



August 26, 2016

The Honorable Kimberly D. Bose  
Secretary  
Federal Energy Regulatory Commission  
888 First Street, NE  
Washington, D.C. 20426

## **INFORMATIONAL FILING-NO NOTICE REQUIRED**

**Re: California Independent System Operator Corporation Informational Readiness Certification for Arizona Public Service Company's Participation in the Energy Imbalance Market  
Docket No. ER15-861-000**

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) submits this informational filing in compliance with section 29.2(b)(6) of the CAISO tariff.<sup>1</sup> The CAISO, in consultation with Arizona Public Service Company (APS), has determined that, following market simulation and an adequate period of parallel operations, the CAISO and APS have met all readiness criteria specified in section 29.2(b)(7). In support of this determination the CAISO hereby submits the sworn CAISO affidavit of Petar Ristanovic, Vice-President, Technology, and the sworn APS affidavit of Tammy McLeod, Vice President, Energy Resource Management. This filing certifies the readiness of the CAISO's and APS's processes and systems to proceed with APS's participation in the CAISO's Energy Imbalance Market (EIM) on October 1, 2016, without exception, consistent with the requirement to do so at least 30 days prior.

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<sup>1</sup> The Commission has determined that readiness certifications are considered informational filings and will not be noticed for comment. See *Cal. Indep. Sys. Operator Corp.*, 153 FERC ¶ 61,205 at P 86 and n.173; see also *Cal. Indep. Sys. Operator Corp.*, 155 FERC ¶ 61,283 at P 8.

## I. Background

The EIM provides other balancing authority areas the opportunity to participate in the real-time market for imbalance energy that the CAISO operates in its own balancing authority area. PacifiCorp's balancing authorities were the first two balancing authorities to join the EIM beyond the CAISO balancing authority area. The CAISO's EIM tariff provisions went into effect on October 24, 2014, in time for the first trading day of November 1, 2014.<sup>2</sup> The second EIM entity, NV Energy, began participation in the EIM on December 1, 2015, and Puget Sound Energy (PSE) balancing authority area will commence its participation on October 1, 2016, concurrently with the APS balancing authority area.<sup>3</sup>

In a March 16, 2015 order,<sup>4</sup> the Commission concluded that certain readiness safeguards are necessary prior to activating a prospective EIM entity in the EIM.<sup>5</sup> Accordingly, the Commission directed the CAISO to include in its tariff requirements to ensure the readiness of any new EIM entity. The Commission further required that the certification of market readiness include a sworn affidavit from an officer of the CAISO and an officer of the prospective EIM entity attesting that both have prepared and made ready the systems and processes for the new EIM entity to commence participation in the EIM.<sup>6</sup> Following two compliance filings, the Commission accepted the CAISO's proposed readiness criteria.<sup>7</sup> These criteria appear in section 29.2(b)(7) of the CAISO Tariff.

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<sup>2</sup> See *Cal. Indep. Sys. Operator Corp.*, 147 FERC ¶ 61,231 (2014) (June 19 Order) (conditionally accepting tariff revisions to implement Energy Imbalance Market); *Cal. Indep. Sys. Operator Corp.*, 149 FERC ¶ 61,058 (2014) (order denying requests for rehearing, granting in part and denying in part requests for clarification, and conditionally accepting tariff revisions on compliance with regard to order listed above); Commission Letter Order, 149 FERC ¶ 61,005 (Oct. 2, 2014) (order granting CAISO request to extend effective date of Energy Imbalance Market tariff revisions from September 23, 2014, to October 24, 2014, for trading day November 1, 2014).

<sup>3</sup> A separate filing that addresses the readiness of PSE was submitted on August 24, 2016 in FERC Docket No. ER15-861-000.

<sup>4</sup> *Cal. Indep. Sys. Operator Corp.*, 150 FERC ¶ 61,191 (2015) ("March 16 Order").

<sup>5</sup> March 16 Order at P 30.

<sup>6</sup> *Id.* n.85.

<sup>7</sup> *Cal. Indep. Sys. Operator Corp.*, 153 FERC ¶ 61,205 (2015).

## II. Readiness Reporting, Determination, and Attestations

The CAISO and APS ran market simulation from July 6, 2016 to July 29, 2016. Parallel (*i.e.*, financially nonbinding) operations, which began on August 1, 2016, will formally run through at least August 30, 2016 and, in any event, will continue to be supported and available to APS until October 1, 2016. During market simulation and parallel operations the CAISO and APS have engaged in daily discussions to track progress and confirm the status of each readiness criterion, and the CAISO has regularly reported on readiness status in market forum discussions and publicly posted a table or “dashboard,” showing progress towards meeting the readiness criteria.<sup>8</sup> The process of updating the readiness dashboard through this joint effort involved representatives from both organizations, including the senior officers who have attested that the parties’ processes and systems are ready for APS’s participation in the EIM.

The market simulation confirmed system functionality and connectivity by identifying issues and software variances in advance of implementation that have since been resolved. In addition, market simulation permitted the CAISO and APS to validate performance of the systems and processes under a variety of structured scenarios. Having achieved the benefits from market simulation, the CAISO and APS transitioned to parallel operations testing on August 1, 2016.

The parallel operations phase is designed to test performance of the systems and processes in a non-binding environment using historical data and information from production systems to the maximum extent possible. The CAISO and APS have engaged in parallel operations twenty-four hours a day in order to examine capabilities at different times and conditions (morning ramp, evening ramp, low load and peak load). Doing so has permitted APS to understand the interaction between resource plans, base schedules, outage management, manual dispatch, and the CAISO full network model. This period has also allowed the CAISO to identify and resolve software issues. The dashboard dated August 9, 2016 demonstrated that the CAISO and APS were ready to enter parallel operations. The updated dashboard dated August 16, 2016 showed the progress during parallel operations as additional readiness criteria were met.

The final updated dashboard, dated August 25, 2016, is included as Attachment A. The dashboard sets forth each of the readiness criteria in the tariff, the metrics by which the CAISO measures satisfaction of the criteria, and the actions or status that demonstrate APS’s compliance with criteria. The dashboard shows satisfaction of all readiness criteria.

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<sup>8</sup> More information on the status of these other reports consistent with CAISO tariff section 29.2(b)(8) is available on the CAISO website under the EIM Entities APS and PSE entry at: <http://www.caiso.com/informed/Pages/ReleasePlanning/Default.aspx>.

Section 29(b)(6) requires that a senior officer of the CAISO and a prospective EIM entity attest (1) that the processes and systems of the prospective EIM entity have satisfied or will have satisfied the readiness criteria set forth in section 29.2(b)(7) as of the Implementation Date; (2) to any known issues requiring resolution prior to the Implementation Date in accordance with section 29.2(b)(8); (3) to any exceptions from the established thresholds specified in the Business Practice Manuals, and that despite such exceptions the criteria were met or will be met as specified in 29.2(b)(7); and (4) that the Implementation Date is conditional on the resolution of the known issues identified in the certificates and any unforeseen issues that undermine the satisfaction of the readiness criteria. Attachments B and C, respectively, contain the sworn CAISO affidavit of Petar Ristanovic, Vice-President, Technology, and the sworn APS affidavit of Tammy McLeod, Vice President, Energy Resource Management, in satisfaction of this requirement.

The affidavits are based upon the engagement by these senior officers in assessing the readiness criteria as reported in the dashboard, including supporting documentation. The CAISO believes that the market simulation and parallel operations to date demonstrate that APS is prepared to enter financially binding production EIM operations on October 1, 2016.<sup>9</sup> As discussed the attached Market Quality Report, any issues identified in the parallel operations have been resolved or will be resolved. Neither the CAISO nor APS has identified any exception to any of the readiness criteria.

#### **IV. Market Quality Report on Parallel Operations**

Parallel operations allowed the CAISO and APS to identify and resolve numerous input, process, and software issues prior to the commencement of financially binding operations.<sup>10</sup> The CAISO and APS worked diligently during parallel operations to identify the cause of the infeasibilities that arose during parallel operations. The attached Market Quality Report demonstrates that the majority of the power balance infeasibilities identified during parallel operations were caused by input data issues, some of which are unique to parallel operations and software issues, all of which have been resolved or have a solution in place by the date of the report.

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<sup>9</sup> Changes to APS's market based tariff that will provide for APS's participation in the EIM on October 1, 2016 are currently pending with FERC in Docket No. ER16-1363. APS has requested that FERC issue an order on APS's proposed request for market-based rate authorization in the EIM no later than September 1, 2016, with a tariff effective date of September 30, 2016, in order to limit the potential for delays in APS beginning EIM operations on October 1, 2016.

<sup>10</sup> The market quality report on parallel operations explains how each of these issues impacted the market results and how they were resolved by the CAISO and APS.

Notwithstanding these differences and challenges, the CAISO validated both prices and schedules based on the data input to the market systems throughout parallel operations. This validation demonstrates that the market solution produced is as expected and consistent with the market rules as designed based on the input data. The analysis conducted for the report accounts for the fact that input data may be influenced by limitations inherent in the parallel operations environment and these limitations may affect the quality of the solution. When factors affecting the input data are controlled for, the numerical quality of the market solution is good and indicates that the systems and processes of APS are ready to operate in production.

## **V. Attachments**

- Attachment A: Readiness Dashboard Report
- Attachment B: Affidavit of Petar Ristanovic
- Attachment C: Affidavit of Tammy McLeod
- Attachment D: Parallel Operations Market Quality Review

## **VI. Conclusion**

The CAISO respectfully requests that the Commission accept this certification as consistent with section 29.2(b)(6) of the CAISO tariff. The CAISO or APS will notify the Commission in the event of any subsequent determination that the implementation of APS into the EIM on October 1, 2016 should be delayed, the reason for the delay, the new implementation date if it can be determined, and whether a portion or all of this certification needs to be reissued.

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Respectfully submitted,

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Counsel for the California Independent System Operator Corporation

**Attachment A – Readiness Dashboard Report**  
**Arizona Public Service Company EIM Readiness Certification**  
**California Independent System Operator Corporation**

Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
1	Prospective EIM Entity Full Network Model Integration	Generation, Interchange and Load comparison	Load, EIM Internal Intertie and EIM External Interties, and Generating Unit definition in the Full Network Model is consistent with the Load, EIM Internal Intertie and EIM External Interties, and Generating Unit definition in the exported prospective EIM Entity network model file that it delivered to the CAISO.	Data matches within 10%, measured in MW capacity to start parallel operation, and within 5% before full activation. Discrepancies, if any, are accounted for in terms of imbalance adjustment	CAISO	Complete	<p>Email evidence provided by ISO Project Sponsor. Data for August 2, 2016 indicates Load, EIM Internal Intertie and EIM External Interties, and Generating Unit definition in the Full Network Model is consistent with the Load, EIM Internal Intertie and EIM External Interties, and Generating Unit definition in the exported prospective EIM Entity network model file that it delivered to the CAISO.</p> <p>Data matches within 10%, measured in MW capacity to start parallel operation, and within 5% before full activation. Discrepancies, if any, are accounted for in terms of imbalance adjustment.</p>	Tariff section 29.2(b)(7)(A)(i)
2	Prospective EIM Entity Full Network Model Integration	Comparison of SCADA measurement	SCADA measurements used in prospective EIM Entity EMS model match the measurements observed by the CAISO through the CAISO EMS model	Critical and used SCADA measurements match 90% to start parallel operation and 95% before full activation, measured in MW, outside of any exception in EMS model	CAISO	Complete	<p>Data reviewed from August 1 through August 9, 2016. Email evidence provided by ISO Project Sponsor. SCADA measurements used in APSI EMS model match the measurements observed by the CAISO through the CAISO EMS model and ICCP link between APSI and CAISO.</p> <p>Critical and used SCADA measurements match 90% to start parallel operation and 95% before full activation, measured in MW, outside of any exception in EMS model.</p>	Tariff section 29.2(b)(7)(A)(ii)
3	Prospective EIM Entity Full Network Model Integration	State Estimator solution	CAISO state estimator solution is equivalent or superior to the prospective EIM Entity state estimator solution for its Balancing Authority Area.	State Estimator solutions converge >90% of the time in two days before parallel operation and three days before full activation. Solution differences within 10% before parallel operation and 5% before full activation measured in MW or justified due to different external BAA modeling	CAISO	Complete	<p>Data reviewed from August 1 through August 9, 2016. Email evidence provided by ISO Project Sponsor. CAISO state estimator solution is equivalent or superior to the prospective EIM Entity state estimator solution for its Balancing Authority Area.</p> <p>State Estimator solutions converge &gt;99% of the time in two days before parallel operation and three days before full activation. Solution differences within 10% before parallel operation and 5% before full activation measured in MW or justified due to different external BAA modeling.</p>	Tariff section 29.2(b)(7)(A)(iii)



Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
4	Prospective EIM Entity Full Network Model Integration	Non-Conforming Load, Behind-the-Meter Generation, Pseudo Ties, and Dynamic Schedules	Physical representation of the prospective EIM Entity's network matches the Base Market Model that accounts for non-conforming load, behind-the-meter generation, pseudo-ties, and dynamic schedules, and third party transmission service provider and path operator information that supports EIM Transfers and Real-Time Dispatch in the Energy Imbalance Market, as applicable	Prospective EIM Entity major non-conforming loads > 5% of prospective EIM Entity total actual load in MW are modeled separately from conforming load in market model	CAISO	Complete	There are no non-conforming loads in Arizona Public Service BAA.	Tariff section 29.2(b)(7)(A)(iv)
5	Agreements	Execution of Necessary Agreements	The prospective EIM Entity has executed all necessary agreements.	The prospective EIM Entity will execute all agreements, as outlined in Section 5 of the EIM BPM within the required timelines outlined in Section 5.	CAISO	Complete	Arizona Public Service has executed all agreements, as outlined in Section 5 of the EIM BPM within the required timelines.	Tariff section 29.2(b)(7)(K)(i)
6	Operations Training	Completion of mandatory training courses	Prospective EIM Entity operators who will have responsibility for EIM operations, transactions and settlements, will complete CAISO training modules.	Prospective EIM Entity operators will complete training and close-of-training assessment in the appropriate timeframes as outlined in <ul style="list-style-type: none"> <li>· "100 series" – an introduction to Energy Imbalance Market training</li> <li>· "200 series" – the specific hourly and daily tasks and duties for normal operation training module; and</li> <li>· "300 series" – the assessment of market results and response to contingencies and abnormal situations training module.</li> </ul>	APS	Complete	Arizona Public Service confirms full completion of all training series and knowledge testing with minimum required score for all Arizona Public Service operators.	Tariff section 29.2(b)(7)(B)
7	Forecasting Capability	Load forecast capability	Definition of EIM demand forecast boundaries based on the conforming and non-conforming load characteristics, as applicable <ul style="list-style-type: none"> <li>· Accuracy of the CAISO forecast of EIM demand based on historical actual load data for the defined EIM demand forecast boundaries.</li> <li>· Identification of weather station(s) locations used in forecasting, if applicable,</li> </ul>	All Plant Information (PI) tags and historical data for defined load area(s), and non-conforming load, if applicable, compared with load forecasts provided from CAISO (if CAISO load forecast used).	CAISO	Complete	CAISO reviewed the Load forecasts accuracy for Arizona Public Service for the period July 14, 2016 through August 15, 2016.  All plant information and historical data for Arizona Public Service have been defined. Full compliance with threshold metric for all intervals during parallel operations: Average Load forecast error on August 17, 2016 for T-60 is 1.92%; Average Load forecast error for T-40 is 1.60%.	Tariff sections 29.2(b)(7)(C)(i)-(iii)
8	Forecasting Capability	Variable Energy Resource (VER) forecast capability	Identification of the source of VER forecasts. (If a participating wind or solar unit requires a CAISO forecast, then BPM and Tariff requirements apply.) <ul style="list-style-type: none"> <li>· Accuracy of the CAISO forecast of EIM demand based on historical actual load data for the defined EIM demand forecast boundaries.</li> </ul>	Forecasting entity must demonstrate delivery of Unit MW forecast at 5 min intervals for at least three hours ahead. Forecasting entity must also provide base schedule by T-75, T-55 and T-40. EIM Entity provides to CAISO real-time MW production PI tags.	CAISO	Complete	Full compliance with threshold metric. Arizona Public Service forecasting entity has demonstrated delivery of VER forecasts. VER forecasts are provided in parallel operations and ready to move to production. In addition, Arizona Public Service has also successfully submitted corresponding base schedules within appropriate timeframes.	Tariff section 29.2(b)(7)(C)(iv)

Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
9	Forecasting Capability	Flexible capacity requirements	CAISO has established flexible capacity requirements for the prospective EIM Entity Balancing Authority Area and the combined EIM Area including the prospective EIM Entity	The CAISO has received and stored all historical data from the prospective EIM Entity necessary and sufficient for the CAISO to perform the flexible ramp requirement.	CAISO	Complete	Full compliance with threshold metric. CAISO has established flexible capacity requirements based on received and stored data from Arizona Public Service. The data feeding into CAISO are of good quality and appropriate. Arizona Public Service is able to consistently pass the flex ramp sufficiency test.	Tariff section 29.2(b)(7)(K)(iv)
10	Balanced Schedules	Base schedule balancing capability	The prospective EIM Entity Scheduling Coordinator demonstrates its ability to balance EIM demand and EIM supply for the prospective EIM Entity's Balancing Authority Area	90% or greater of base schedules balance tests during monitored hours are within 10% average imbalance of load forecast over one day period before parallel operation, and 5% average over five full days before full activation. The CAISO will provide examples of MW thresholds for each prospective EIM Entity to indicate a reasonable threshold as it applies to a given EIM Entity and indicate the potential implications of a swing from 5% over to 5% under forecast in one hour to the next.	APS	Complete	Full compliance with threshold metric met prior to parallel operations. Full compliance with threshold metric during parallel operations on the following 5 days: 8/3, 8/6, 8/7, 8/8, 8/9.	Tariff section 29.2(b)(7)(D)(i)
11	Balanced Schedules	Flexible ramping sufficiency test capability	The prospective EIM Entity \ Scheduling Coordinator demonstrates its ability to pass the flexible ramping sufficiency test	Passes 90% of the time or greater over monitored hours of one day before parallel operation and five non-consecutive days before full activation	APS	Complete	Full compliance with threshold metric met prior to parallel operations. Full compliance with threshold metric. Arizona Public Service successfully met flexible capacity requirements on trade dates 7/13 before parallel operations. Arizona Public Service successfully met flexible capacity requirements on the following trade dates during parallel operations; 8/2 - 8/11.	Tariff section 29.2(b)(7)(D)(iii)
12	Balanced Schedules	Capacity test capability	The prospective EIM Entity Scheduling Coordinator demonstrates its ability to pass capacity test	Passes 90% of the time or greater over monitored hours of one day before parallel operation and five non-consecutive days before full activation. The CAISO will explain the implications of any potential issues with the reliability of an EIM Entity to meet its capacity requirements.  The prospective EIM Entity receives CAISO operating procedures four months prior to the parallel operations date	Joint	Complete	Full compliance with threshold metric met prior to parallel operations. Full compliance with threshold metric. Arizona Public Service successfully met capacity test capability of at least 90% over monitored hours.	Tariff section 29.2(b)(7)(D)(ii)
13	Operating Procedures	CAISO operating procedures (relevant to EIM operations)	The prospective EIM Entity signs CAISO non-disclosure agreement and receives appropriate CAISO "public" and "restricted" operating procedures	Operating procedures NDA signed by the prospective EIM Entity.	CAISO	Complete	NDA signed - October 30, 2015. Arizona Public Service received operating procedures four months prior to parallel operations.	Tariff section 29.2(b)(7)(K)(i)
14	Operating Procedures	Prospective EIM Entity operating procedures	The prospective EIM Entity operating procedures are defined, updated, and tested for the EIM Entity Scheduling Coordinator	The prospective EIM Entity operating procedures are updated tested and implemented prior to parallel operations date.	APS	Complete	Arizona Public Service confirms all required operating procedures are updated, tested and validated as of August 10, 2016.	Tariff section 29.2(b)(7)(K)(ii)

Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
15	System Readiness & Integration	Functional Testing	The prospective EIM Entity and the CAISO will test the functional and system elements in accordance with functional and system testing documentation posted on the CAISO website	All tasks identified in the functional and system testing documentation are completed and will not have any issues deemed significant.  Any exceptions will be explained or have an interim solution that is functionally equivalent.	APS	Complete	Confirmation of successful completion of all functional and system tests. Arizona Public Service provided a completed EIM Testing Timeline Summary noting all functionality was successfully tested.	Tariff section 29.2(b)(7)(E)(i)
16	System Readiness & Integration	System Integration	The prospective EIM Entity and CAISO will test system integration testing in accordance with the system integration testing documentation posted on the CAISO website	All tasks identified in the system integration testing documentation are completed and will not have any issues deemed significant.  Any exceptions will be explained or have an interim solution that is functionally equivalent.	APS	Complete	All system integration tests completed successfully in CAISO simulation environment. Arizona Public Service provided a completed EIM Testing Timeline Summary noting all interfaces were successfully tested.	Tariff section 29.2(b)(7)(E)(ii)
17	System Readiness & Integration	The prospective EIM Entity system access complete	All prospective EIM Entity employees who require system access to perform EIM-related job functions identified and have necessary certificates.	All prospective EIM Employees performing job functions for EIM market are identified.  All CASIO issued certificates are requested within the appropriate timeframes.  All identified employees provided the necessary EIM system access certificates.	APS	Complete	Complete access configuration in parallel operations environment by August 1, 2016 and a plan in place for completing all production access.	Tariff section 29.2(b)(7)(E)(iii)
18	System Readiness & Integration	ISO - prospective EIM Entity interfaces	Data interfaces between prospective EIM Entity's systems and CAISO systems are tested	ISO and prospective EIM Entity identify significant data interface issues. EIM Entity and CAISO executives to approve exceptions.	APS	Complete	Confirmation of successful completion of all data interfaces. Arizona Public Service provided a completed EIM Testing Timeline Summary noting all data interfaces were successfully tested.	Tariff section 29.2(b)(7)(E)(i)
19	Market Simulation	Day in the life simulation	The prospective EIM Entity operators are able to meet the market timelines	The prospective EIM Entity grid operations staff complete end-to-end daily market workflow with no critical defects.	APS	Complete	Confirmation of successful completion of end to end workflow. Arizona Public Service provided a completed EIM Day in the Life Readiness worksheet noting that all workflows and EIM functionality were successfully tested.	Tariff section 29.2(b)(7)(I)(ii)
20	Market Simulation	Structured scenarios simulation	The prospective EIM Entity operators execute and pass all structured scenarios provided by CAISO	All significant issues resolved or have an interim solution that is functionally equivalent.	CAISO	Complete	CAISO and Arizona Public Service confirms completion of all market simulation structured scenarios including Arizona Public Service validation of settlements statements.	Tariff section 29.2(b)(7)(I)(iii)
21	Market Simulation	Unstructured scenarios simulation	The prospective EIM Entity operators execute and pass all unstructured scenarios provided by prospective EIM Entity	All significant issues resolved or have an interim solution that is functionally equivalent.	APS	Complete	Arizona Public Service confirms completion of all related unstructured scenarios in simulation environment.	Tariff section 29.2(b)(7)(I)(iv)
22	Market Simulation	Market results reports	Market results are appropriate based on inputs	The prospective EIM Entity and CAISO executive project sponsors approve the market results reports during market simulation	CAISO	Complete	CAISO and Arizona Public Service executive project sponsors have approved the market results reports during market simulation.	Tariff section 29.2(b)(7)(I)(v)
23a	Market Simulation	Market quality review	Prices are validated based on input data	Market simulation prices and MWs schedules/dispatches are validated by CAISO market quality team for entry into parallel operation	CAISO	Complete	CAISO confirms validation of market prices and MWs schedules/dispatches observed during market simulation exercises.	Tariff section 29.2(b)(7)(I)(vi)

Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
23b	Parallel Operations	Market quality review	Prices are validated based on input data	Parallel operations prices and MWS schedules/dispatches are validated by the CAISO market quality team	CAISO	Complete	Market solution in general, including prices are being validated for parallel operations. All data quality, set-up and functionality issues identified have been and are being resolved.	Tariff section 29.2(b)(7)(I)(vi)
24	Market Simulation	The prospective EIM Entity Identification	Validation of SCID's and Resource ID's	The CAISO has established and the prospective EIM Entity has tested all necessary SCIDs and Resource IDs established for the prospective EIM Entity's Balancing Authority Area	CAISO	Complete	CAISO and Arizona Public Service confirms that all necessary SCIDs and Resource IDs have been established for the Arizona Public Service Balancing Authority Area. Arizona Public Service provided a final Schedule 1 with all production planned resources on July 14, 2016.	Tariff section 29.2(b)(7)(I)(i)
25	Settlements	ISO Settlement Statements and Invoices published to the prospective EIM Entity and EIM Participating Resources	The CAISO Settlement statements and invoices match the operational data published to stakeholders or fed into settlement system and the resulting calculations correspond to the formulas defined in ISO's tariff and BPMs	Monthly settlement statement and invoice with corresponding daily statements produced during market simulation and parallel operations are verifiably accurate against available data.	APS	Complete	Arizona Public Service verified settlement statements and invoices during market simulation and parallel operations. Successful verification of criteria during market simulation testing for trade dates July 14, 2016, and July 19 through 21, 2016. CAISO published initial statements for trade date August 1 through August 11, 2016 in parallel operations, monthly statements posted on August 5 through August 17, 2016.	Tariff section 29.2(b)(7)(F)(i)
26	Settlements	The prospective EIM Entity settlement statements and invoices reflect accurate allocations to the prospective EIM Entity customers prior to financially binding operations.	Verification that settlement statements and invoices accurately reflects system and market data	The prospective EIM Entity settlement statements and invoices that allocate charges and credits to its customers accurately reflect system and market data during parallel operations.	APS	Complete	Arizona Public Service prepared settlement statements and invoices that allocate the associated charges and credit to their customers and accurately reflects system and market data for trade date August 1 through August 11, 2016 in parallel operations.	Tariff section 29.2(b)(7)(F)(ii)
27	Monitoring	Data monitoring	Sufficient and adequate data is available to the CAISO and the Department of Market Monitoring	All required market monitoring data is available during testing and during post go-live for the key metrics (any exceptions will be addressed).  CAISO will provide a market report that will provide publicly available information to all market participants.	CAISO	Complete	CAISO provided daily market monitoring reports throughout Parallel Operations.	Tariff section 29.2(b)(7)(K)(v)



Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
28	Parallel Operations Plan	Deployment plan	Parallel operations run consistently and in accordance with the timeframe set forth in the prospective EIM Entity specific parallel operation plan	Parallel operations runs consistently within normal production CAISO Market disruption tolerances.	CAISO	Complete	Parallel operations plan posted on July 29, 2016. CAISO verified parallel operations ran consistently within normal CAISO disruption tolerances. During parallel operations the availability of RTD, RTPD, STUC are 99% and above for the whole day and 100% availability during the monitored hours of the day.	Tariff section 29.2(b)(7)(J)
29	Outage Management System	Transmission and generation outage submittal and retrieval	The prospective EIM Entity will verify its ability to submit and retrieve outage information with the CAISO	The prospective EIM Entity validate their ability to submit and retrieve transmission out-of-service outages, generation Pmax derates, generation Pmin rerates, and generation out-of-service outage tickets within the required timelines.	CAISO	Complete	Arizona Public Service verifies its ability to submit and retrieve outage information with CAISO.	Tariff section 29.2(b)(7)(G)
30	Communications between the CAISO and the prospective EIM Entity	Voice and/or electronic messaging	Implemented process and procedures used for voice and/or electronic messaging	The process and procedures are incorporated into the prospective EIM Entities business processes before the start of market simulation.	APS	Complete	Arizona Public Service confirms that voice and electronic messaging communication processes and procedures have been incorporated into the Arizona Public Service business processes.	Tariff section 29.2(b)(7)(H)(i)
31	Communications between the CAISO and the prospective EIM Entity	Communication tools	Staff are trained on communication procedures and tools	The prospective EIM Entity operations staff who will have responsibility for EIM operations, transactions and settlements are trained on the relevant operating procedures and tools used for EIM related communications before the start of parallel operations	APS	Complete	Arizona Public Service confirms completion of training on communication procedures and tools for staff who will have responsibility for EIM operations, transactions and settlements.	Tariff section 29.2(b)(7)(H)(ii)
32	Communications between the CAISO and the prospective EIM Entity	3 <sup>rd</sup> party transmission service provider	The third party transmission service provider information that supports EIM Transfers and Real-Time Dispatch included in the Full Network Model is available during parallel operations	The CAISO provides third party transmission service provider and path operator information to the prospective EIM Entity through parallel operations	APS (NA)	Complete	Not applicable for Arizona Public Service	Tariff section 29.2(b)(7)(H)(iii)
33	EIM Available Balancing Capacity	Identification of EIM Available Balancing Capacity	Participating resources and non-participating resources for EIM Available Balancing Capacity.	The prospective EIM Entity has identified EIM participating resources and non-participating resources that it intends to designate in the EIM Resource Plan as EIM Available Balancing Capacity	APS	Complete	Arizona Public Service designated EIM participating resources and/or non-participating resources in the EIM Resource Plan as EIM Available Balancing Capacity.	Tariff section 29.2(b)(7)(K)(iii)

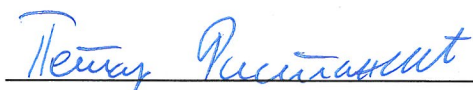
**Attachment B – Affidavit of Petar Ristanovic**  
**Arizona Public Service Company EIM Readiness Certification**  
**California Independent System Operator Corporation**

Affidavit of Petar Ristanovic Certifying Readiness of  
Arizona Public Service Company (APS) to Operate as an EIM Entity

I, Petar Ristanovic, Vice President of Technology for the California Independent System Operator Corporation (CAISO), hereby certify as follows:

1. As the Vice President of Technology, I am responsible for the systems and processes that support and enable the Energy Imbalance Market and, as such, I have overall responsibility for the implementation of APS into that market.
2. I have reviewed the readiness dashboard and find that it is accurate and complete. All readiness criteria set forth in the CAISO's tariff and business practice manual have been satisfied.
3. Based on the readiness dashboard and other materials prepared for me or for those that report directly to me and my own review of relevant information and direct involvement with readiness efforts, including testing, market simulation, training and parallel operations, and barring unforeseen developments, the systems and processes of the CAISO and APS will be ready to implement APS into the Energy Imbalance Market on October 1, 2016.
4. I will ensure that the CAISO maintains resource commitments necessary to sustain readiness through October 1, 2016 and address any unexpected conditions that may arise before October 1, 2016 that could undermine grid operation or market operation within the existing EIM Area. I will continue to monitor progress and resolve any unexpected conditions that may arise.
5. Actual implementation of APS on October 1, 2016 is conditioned upon the lack of any unexpected and unresolved issues that could undermine grid operation or market operation within the existing EIM Area. I will update this certification in the event any unexpected issues are not resolved as of October 1, 2016.

I hereby declare under penalty of perjury that the foregoing statements are true and correct to the best of my knowledge, information, and belief:

  
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Petar Ristanovic, Vice President of Technology

August 25, 2016

**Attachment C – Affidavit of Tammy McLeod**  
**Arizona Public Service Company EIM Readiness Certification**  
**California Independent System Operator Corporation**





**Affidavit of Tammy McLeod**  
**Certifying Readiness of Arizona Public Service Company to Operate as an EIM**  
**Entity**

I, Tammy McLeod, Vice President of Resource Management for Arizona Public Service Company ("APS"), hereby certify the following:

1. As the Vice President of Resource Management, I am responsible for the oversight of the implementation of the systems and processes that support and enable APS to operate in the Energy Imbalance Market ("EIM") and, as such, I have responsibility for the implementation of APS's entry into that market.
2. I have reviewed the readiness dashboard and find that it is accurate and complete. APS's processes and systems satisfy the readiness criteria set forth in Section 29.2(b)(7) of the CAISO tariff (the "Readiness Criteria"). Based on my knowledge and information provided to me or those that report directly to me regarding APS's EIM readiness efforts, including testing, market simulation, training and parallel operations, and barring unforeseen developments, APS will be ready to operate in the EIM on October 1, 2016.
3. At this time, I am not aware of any system issues requiring resolution prior to APS entering the EIM market on October 1, 2016. In addition, there are no known exceptions or deviations from the established thresholds identified in the CAISO Business Practice Manuals that would undermine the satisfaction of the Readiness Criteria. I will ensure that APS maintains resource commitments necessary to sustain readiness through October 1, 2016 and address any unexpected conditions should they arise.
4. APS's entry into the EIM on October 1, 2016 is conditioned upon completion of any known or unforeseen issues that could undermine the satisfaction of the Readiness Criteria. APS will update this certification in the event that any known or unforeseen issues are not resolved as of October 1, 2016.

I hereby declare under penalty of perjury that the foregoing statements are true and correct to the best of my knowledge, information, and belief.

A handwritten signature in blue ink that reads "Tammy McLeod". The signature is fluid and cursive, written in a professional style.

Tammy McLeod  
Vice President of Resource Management  
August 25, 2016

**Attachment D – Parallel Operations Market Quality Review**  
**Arizona Public Service Company EIM Readiness Certification**  
**California Independent System Operator Corporation**



California ISO

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# **Market Validation of Parallel Operations for APS EIM Entity**

**August 24, 2016**

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## Executive Summary

Parallel operations of the Energy Imbalance Market (EIM) started on August 1, 2016 for purposes of evaluating the readiness of Arizona Public Service (APS), the prospective EIM Entity. The readiness criteria requires the ISO to provide a market performance report for the period of parallel operations carried out for the integration of the APS balancing authority area (BAA) in the real-time energy imbalance market. This report fulfills that requirement and summarizes the main findings of market validation carried out by the ISO with an emphasis on the EIM results for the APS Balancing authority area (BAA). This report encompasses both the fifteen and five-minute real-time markets.

The ISO validated both prices and schedules based on input data that was fed through the market systems parallel operations from August 1 through August 11. This validation demonstrates that the market solution produced is as expected and consistent with the market rules as designed, recognizing that the input data may be influenced by limitations inherent in the parallel operating environment and these limitations may affect the quality of the solution. When factors affecting the input data are controlled for, the quality of the market solutions are good and indicate that the systems and processes of APS are capable of operating in production.

## Background and Scope

The intent of parallel operations is to run the market to simulate as close as possible to actual operating conditions of the system, and to provide APS with an opportunity to go over specific day-to-day processes and activities required for the operation of the EIM. This set-up provides APS and the ISO with an opportunity to test their systems and procedures in advance of financially binding market operations.

Although closely resembling actual operations, parallel operations has some limitations that need to be considered when evaluating market results, including the following:

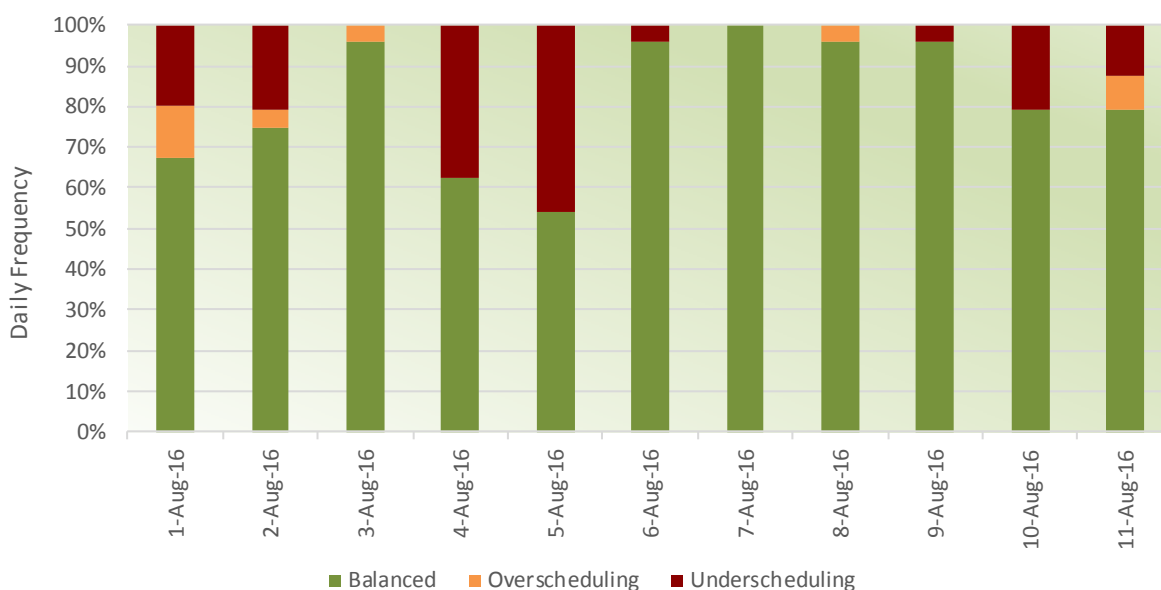
- i) The real time market requires a set of data inputs to run. In actual real-time market operations, many of these inputs are dynamic, dependent on the participants' resources actual performance, and following of instructions. For example, in an actual operating environment, telemetry received from resources gives the information to the ISO system of the operating status of the units, which are changing dynamically and interact with the market systems as the conditions change. During parallel operations this iterative and interactive data processes are limited because the resources of the prospective EIM entity are not yet required to follow their five-minute dispatch instruction. Similarly, if telemetry from actual production is used, there may be a potential for mismatches between what the actual system is running with versus what the market is projecting due to units potentially not following closely the market instructions. Therefore, the information regarding the resource's performance fed back to the market systems may or may not be related to the dispatch instruction issues through the parallel operations environment.
- ii) In actual operations, intertie resources require a closed loop for the market system to fully reflect the system and market conditions and intertie schedules eventually need to be tagged in order to reflect the system data flows. For parallel operations, it is not possible to replicate fully the actual tagging process, which may pose an additional challenge based on the data that is fed into the market system.
- iii) During parallel operations, the market participant is still defining its resources' data including characteristics and bids, which consist of three-part bids used for generation resources that require careful consideration of start-up, minimum load and energy bid costs. During this period, the participant is also learning the impacts of the resources constraints on the actual operations of the market.

These factors, among others, have an effect on the market results and the quality of the solution. Therefore, conclusions on the quality of the market results must consider the input data and the inherent set-up for parallel operations to avoid misleading conclusions about the actual functionality and robustness of the market.

## Market Trends

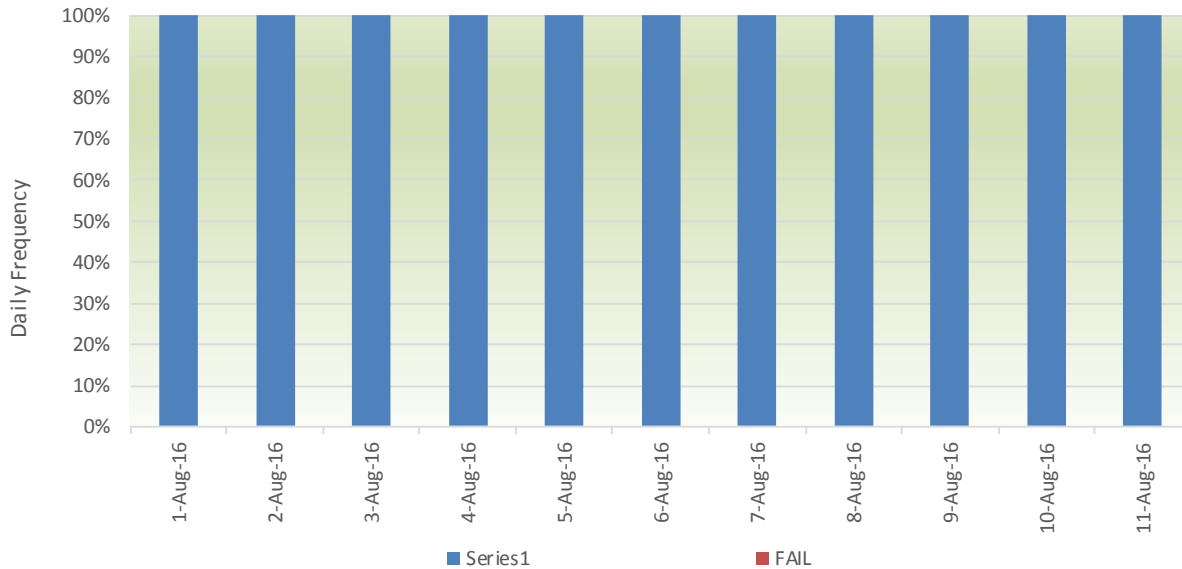
Figure 1 shows the percentage of hours failing the balancing test required under section 29.34(k) of the ISO tariff. The ISO calculated the frequency for each day, by dividing by 24 hours the number of hours where the prospective EIM entity failed the balancing test. The figures below present the results for both under-schedule and over-schedule cases. The balancing test provides a reference of how well balanced (energy supply and demand defined by the hourly base schedules and forecast respectively) the EIM entity BAA is going to come into the real-time energy imbalance market. Having a large percentage of positive imbalance means the real-time market will be the last resort to incrementally balance the area. The incremental balancing of supply will come from the bid-in capacity made available in the market in addition to the base schedule or EIM transfers between the participating EIM entities' BAAs. For the period of parallel operations, the APS area passed the balancing test in 82 percent of the hours in August 1 -11 period including all hours of the days even when system, data flow or interface issues were detected and impacted the capability of APZS to submit balanced schedules. APS area passed the balance test more than 90% of the hours on August 3,6,7,8, and 9, and was 100% pass on August 7.

**Figure 1: Daily frequency of power balancing test failures**



A second test carried out prior to running the real-time market is the capacity test. For this period, APS passed the capacity test for all 24 hours on each day from August 1-11, as shown in Figure 2.

**Figure 2: Daily frequency of capacity test failures**



A third test carried out prior to running the real-time market (which includes the EIM) is the flexible ramp sufficiency test as required by section 27.34 (m) of the ISO tariff. The flexibility test evaluates whether the EIM entity has sufficient flexible capacity based on submitted energy at the time. Figure 3 shows the daily frequency of test failures observed in the first 11 days of parallel operation for the APS BAA. For this period, the APS passed the flex ramp test in 94% of the time. The flex ramp sufficiency failures on August 2 were due to an issue on APS side with submission of participating bids. This is why the flex test failed for the first half of the day.



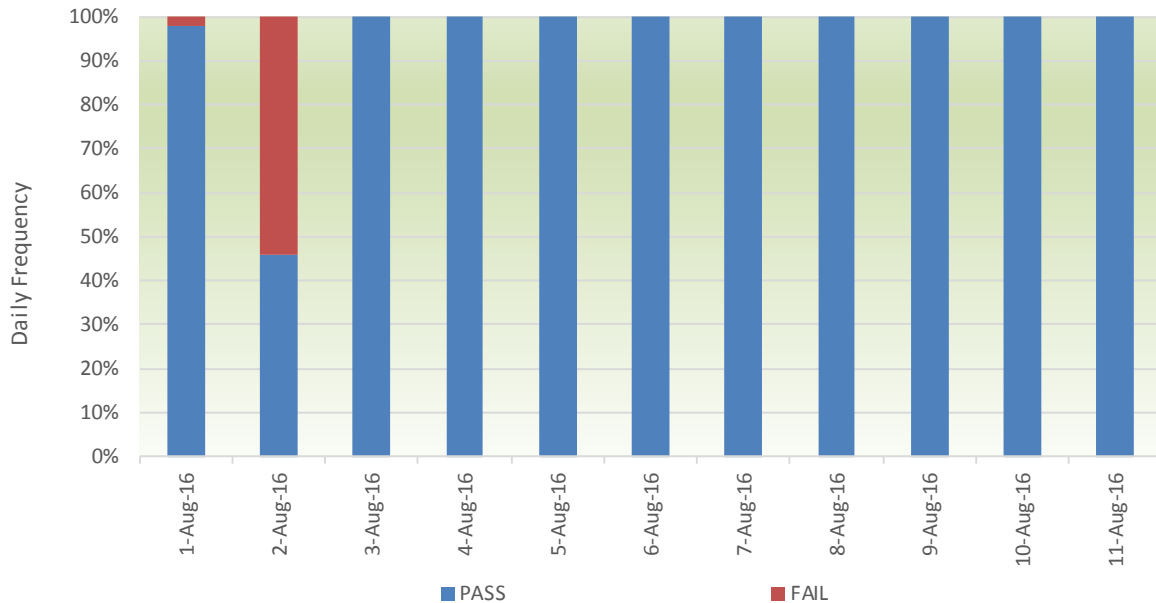
**Figure 3: Daily frequency of flexible ramp capacity test failures**


Figure 4 and 5 shows the frequency of power balance infeasibilities for under-generation conditions in both the FMM and RTD markets. The power balance constraint infeasibilities are pegged to the corresponding penalty prices, of \$1000/MWh for under-supply infeasibilities, and about -\$150/MWh for over-supply infeasibilities. However, during parallel operations, the EIM market for APS has been set-up to run under the conditions reflecting the price discovery mechanism that is in effect under the transitional measurement period (the first six months in actual production system); under this functionality, when a power balance constraint is infeasible, the market will reflect the last economical signal instead of the penalty prices. The first six months transitional (waiver) period pricing is based on the FERC Order<sup>1</sup> which grants the prospective EIM entity the time to re-adjust and fine tune its systems, processes, and procedures to avoid conditions that leads to trigger administrative penalty prices due to false under-supply or over-supply conditions. The transition period pricing also shields the prospective EIM entity from getting administrative penalty prices during the first six month of gaining production experience for the timely response to inform the market about operators’ manual actions that are taken or decided outside the market to maintain the EIM entity BAA reliability or balancing needs such as deployment of operating reserve in response to forced outages. For the first 11 days of parallel operations, the majority of infeasibilities occurred on the over-supply condition. These infeasibilities were driven by the EMS issues described in the following sections and the infeasibilities stopped once these EMS issues were workaround.

<sup>1</sup> *Calif. Ind. System Op.*, 153 FERC ¶ 61,104 (2015).

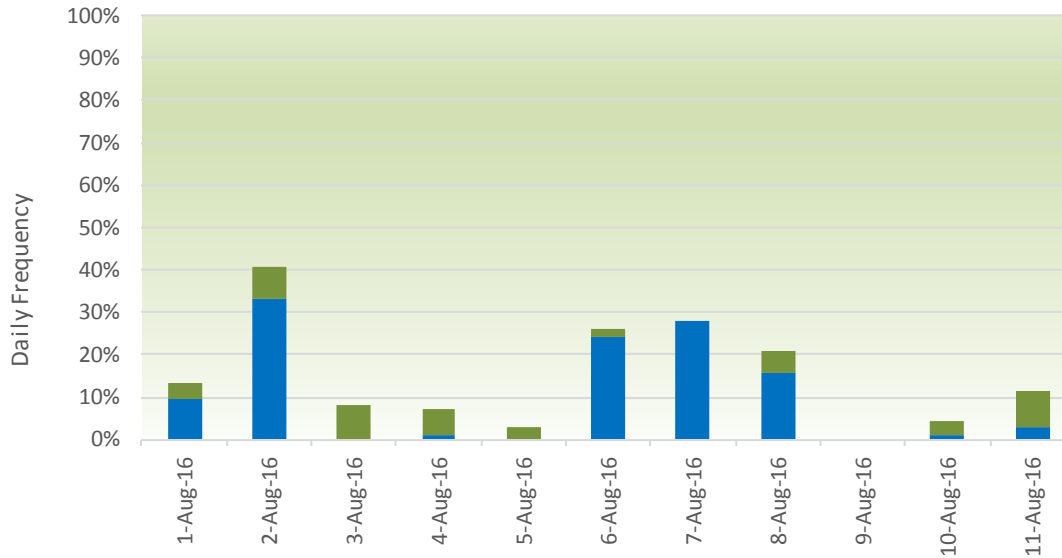
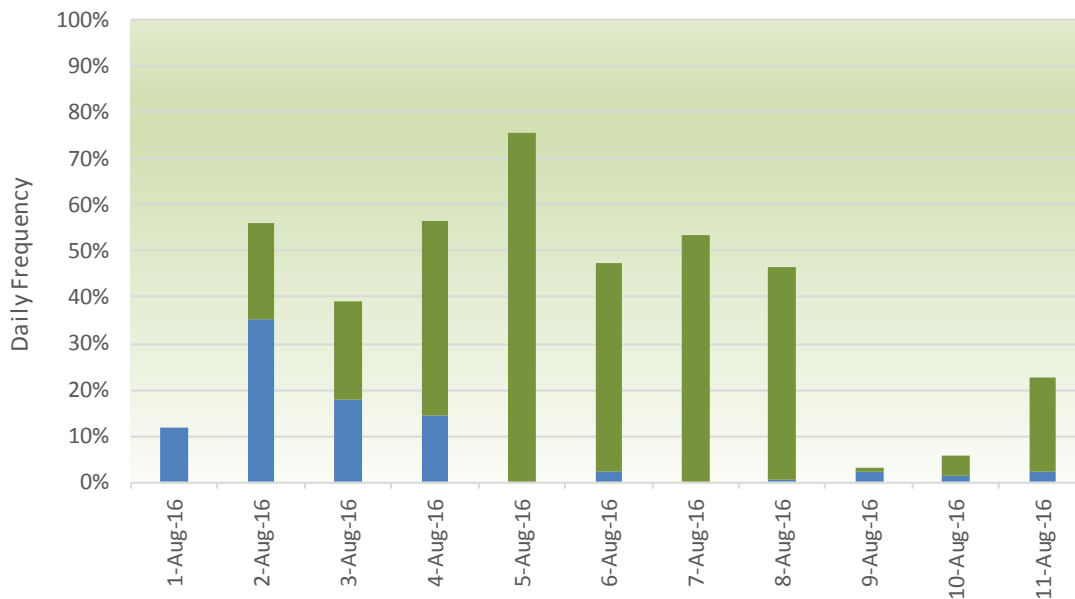
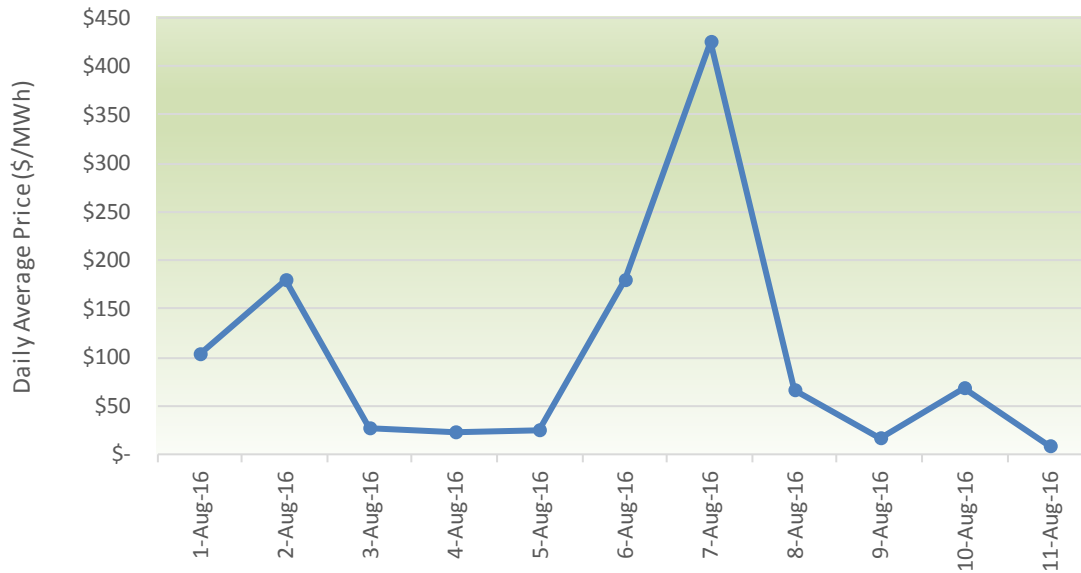
**Figure 4: Daily frequency of supply infeasibilities in the fifteen-minute market**

**Figure 5: Daily frequency of supply infeasibilities in the five-minute market**


Figure 6 and 7 show the daily average ELAP LMPs for the fifteen-minute market and the five-minute markets. In average daily prices from August 1 through August 11 in the fifteen market were between \$20 and \$425 with the highest average price on August 7. The average five minute price was between -\$110 and \$190. Prices on August 5 were reasonable. One issue contributed to the prices staying lower. During this day the RTM was not receiving requirements for the flexible ramp capacity. The other aspect that

contributed to the lower prices was the imbalance in between the FMM and RTD markets due to telemetry issues on the export resource share for Paloverde. Due to this issue the RTD market had 1000 MW less export ties. Because FMM had this export resource the system was in balance in the FMM. High prices that occurred on August 7 were driven by congestion on internal flowgate constraints to APS. This congestion was causing tie schedules to be cut which led to shortages along with higher prices on the ELAP.

**Figure 6: Daily average of fifteen-minute prices**



**Figure 7: Daily average of five-minute prices**

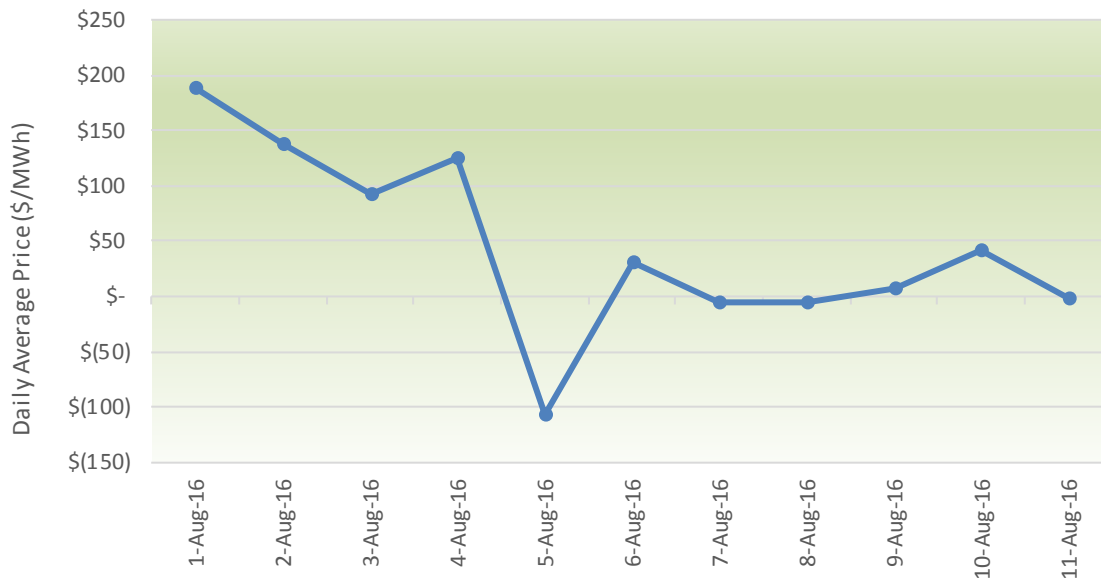
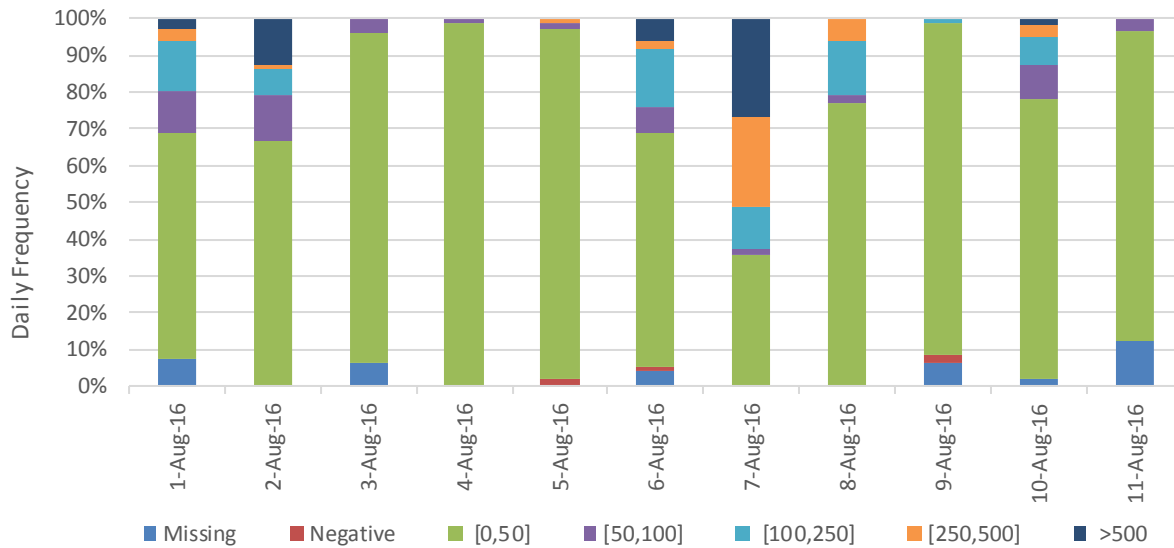
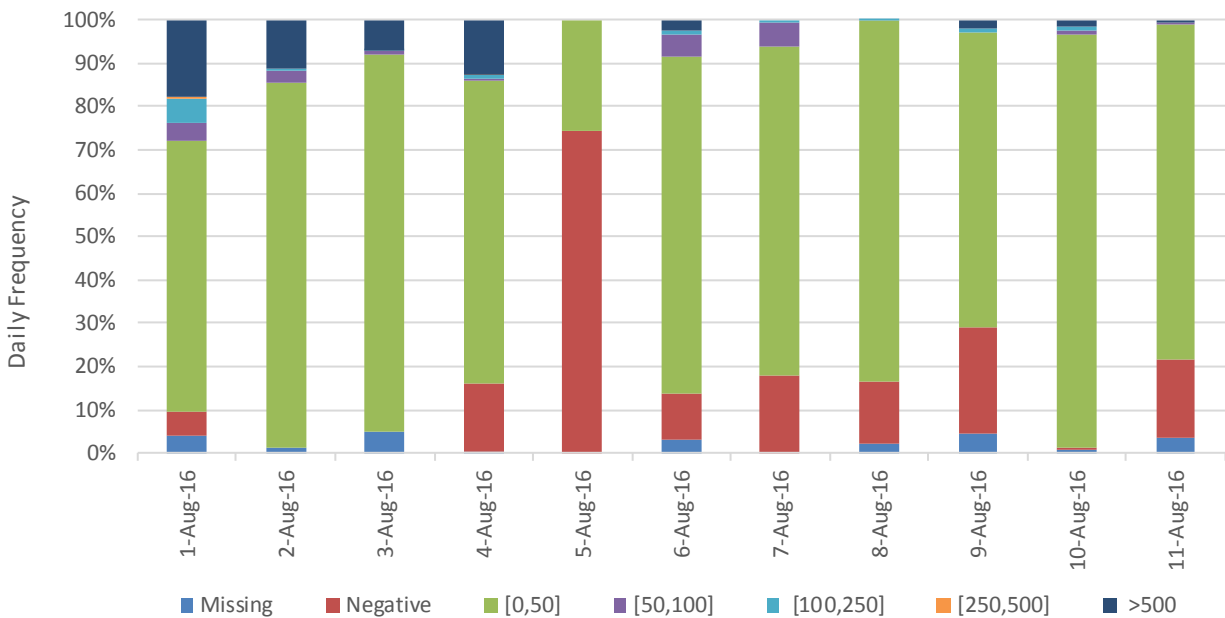


Figure 8 shows the five minute ELAP prices classified by price bins and figure 9 shows the five minute ELAP prices classified by the same price bins.

**Figure 8: Daily frequency of fifteen-minute prices organized by price ranges**



**Figure 9: Daily frequency of five-minute prices organized by price ranges**



The price bin in green shows the frequency of prices in the range of \$0/MWh to \$50/MWh and the price bin in purple shows prices in the range of \$50 and \$100. In the fifteen-minute market 81 percent of prices fall between \$0 and \$100/MWh, while 75 percent of prices do so in the five-minute market.

## Market Validation Items

### 1. Forecasting issues.

Type of issue: Syncing of correct data elements

Status: Resolved on 8/7.

During the first days of operations, there was a large amount of infeasibilities due to load forecast error. Infeasibilities in HE 18 through 20 on August 2 were related to the accuracy of the load and VER forecasting due to a monsoon storm that blew into the APS balancing area during this time. The load levels were significantly below balancing and FMM levels which led to the over generation amounts during this time. APS was working with ISO forecast team to get correct actual numbers because the actuals were including external loads not being included. Improving load forecast accuracy is an ongoing activity.

### 2. Balancing with AS

Type of issue: Wrong Input Data

Status: Resolved on August 2

On the APS side there were instances where the amount of ancillary services that were being submitted for balancing was five times larger than the actual amount due to a process issue that was fixed on August 2. This suppressed the amount of bidding capacity that APS had that day, and resulted in increased transfers and more price volatility due to a decreased bid stack. APS identified the software issue and fixed it on August 2.

### 3. Jointly-owned-unit (JOU) EMS data in the market

Type of issue: Missing telemetry data input.

Status: Partial resolution on August 2. Temporary solution put in place on August 8 till next EMS network model update.

On August 2, there were instances with large amounts of under generation. This was due to an increase in the JOU resource for the Paloverde share. In some cases the resource was scheduled at around 1000 MW level and increased to 2700 MW. This behavior was driven by missing EMS telemetry/SE values.

After August 2, the limits were frozen to the base schedules along with this an EMS update was made when this was done. Before this occurrence the Paloverde share JOU resource was not receiving EMS data. With the rebuilt, the resource started receiving data but the values were 0 MW. This caused the aggregate Paloverde export share to be 0 MW. This was the main cause for over-generation conditions.

#### 4. 500 KV constraints heavily overloaded

Type of issue: Simulation-related Data input inconsistency

Status: Root cause identified to be simulation issue.

APS observed high prices in the FMM market. With the transfer levels still frozen to the base transfer schedules, there was no transfers greater than base schedules. The investigation found that on August 9 there were several 500 KV constraints binding within the markets that were overloaded. These constraints had high effectiveness on APS ties schedules. As a result several interties schedules were cut due to high shadow price on one internal APS 500KV constraint. This decrease in imports led to increased need for generation levels thus increasing the price within the APS BAA. It was found that the root cause was input data inconsistency in the simulation environment that resulted in erroneous calculation of aggregate generation for a neighboring area.

#### 5. APS network communication error

Type of issue: Network communication related

Status: IT issue was resolved on the same day.

On August 10, APS had connectivity issues to the ISO systems due to a firewall set-up. This led to failing three hours of the balancing test, which contributed to market imbalances. In addition, large changes in the net schedule interchange were contributing to power balance constraint infeasibilities.

#### 6. High prices in FMM market

Type of issue: Data input configuration issue

Status: Root cause identified and permanent fix is in progress.

Mitigation: Temporary solution is in place.

It was observed that congestion on the EIM transfer constraints occurred during the cross hour ramping time, which resulted in high LMP values. The root-cause analysis identified an issue related to how the MW ramp profile is submitted for the cross-hour ramp period. APS acknowledged the issue and a permanent fix is in progress. A mitigation plan is also in place to shift the submitted data 5 min backward during the cross hour period till the permanent fix is delivered.

## CERTIFICATE OF SERVICE

I certify that I have served the foregoing document upon the parties listed on the official service list in the captioned proceedings, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Folsom, California this 26<sup>th</sup> day of August, 2016.

*Grace Clark*  
Grace Clark