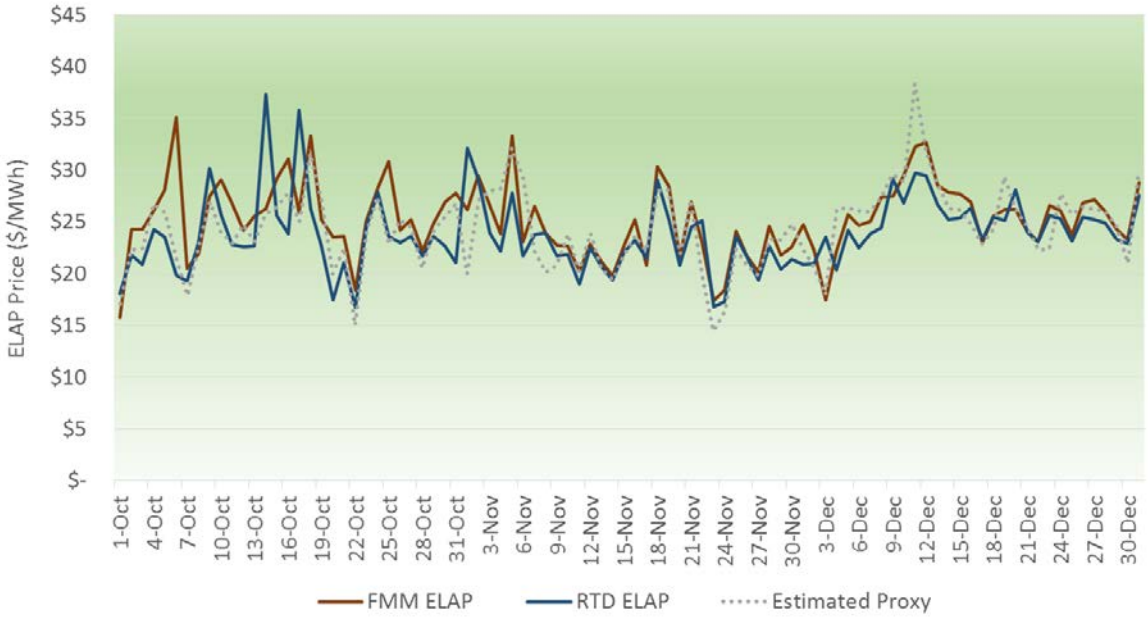
- In December, prices continue to be stable and within reasonable ranges, with the monthly average PGE BAA prices being $25.91/MWh in the fifteen-minute market (FMM) and $24.89/MWh in the real-time dispatch (RTD).
- Power balance constraint infeasibilities for under-supply conditions in the PGE BAA were minimal with no infeasibilities in FMM and 0.13 percent of the total intervals in the RTD. With such low frequency of infeasibilities, the transitional period provisions for price discovery had a negligible impact on market prices.
- As part of the resource sufficiency test performed for each EIM entity prior to the real-time markets, PGE successfully passed over 97.31 percent of its balancing tests in December.
- Also as part of the resource sufficiency test, PGE passed successfully over 99.33 percent of its upward flexible ramping sufficiency tests in December.
- The price for upward flexible ramping capacity in the PGE BAA averaged $0.66/MWh in December, while prices for the downward flexible ramping product were zero most of the time.

III. Market Performance Related to the Transitional Period

a. Prices

Figure 1 shows that average prices in the PGE EIM Load Aggregation Point (ELAP), the monthly average in the FMM was $25.91/MWh and $24.89/MWh in the RTD. The proxy price for the PGE BAA, referenced as a grey dotted line, is the simple average from the Mid C hub price from Powerdex. On December 12, the daily average FMM ELAP price was $32.64/MWh, which was the maximum daily average price for the month, and it was $6.38/MWh above the monthly average. High system wide prices drove the increase in daily average ELAP price in hours ending 8, 18, and 19. In the RTD market, the maximum daily average ELAP LMP was $29.11/MWh, which occurred on December 9. On this day in hour ending 17 interval 12 the system wide price was set at $987/MWh, which was driven, by load changes and resource deviation.

Figure 1: Daily average prices for the PGE BAA.



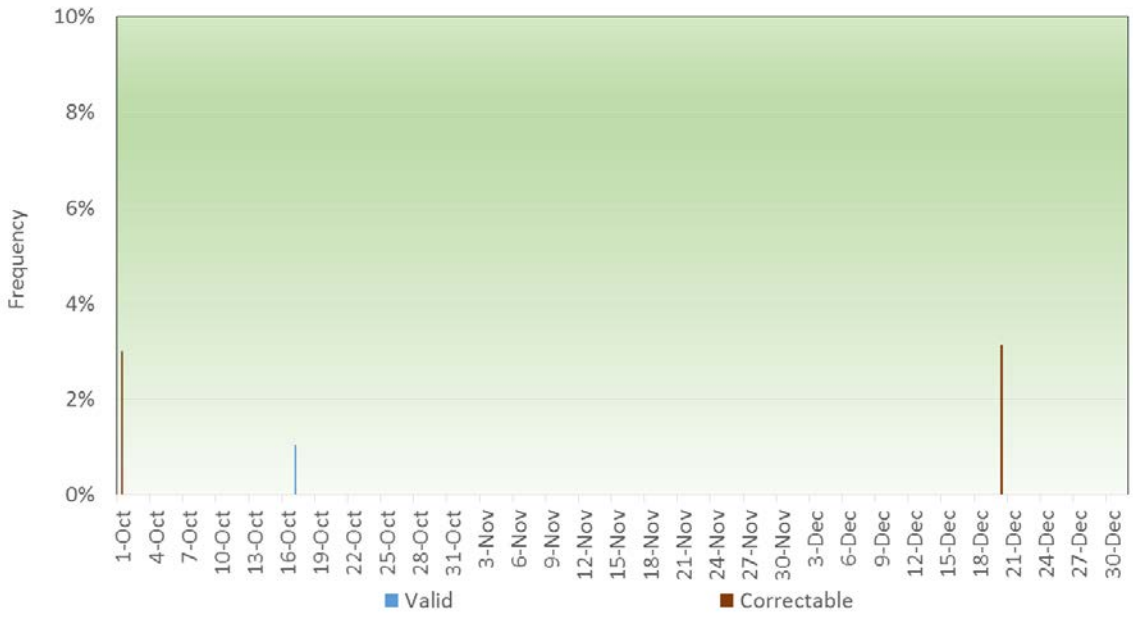
Under the CAISO's price correction authority in Section 35 of the CAISO tariff, the CAISO may correct prices posted on its Open Access Same-Time Information System (OASIS) if it finds: (1) that the prices were the product of an invalid market solution; (2) the market solution produced an invalid price due to data input failures, hardware or software failures; or (3) a result that is inconsistent with the CAISO tariff. The prices presented in Figure 1 include all

prices produced by the CAISO consistent with its tariff requirements.[3] That is, the trends represent: (1) prices as produced in the market that 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 the transition period pricing reflected in Section 29.27 of the CAISO tariff. In December, three intervals in the FMM and six intervals in the RTD required a price correction for the PGE BAA prices under the CAISO's price correction authority provided in Section 35 of the CAISO tariff.

b. Frequency of Power Balance Constraint Infeasibilities

Figures 2 and 3 show the frequency of intervals in which the power balance constraint was relaxed for under-supply conditions in the PGE BAA for the FMM and RTD, respectively. The under-supply infeasibilities are categorized into "valid," "load conformance," and "correctable" instances. Prices for the intervals that fell in the "valid" category are instances with under-supply infeasibilities that were not in error and are subject to the transitional period pricing.

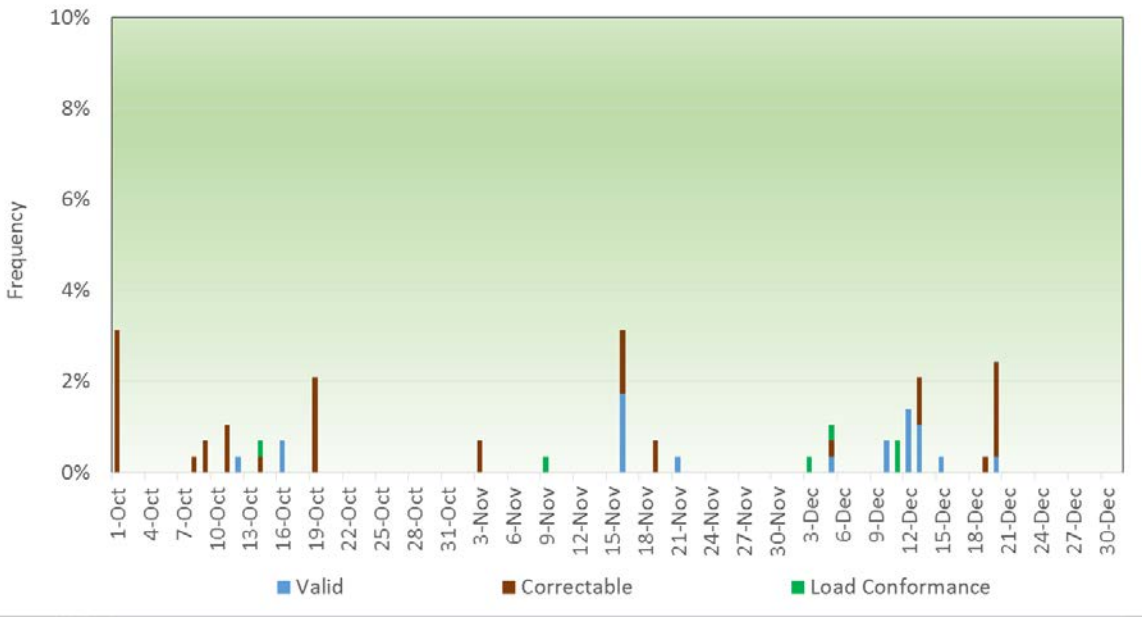
Figure 2: Frequency of FMM under-supply power balance infeasibilities in the PGE BAA.



[3] Figure 1 also provides an estimated proxy price, which for PGE is the simple average of Mid C hub price taken from the Intercontinental Exchange (ICE).

Instances labelled as “load conformance” are the valid infeasibilities observed when a load conformance was in place for that market interval. Whereas the infeasibilities that fell in the “correctable” category had a correction based on the provisions of Section 35 of the CAISO tariff due to either a software or a data error.

Figure 3: Frequency of RTD under-supply power balance in feasibilities in the PGE BAA.



In the PGE BAA, there was no under-supply infeasibility in the FMM and there were 12 (0.13 percent of the time) valid under-supply infeasibilities in the RTD. The reasons for these infeasibilities were:

i) December 5, 2017, RTD. There was a single interval under-supply infeasibility in hour ending six interval 10 due to changes in load forecast and renewable deviation.

ii) December 10, 2017, RTD. There were two intervals with under-supply infeasibilities in hour ending nine, intervals four, and five due to changes in renewable deviation and resource data.

iii) December 12, 2017, RTD. There were four intervals with under-supply infeasibilities in hour ending 23 intervals two, three, four, and six due to delay in start-up of a resource.

iv) December 13, 2017, RTD. There were three intervals with under-supply infeasibilities in hour ending 18, intervals nine, ten, and eleven due to a forced outage on a unit.

v) December 15, 2017, RTD. There was a single interval with under-supply infeasibility in hour ending 10, interval two due to deviation of a resource.

vi) December 20, 2017, RTD. There was a single interval with under-supply infeasibility in hour ending 12 interval two due to deviation of renewable resources.

The maximum number of infeasibilities occurred on December 12 with four intervals in hour ending 23. The infeasibilities were due to a delay in the startup of a unit. Furthermore, PGE had failed the flexible ramping sufficiency test, and as a result, its import EIM transfers were limited to one MW. On December 13, there were three infeasibilities in the hour ending 18 due to a forced outage on a unit. The remaining infeasibilities occurred on four days with one or two interval infeasibilities on each of these days.

There were four intervals in the five-minute market for the PGE BAA that coincided with load conformance. The CAISO uses a load conformance limiter to prevent over-adjustments, 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 or below the infeasibility. 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 operational adjustments that do not reflect supply issues. During the transition period, the CAISO does not apply the load conformance limiter because it applies the transition period pricing, which obviates the need for the load conformance limiter. Therefore, Figure 3 illustrates the infeasibilities that would have been covered by the load conformance limiter were it in effect instead of transition period pricing during the transition period in the PGE BAA.

The CAISO corrected prices for the fifth and twentieth day of December for eight RTD intervals due to a software defect. For both of these days, PGE failed the upward flexible ramping sufficiency test due to a software defect that resulted in a much lower ramping capacity calculation for the unit compared to its actual ability. Since the software defect affected PGE's ability to import EIM transfers, the CAISO performed price correction by selective re-calculation.

Tables 1 and 2 list the FMM and RTD intervals with infeasibilities observed in December, including the amount of load conformance to reflect the instances in which the load conformance limiter would have been triggered and offset the infeasibility. As stated below, there were no FMM under-supply infeasibilities for December 2017.

Table 1: List of valid FMM under-supply infeasibilities in the PGE balancing authority area.

Trade Date	Trade Hour	Trade Interval	MW Infeasibility	Load Conformance
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Table 2: List of valid RTD under-supply infeasibilities in the PGE balancing authority area.

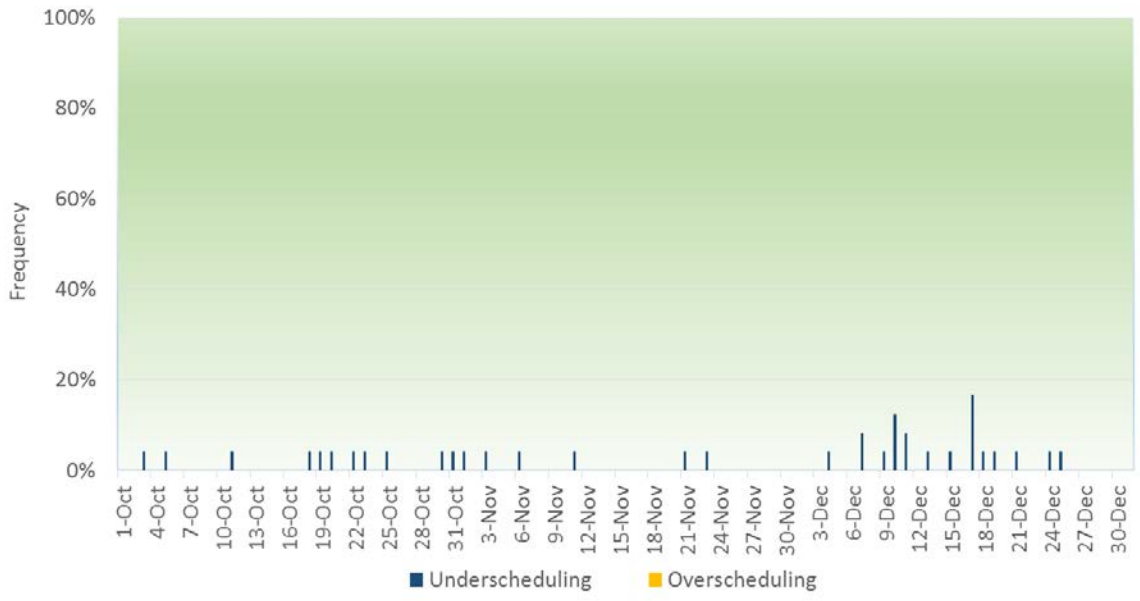
Trade Date	Trade Hour	Trade Interval	MW Infeasibility	Load Conformance
3-Dec-17	22	3	14.23	30
5-Dec-17	6	9	17.77	30
5-Dec-17	6	10	39.02	30
10-Dec-17	9	4	31.5	20
10-Dec-17	9	5	29.14	20
11-Dec-17	9	8	45.63	225
11-Dec-17	9	9	10.89	225
12-Dec-17	23	2	9.27	0
12-Dec-17	23	3	33.89	0
12-Dec-17	23	4	16.11	0
12-Dec-17	23	6	15.32	0
13-Dec-17	18	9	56.31	20
13-Dec-17	18	10	56.71	20
13-Dec-17	18	11	103.2	20
15-Dec-17	10	2	44.2	0
20-Dec-17	12	2	38.43	0

c. Balancing and Sufficiency Test Failures

The EIM provides an opportunity to various BAAs to serve its load while realizing the benefits of increased resource diversity. Since the EIM does not include resource adequacy requirements or obligations for resources to submit bids, the CAISO performs a series of resource sufficiency tests comprised of: (i) a balancing test; (ii) a capacity test; and (iii) a flexible ramping sufficiency test. These tests occur prior to the real-time market.

Performance of a balancing test prior to each trading hour ensures that each participating BAA submits a balanced base schedule of generation and a net schedule interchange to meet its demand. In addition, the participating BAA is required to submit bids with enough ramping capability to meet its net load forecast uncertainty and net load movement requirements. Figure 4 shows the trend of balancing test outcomes for the three-month period of October 2017 until December 2017.[4] The PGE BAA passed the balancing test in 97.31 percent of the intervals in December. The frequency of these failures are within expected performance tolerances for balancing tests.

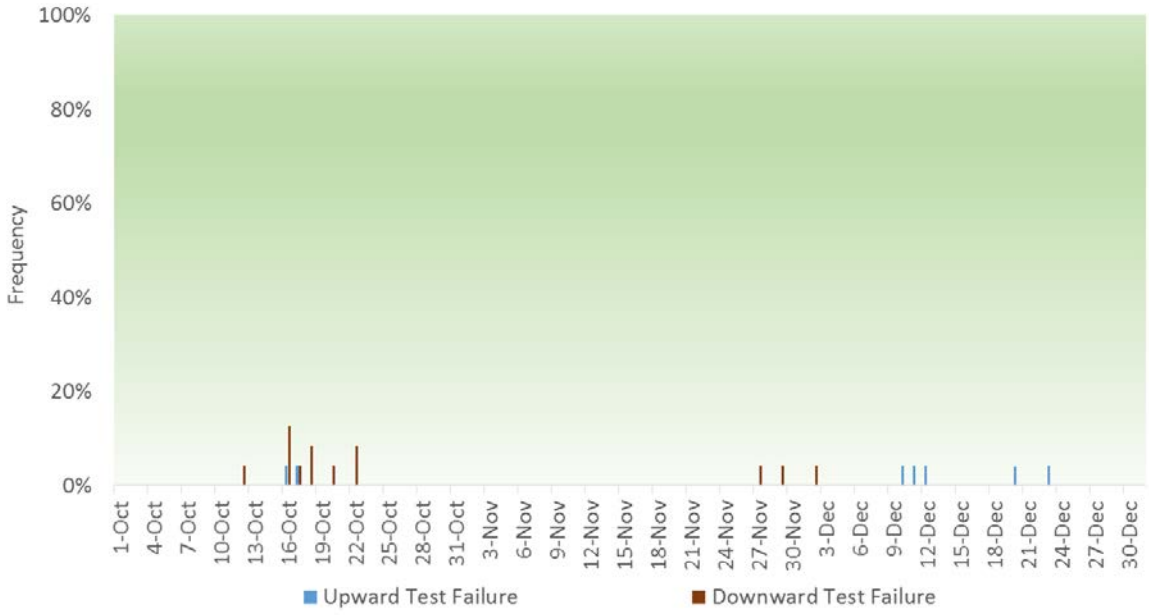
Figure 4: Frequency of Balancing test failures in the PGE BAA.



The CAISO also performs the flexible ramping sufficiency test as specified in Section 29.34(m) of the CAISO tariff. Figure 5 shows the trend of the test failures for flexible ramping for the three-month period of October 2017 until December 2017. The PGE BAA passed the test in 99.33 percent of the intervals in December. The level of failures of this test is well within the expected and typical rate observed in the EIM.

[4] The CAISO performs resource sufficiency tests pursuant to Section 29.34(k) of the CAISO tariff.

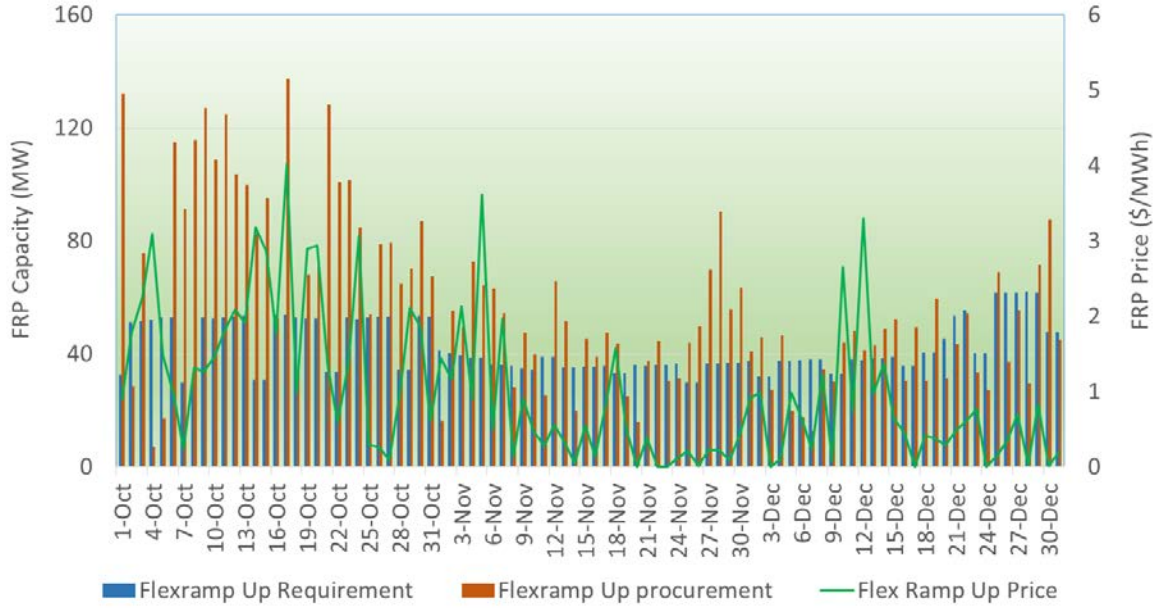
Figure 5: Frequency of flexible ramping sufficiency test failures in the PGE BAA.



d. Flexible Ramping Product

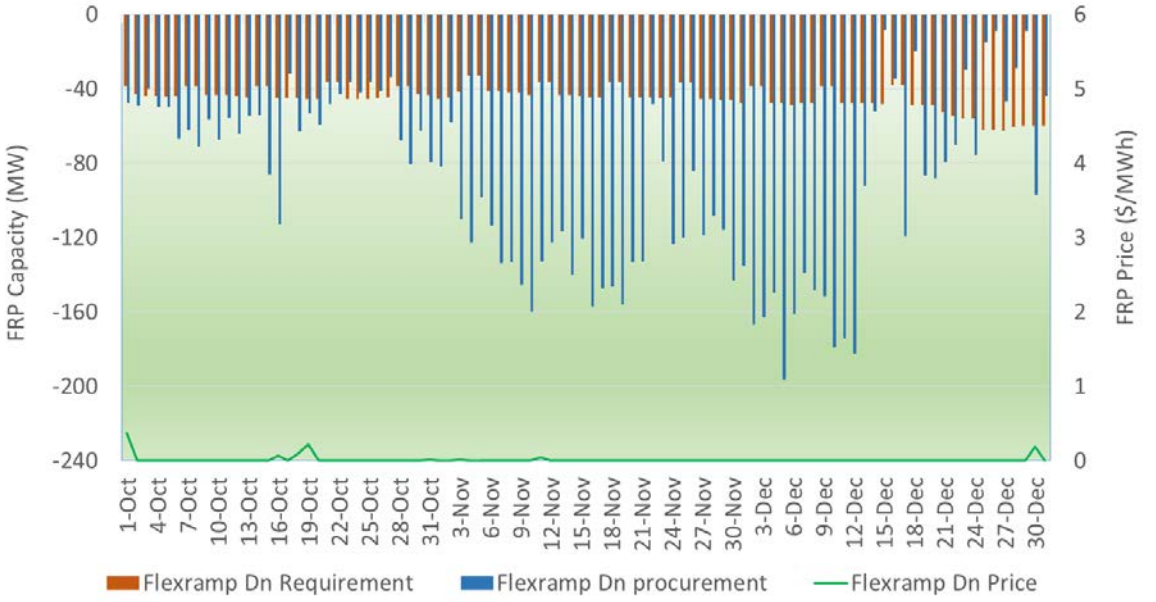
Figure 6 shows the daily average of the upward flexible ramping constraint requirement, procurement, and prices in the FMM. Figure 7 shows the daily average of the downward flexible ramping constraint requirement, procurement, and prices in the FMM. With the implementation of the flexible ramping product on November 1, 2016, calculation of the requirements consists of historical data for uncertainty with any applicable net import/export capability or credit. This effectively reduces the amount of flexible ramping the PGE BAA has to procure and, generally, the EIM system-wide area (which includes all the BAAs in the EIM including the CAISO BAA) will drive the requirements. The market clearing process may result in procuring the PGE BAA capacity towards meeting the overall EIM-system-wide area requirement. This is the main reason why the individual PGE BAA procurement may generally fall below or be above the individual PGE BAA requirement.

Figure 6: Daily Average requirement, procurement, and price of upward flexible ramping in the FMM in the PGE BAA.



In addition, the price trend provided in Figure 6 and Figure 7 is the nested price determined by the summation of the shadow price of the individual PGE BAA plus the shadow price of the EIM system-wide area. In December 2017, the average upward flexible ramping capacity price was $0.66 /MWh and the average downward flexible ramping capacity price was $0.01/MWh.

Figure 7: Daily Average requirement, procurement, and price of downward flexible ramping in the FMM in the PGE BAA.



For most of the time, the flexible ramping procurement was above the area requirements, which naturally will lead to zero prices in the PGE BAA. Still, with the EIM area binding, the net price in the PGE BAA may be greater than zero.

e. Impact on Non-EIM Nodes

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 market and the EIM. These shared locations schedule energy for the CAISO BAA and are located in the EIM BAA, and have associated mirror resources. 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 affecting such shared locations.

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 22nd day of January, 2018.

/s/ Grace Clark
Grace Clark