March 13, 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. ER15-2565-___
November 2016 Informational Report
Energy Imbalance Market – Transition Period Report – Arizona Public Service

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) hereby submits its report on the transition period of Arizona Public Service during its first six (6) months of participation in the Energy Imbalance Market (EIM) for November 2016. The Commission also directed the Department of Market Monitoring (DMM) to submit an independent assessment of the CAISO's report, which the DMM will seek to file within approximately 15 business days.

The CAISO will continue filing such reports, consistent with the Commission's order, through the six (6) 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

November 1 – November 30, 2016

Transition Period Report

Arizona Public Service Entity

March 13, 2017

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] Arizona Public Service Company (APS) entered the EIM on October 1, 2016, and the transition period will apply to their balancing authority area until April 1, 2017.

During the six-month transition period, the pricing of energy in the balancing authority area of a new EIM entity 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 balancing authority area between $0 and $0.01, but only when the power balance or transmission constraints are relaxed in the relevant EIM balancing authority area. 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 APS to comply with the requirements in the Commission's October 29 order. The CAISO will continue to file the monthly reports until the expiration of the transition period for the APS balancing authority area. The timing of the monthly reports may vary according to availability of data and coordination with the EIM entity to whom the report pertains. Because the DMM must review the CAISO's report before completing its own independent assessment, the DMM will file its report approximately 15 business days after the CAISO files its report.

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

II. Highlights

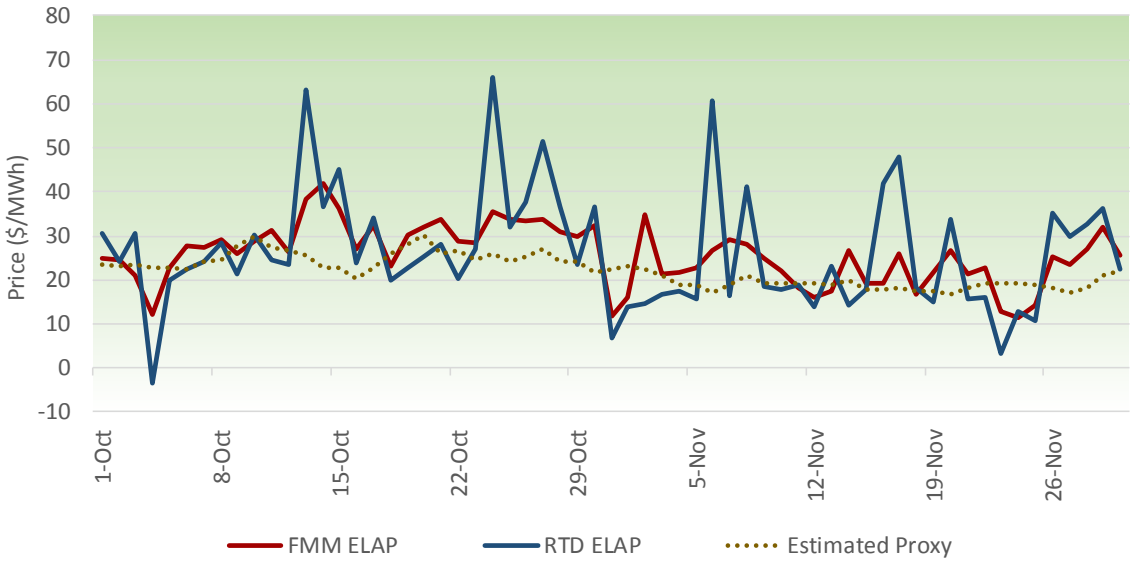
- In the month of November, APS observed average prices of $22.34/MWh and $23.07/MWh in the fifteen-minute market (FMM) and real-time dispatch market (RTD).
- APS passed over 92.6 percent of its balancing tests during the month of November.
- APS passed in 94.62 percent and 88.8 percent of its flexible ramping sufficiency tests for upward and downward capacity during the month of November.
- With the 5.38 percent failed upward flexible ramp sufficiency test, 2.9 percent of the FMM intervals observed flexible ramp up constraint infeasibilities, and with the 11.2 percent failed downward flexible ramp sufficiency test, 9.5 percent of the FMM intervals observed flexible ramp down constraint infeasibilities.
- APS observed power balance constraint infeasibilities in 1.39 percent of the intervals in the FMM and in 0.93 percent of the intervals in RTD.

III. Report

a. Prices

Figure 1 shows that average prices in the APS EIM Load Aggregation Point (APS ELAP)[2] were $22.34/MWh in the FMM and $23.07/MWh in the RTD in November. Lower than the respective prices of $28.85/MWh and $29.42/MWh in October[3]. Prices in the APS balancing authority area were stable during the first two months of operation and tracked closely between markets.

Figure 1: Daily average prices for the APS balancing authority area.



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.[4] 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 under the

[2] The ELAP provides aggregate prices that are representative of pricing in the overall APS balancing authority area.

[3] Downward flexible test failures in November 2016 limits the export or APS's out bound EIM transfer.

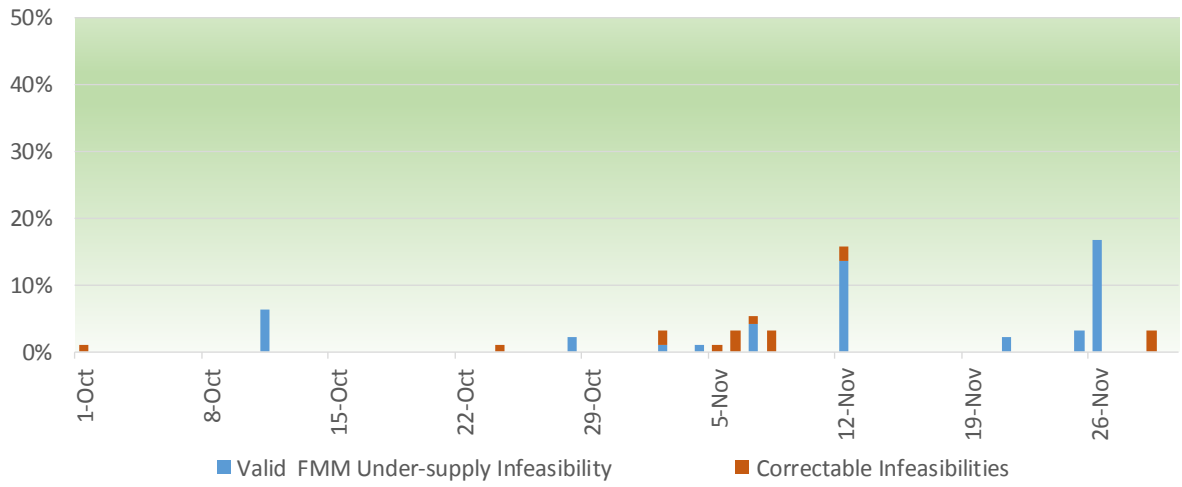
[4] Figure 1 also provides an estimated proxy price, which for APS is the weighted average the day-ahead price for Palo Verde, Four Corners, and Mead hubs from the Intercontinental Exchange (ICE).

CAISO's price correction provided in 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. For the month of November, there were 15 instances in the FMM and 14 instances in the RTD that required a price correction for the APS balancing authority area under the CAISO's price correction authority.

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 APS balancing authority area for the FMM and RTD, respectively. The under-supply infeasibilities are grouped into "valid" and "correctable" instances. Prices for the intervals that fell in the "valid" category are instances with under-supply infeasibilities that are not in error and are subject to the transitional period pricing, whereas the CAISO corrected the prices that fell in the "correctable" category based on the provisions of Section 35 of the CAISO tariff due to either a software or a data error.

Figure 2: Frequency of FMM under-supply power balance infeasibilities in the APS balancing authority area.



In the APS balancing authority area, there were 40 (1.39 percent of the time) valid under-supply infeasibility in the FMM and 80 (0.93 percent of the time) valid under-supply infeasibilities in the RTD. The majority of these infeasibilities accrued on three days in November.

i) November 12, FMM and RTD. The APS balancing authority area had significant exports and during the hours it failed the flexible ramping sufficiency test, which is consistent with the market rules

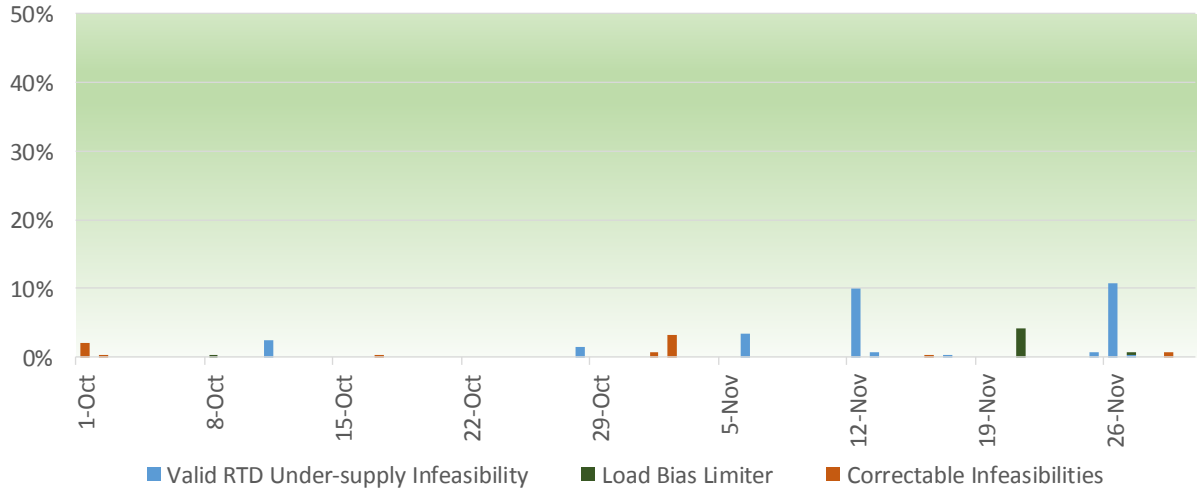
that limit the APS balancing authority area's ability to import capacity from other EIM balancing authority areas through the EIM.

ii) November 26, FMM and RTD. The APS balancing authority area EIM scheduling coordinator did not submit sufficient economic bids in to the EIM. This shortage was compounded by: (1) manual dispatches made by the APS balancing authority area EIM entity on four resources that reduced the capacity available to the EIM; and (2) high load forecast that were above their base schedules.

iii) November 25, FMM and RTD. Changes in the imports in the real-time market with respect to the base schedules that resulted in a reduction of supply capacity.

There were 17 valid RTD infeasibilities in the APS balancing authority area that coincided with the use of load conformance. The CAISO uses a load conformance limiter in the CAISO balancing authority area and in each of the EIM balancing authority areas to prevent over-adjustments using 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 level of 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 balancing authority area 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 avoided by the load conformance limiter were it in effect during the transition period in the APS balancing authority area.

Figure 3: Frequency of RTD under-supply power balance in feasibilities in the APS balancing authority area.



Tables 1 and 2 list the FMM and RTD intervals, respectively, with infeasibilities observed in November, including the amount of load conformance to reflect the instances that the load conformance limiter would have triggered and offset the infeasibility.

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

Trade Date	Trade Hour	Trade Interval	MW Under-supply	Load Conformance
2-Nov-16	6	2	0.3	0
4-Nov-16	8	2	74.0	90
7-Nov-16	7	2	129.4	500
7-Nov-16	7	3	84.6	500
7-Nov-16	1	2	206.6	0
7-Nov-16	1	3	16.9	0
12-Nov-16	9	1	59.2	0
12-Nov-16	9	2	208.6	0
12-Nov-16	9	3	166.0	0
12-Nov-16	9	4	110.4	0
12-Nov-16	10	1	128.7	0
12-Nov-16	10	2	84.6	0
12-Nov-16	10	3	68.1	0
12-Nov-16	10	4	54.1	0
12-Nov-16	11	1	34.8	0
12-Nov-16	11	2	44.7	0
12-Nov-16	11	3	5.7	0
12-Nov-16	11	4	36.5	0
12-Nov-16	12	4	88.6	0
21-Nov-16	6	3	51.0	550

Trade Date	Trade Hour	Trade Interval	MW Under-supply	Load Conformance
21-Nov-16	23	3	4.3	0
25-Nov-16	24	2	122.3	0
25-Nov-16	24	3	113.4	0
25-Nov-16	24	4	35.0	0
26-Nov-16	1	3	73.5	0
26-Nov-16	1	4	37.3	0
26-Nov-16	2	1	22.8	0
26-Nov-16	2	2	107.1	0
26-Nov-16	2	3	73.9	0
26-Nov-16	2	4	79.7	0
26-Nov-16	3	1	18.3	0
26-Nov-16	3	2	35.7	0
26-Nov-16	3	3	36.8	0
26-Nov-16	3	4	52.6	0
26-Nov-16	4	1	27.4	0
26-Nov-16	4	2	60.6	0
26-Nov-16	4	3	66.4	0
26-Nov-16	4	4	76.6	0
26-Nov-16	5	4	40.1	0
26-Nov-16	6	2	105.6	0

Table 2: List of valid RTD under-supply infeasibilities in the APS balancing authority area.

Trade Date	Trade Hour	Trade Interval	MW Under-supply	Load Conformance
6-Nov-16	10	12	194.5	0
6-Nov-16	18	6	46.3	125
6-Nov-16	18	7	19.1	125
6-Nov-16	10	7	30.2	-50
6-Nov-16	10	8	78.9	0
6-Nov-16	10	9	85.0	0
6-Nov-16	10	10	72.7	0
6-Nov-16	10	11	36.8	0
6-Nov-16	18	3	61.7	150
6-Nov-16	18	5	59.5	150
12-Nov-16	9	1	43.8	0
12-Nov-16	9	2	61.3	0
12-Nov-16	9	3	38.1	0
12-Nov-16	9	4	27.7	0
12-Nov-16	9	5	13.4	0

Trade Date	Trade Hour	Trade Interval	MW Under-supply	Load Conformance
12-Nov-16	10	2	3.5	0
12-Nov-16	10	4	7.0	0
12-Nov-16	10	5	21.1	0
12-Nov-16	10	11	3.3	0
12-Nov-16	10	12	3.7	0
12-Nov-16	11	2	0.5	0
12-Nov-16	11	3	5.8	0
12-Nov-16	11	4	18.5	0
12-Nov-16	11	5	35.4	0
12-Nov-16	11	6	32.7	0
12-Nov-16	11	7	27.6	0
12-Nov-16	11	8	32.6	0
12-Nov-16	11	9	43.8	0
12-Nov-16	11	10	40.6	0
12-Nov-16	11	11	53.1	0
12-Nov-16	11	12	50.2	0
12-Nov-16	12	1	57.8	0
12-Nov-16	12	2	49.9	0
12-Nov-16	12	3	78.9	0
12-Nov-16	12	4	46.0	0
12-Nov-16	12	5	36.2	0
12-Nov-16	12	6	25.5	0
12-Nov-16	12	7	26.0	0
12-Nov-16	12	9	47.8	0
13-Nov-16	24	1	16.0	0
13-Nov-16	24	2	38.1	0
17-Nov-16	19	3	57.3	0
21-Nov-16	6	1	17.9	550
21-Nov-16	6	2	14.8	550
21-Nov-16	6	3	194.2	550
21-Nov-16	6	4	223.6	550
21-Nov-16	6	5	240.4	550
21-Nov-16	6	6	258.2	550
21-Nov-16	6	7	215.4	550
21-Nov-16	6	8	325.7	550
21-Nov-16	6	9	348.5	550
21-Nov-16	6	10	371.7	550
21-Nov-16	6	11	263.4	550
21-Nov-16	6	12	104.3	550
25-Nov-16	24	1	84.5	0
25-Nov-16	24	2	40.5	0

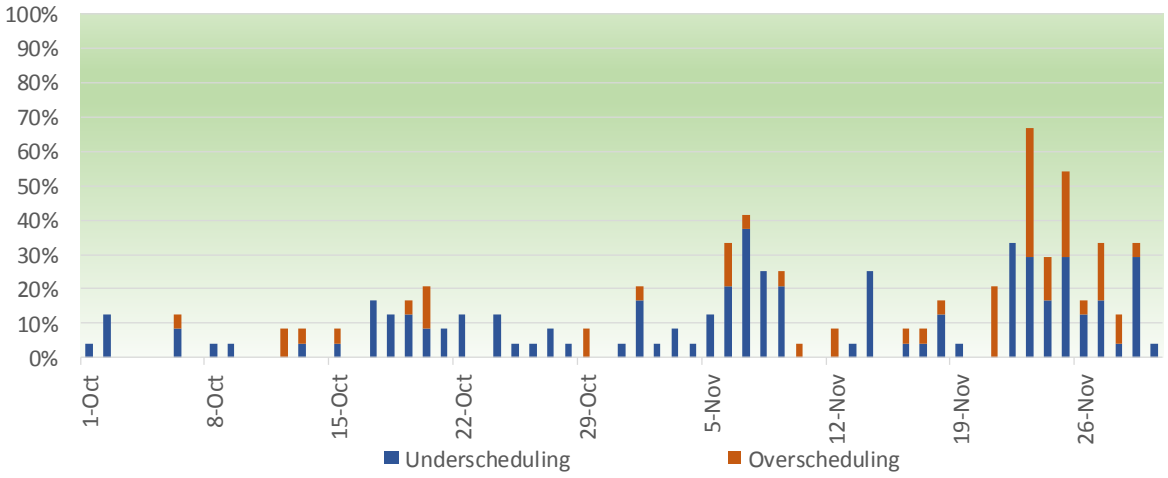
Trade Date	Trade Hour	Trade Interval	MW Under-supply	Load Conformance
26-Nov-16	1	9	18.1	0
26-Nov-16	1	10	10.7	0
26-Nov-16	1	11	9.0	0
26-Nov-16	2	2	36.8	0
26-Nov-16	2	3	9.2	0
26-Nov-16	2	4	19.0	0
26-Nov-16	2	5	31.0	0
26-Nov-16	2	6	15.0	0
26-Nov-16	2	7	6.0	0
26-Nov-16	2	8	23.6	0
26-Nov-16	2	9	23.0	0
26-Nov-16	2	10	9.7	0
26-Nov-16	2	11	8.0	0
26-Nov-16	2	12	12.7	0
26-Nov-16	3	1	25.6	0
26-Nov-16	3	2	29.3	0
26-Nov-16	3	3	10.2	0
26-Nov-16	3	4	0.2	0
26-Nov-16	4	2	7.4	0
26-Nov-16	4	6	8.9	0
26-Nov-16	4	7	11.2	0
26-Nov-16	4	8	17.1	0
26-Nov-16	4	9	24.3	0
26-Nov-16	4	10	15.6	0
26-Nov-16	4	11	9.6	0
26-Nov-16	5	8	22.9	0
26-Nov-16	5	9	30.5	0
26-Nov-16	5	10	40.1	0
26-Nov-16	5	11	45.8	0
26-Nov-16	23	3	85.8	0
26-Nov-16	23	4	36.6	0
27-Nov-16	15	4	20.2	80
27-Nov-16	15	5	80.3	80

c. Balancing and Sufficiency Test Failures

Figure 4 shows the trend of balancing test outcomes for November, which the CAISO performs pursuant to Section 29.34(k) of the CAISO tariff. The APS balancing authority area passed the balancing test in 92.64 percent of the

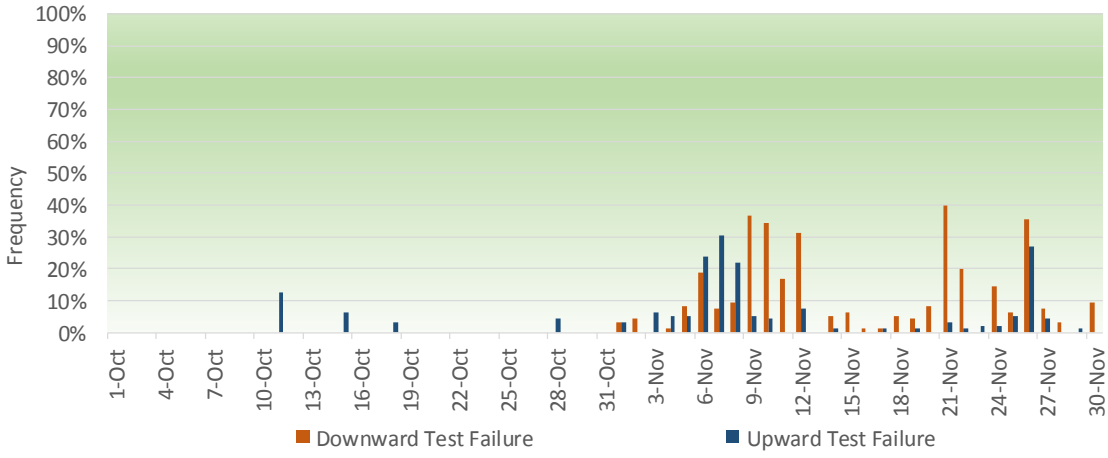
intervals. Failure of the balancing test was due to under-scheduling in 3.75 percent of the intervals and over-scheduling in 3.61 percent of the intervals.

Figure 4: Frequency of Balancing test failures in the APS balancing authority area.



The CAISO also performs the 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 November. The APS balancing authority area passed the test in 94.62 percent and 88.8 percent of the intervals for the upward and downward capacity, respectively. With the implementation of the flexible ramping product on November 1, 2016, the CAISO conducts the test separately for each direction.

Figure 5: Frequency of flexible ramp sufficiency test failures in the APS balancing authority area.



The APS balancing authority area experienced a high frequency of intervals and failed the flexible ramping test, predominantly in the downward direction. Several of these failures were driven by incomplete rules or incorrect accounting for the APS balancing authority area's resources flexible capability

within the flexible ramping sufficiency test calculations. The market software introduced several enhancements and fixes to calculate the flexible capability more accurately. These enhancements and fixes are summerized below:

1. Prior to December 21, 2016, the market software had limitated ability to consider commitment instructions (start-ups, shut-downs, MSG transitions) in the calculation of available capability used in the flexible ramping test. The calculation would account for ramping capacity based only on the resource status and configuration at 7.5 minutes before the trading interval and would disregard resource status or binding instructions after that time. After the enhancement, the logic would primarily use the resource status within the hour to calculate upward capacity.

2. Prior to November 23, 2016, the market software was not using the updated interchange transactions schedule information within the hour in the flexible ramping capacity calculation, instead, the market software was using the submitted static hourly base schedules. This issue was immediately corrected on November 23, 2016. After the issue was resolved, the software updated imports/exports schedules that may accur after the base schedule submission.

3. The flexible capability test calculation was not considering capabilities of pseudo-tie generators since they are seen as imports to the APS balancing authority area and since there is no interchange record for the psuedo-tie generators, the software was assuming zero flexible capability for these resources. The calculation in the market software was enhanced and corrected on November 23, 2016. After the software issue was remedied, the pseudo-tie generator capacity was captured in the test.

4. The flexible capability test calculation was performing incorrect accounting for resources carrying non-spinning reserves. The software issue was resolved on November 23, 2016. After the software issue was corrected the software is able to acount for such capacity in both up and down flexible capability test.

5. The market software was assuming that changes in hourly base schedules for non-partcipating resouces can be achieved within 20 minutes across hour ramping. Unfortunately, this assumption is not true for the APS balancing authority area's hourly base schedule

changes that cannot be achieved in 20 minutes. Therefore, the market software was enhanced on November 10, 2016, to use the resources' ramp rate information for ramping non-partcipating resources across hours. After the software issue was corrected the market software was able to acount for such capacity in calculating the test.

6. The market software has logic to consider the megawatts of the resource coming from offline to be at base schedule or at economic Pmin if a bid is submitted. For solar resources with zero forecasts, the market software was considering them at their incorrect base schedules, thus causing a large reduction in the flexible ramping up and down capability contributions of these resources towards meeting the APS balancing authority area's flexiblecapability requirement. The software issue was resolved on November 10, 2016. After the software issue was corrected the software was able to account accurately for such capacity in calculating the test.

7. When an EIM balancing authority area fails the capacity test, it also fails the flexible ramping test by default/design. Therefore, some of the flexible ramping test failures were actually due to failures in the capacity (range) test. The calculation of the capacity test requirement uses historical data. However, given that APS was a new EIM entity, the APS balancing authority area capacity requirement calculation is very sensitive to small changes in data due to a limited set of similar day-type data for a corresponding hour in available days. Practically, there was not sufficient historical data to calculate the requirements accurately and mitigate volatility of calculation.

8. The APS balancing authority area has many units, particularly multi-stage generators, with a large Pmin MW for the 1x1 configuration. When a large Pmin unit is starting up or coming online, the increase in generation leads to increases in the flexible ramp down requirement to levels where the APS balancing authority area would have otherwise failed the test. Enhancement of the flexible ramp test calculation to simulate startup profile is currently in progress and is expected to be deployed to production by end of the first quarter of 2017.

9. For jointly owned units with dynamic non-EIM export share, the test calculation was looking for export schedule based on the enhancement mentioned in item no. 2 above. However, these jointly owned units do not have an updated real-time interchange schedule within the hour that causes the flexible ramp sufficiency calculation to use zero megawatts instead of the base schedule values. The market optimization uses telemetry as an indication for updated information within the hour as it otherwise uses base schedule values. The test calculation enhancement is in progress and the CAISO expects to deploy it into production by end of the first quarter of 2017.

10. The current flexible ramp uncertainty requirements calculations are based on separate historical data histograms for imports and exports. Requirements increase whenever imports and exports within the hour vary from base schedules. This separation of import and export histograms is not practical and unnecessarily increases the balancing authority area uncertainty requirements. The CAISO will correct this practice by netting imports and exports into one histogram for purposes of calculating the uncertainty and reflecting the changes in its business practice manual (BPM). The BPM change will be communicated to stakeholders and implemented before end of the second quarter of 2017.

The above enhancement and remedies will help the APS balancing authority area, and other EIM entities, enhance the pass rate for the sufficiency capacity tests, and in turn pass the flexible ramping up and down tests.

There were also factors on the APS balancing authority area's side that contributed to some of the flexible ramping test failures, including:

1. The APS balancing authority area model includes a regulation down range for dispatchable areas. For purposes of passing the hourly tests, the APS balancing authority area includes regulation down and up capacity into its model as a dispatchable range. However, the tests do not consider these ranges as dispatchable. Therefore, when the system experiences large net tie schedule changes in between hours, the APS balancing authority area would rely on its regulation to offset the swings and thus cause the tests to fail. The APS balancing authority area resolved this in late November.

2. The initial forecast values for a specific resource provided by the APS balancing authority area were in some cases inaccurate. One of these instances was related to the data that was sent to the CAISO for the horizon past T-40. This forecast did not include changes from the current hour's schedule and led to inaccurate amounts of sufficiency capacity calculation for the shoulder hours of the renewable forecast. This was resolved on December 8, 2016.

3. The APS balancing authority area experienced some instances of a combination of software and training issues that led to APS not submitting bids in the market as well as submitting inaccurate base schedules. This occurred intermittently throughout November.

4. The APS balancing authority area controls multi-stage generating configurations through outage cards. Outage cards limit the range a unit is available to the market and, therefore, reduces flexible ramp capability.

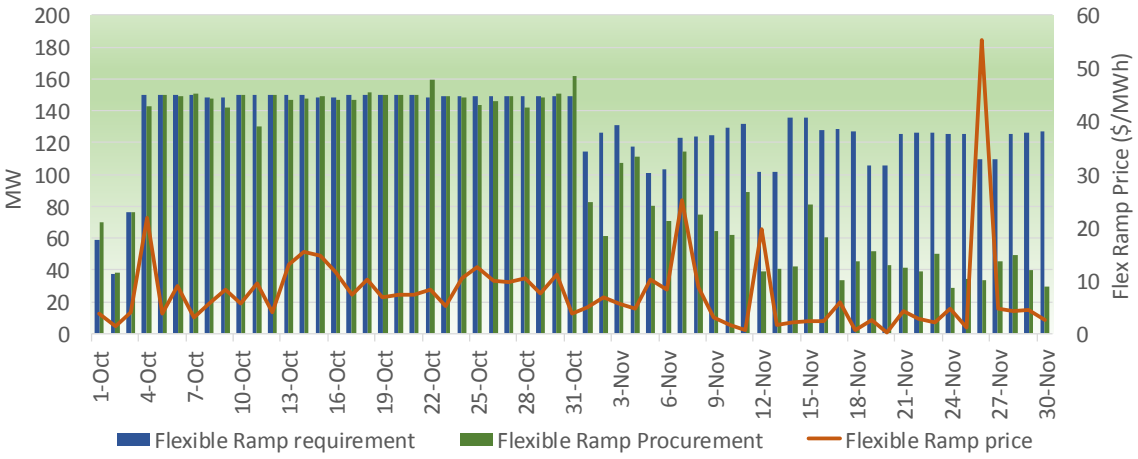
5. The generation that the APS balancing authority area has online affects flexible ramp capability. Having a couple larger units online instead of several smaller units limits the APS balancing authority area's flexible ramp down capability. The APS balancing authority area experienced flexible ramp down failures due to keeping units online that cannot support adequate downward movement.

6. Large load forecast changes have contributed to flexible ramp failures. The APS balancing authority area makes a generation plan to support a higher load forecast at T-55. When the load forecast drops at T-40, the plan does not adequately support room to move down.

d. Flexible Ramping Product

Figure 6 shows the daily average of the flexible ramp constraint requirement and procurement. In the vast majority of the hours, both the CAISO and the APS balancing authority areas were meeting their respective flexible ramping requirement. This plot also shows the daily average of the shadow price for the flexible ramp constraint in the APS balancing authority area.

Figure 6: Average requirement and procurement of flexible ramp in the FMM in the APS balancing authority area.



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 13th day of March 2017.

/s/ Grace Clark
Grace Clark