

February 28, 2019

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

**INFORMATIONAL FILING – NO NOTICE REQUIRED**

**Re: California Independent System Operator Corporation  
Informational Readiness Certification for Balancing Authority  
of Northern California’s Participation in the Energy Imbalance  
Market  
Docket No. ER15-861-004**

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 the Balancing Authority of Northern California (BANC), has determined that, following market simulation and an adequate period of parallel operations, the CAISO and BANC have met all readiness criteria specified in section 29.2(b)(7) of the CAISO tariff. In support of this determination the CAISO hereby submits the sworn CAISO affidavit of Petar Ristanovic, Vice President of Technology, and the sworn BANC affidavit of James R. Shetler. This filing certifies the readiness of the CAISO and BANC to proceed with BANC’s participation in the CAISO’s Energy Imbalance Market (EIM) on April 3, 2019, without exception, consistent with the requirement to do so at least 30 days prior.

**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<sup>2</sup> 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,

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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 (2015); *see also Cal. Indep. Sys. Operator Corp.*, 155 FERC ¶ 61,283 at P 8 (2016).

<sup>2</sup> PacifiCorp’s two balancing authorities are PacifiCorp West and PacifiCorp East.

2014, in time for the first trading day of November 1, 2014.<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 production.<sup>5</sup> Accordingly, the Commission directed the CAISO to include provisions in its tariff 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 financially binding 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.

## II. Readiness Reporting, Determination, and Attestations

The CAISO and BANC ran market simulation scenarios from December 1, 2018 to January 31, 2019. Parallel (*i.e.*, financially nonbinding) operations, which began on February 1, 2019, will run through at least February 28, 2019 and, in any event, will continue to be supported and available to BANC until April 3, 2019. During market simulation and parallel operations the CAISO and BANC 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 BANC's participation in the EIM.

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<sup>3</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>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).

<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 BANC entry for 2019 at: <http://www.caiso.com/informed/Pages/ReleasePlanning/Default.aspx>.

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 BANC to validate performance of the systems and processes under a variety of structured scenarios. The market simulation dashboard dated January 28, 2019 demonstrated that the CAISO and BANC were ready to enter parallel operations. Having achieved the benefits from market simulation, the CAISO and BANC transitioned to parallel operations on February 1, 2019.

The parallel operations phase is designed to test performance of the systems and processes in a financially non-binding environment using historical data and information from production systems to the maximum extent possible. The CAISO and BANC have engaged in parallel operations to examine capabilities at different times and conditions (morning ramp, evening ramp, low load and peak load). Doing so has permitted BANC 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 and BANC to identify and resolve software issues. The dashboard dated February 22, 2019 showed the progress during initial parallel operations as additional readiness criteria were met. The final dashboard, dated February 28, 2019, 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 BANC's compliance with criteria. The dashboard shows that all readiness criteria have been satisfied or will be satisfied by April 3, 2019.

CAISO tariff 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 of Technology and the sworn BANC affidavit of James R. Shetler, General Manager 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 BANC is prepared to enter financially

binding production EIM operations on April 3, 2019. As discussed in the Market Quality Report included as Attachment D, any issues identified in the parallel operations have been resolved or will be resolved. Neither the CAISO nor BANC has identified any exception to any of the readiness criteria.

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

Parallel operations allowed the CAISO and BANC to identify and resolve numerous input, process, and software issues prior to the commencement of financially binding operations.<sup>9</sup> The CAISO and BANC worked diligently during parallel operations to identify the cause of the infeasibilities that arose. The attached Market Quality Report demonstrates that the majority of the power balance infeasibilities identified during the period of parallel operations associated with the readiness determination were caused by input data issues, some of which are unique to the parallel operations environment and software issues, all of which have been or will be resolved by the implementation date.

The CAISO validated both prices and schedules based on the data input to the market systems throughout the first 15 days of 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 BANC are ready to operate in production.

### **V. Attachments**

- Attachment A: Readiness Dashboard Report;
- Attachment B: Affidavit of Petar Ristonavic;
- Attachment C: Affidavit of James R. Shetler; and
- Attachment D: Parallel Operations Market Quality Report.

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<sup>9</sup> The market quality report on parallel operations dated February 22, 2019 explains how each of these issues impacted the market results and how they were resolved by the CAISO and BANC.

## 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 BANC will notify the Commission in the event of any subsequent determination that the implementation of BANC into the EIM on April 3, 2019 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.

Respectfully submitted,

**By: /s/ John C. Anders**

John C. Anders

Roger E. Collanton  
General Counsel  
Burton A. Gross  
Deputy General Counsel  
John C. Anders  
Assistant General Counsel  
California Independent  
System Operator Corporation  
250 Outcropping Way  
Folsom, CA 95630  
Tel: (916) 608-7287  
Fax: (916) 608-7222  
Email: [janders@caiso.com](mailto:janders@caiso.com)

*Counsel for the California Independent System Operator Corporation*

**Attachment A – Readiness Dashboard Report**  
**EIM Readiness Certification for Balancing Authority of Northern California**  
**California Independent System Operator Corporation**

Readiness Criterion ID	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	ISO	Complete	The CAISO provided reports indicating that the Generating Unit, Intertie and Load definition in the CAISO's Full Network Model is consistent with the network modeling information in the BANC-SMUD network model.	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	ISO	Complete	The CAISO provided reports indicating critical and used SCADA measurements that BANC-SMUD is publishing match 99.82% to the values seen by the CAISO.	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	ISO	Complete	The CAISO provided reports indicating that the CAISO state estimator is solving on 30-second continuous basis on the CAISO EMS system and the solution is converging 100% of the time since 2/4/2019.	Tariff section 29.2(b)(7)(A)(iii)
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	ISO	Complete	BANC-SMUD provided an email stating that they have no non-conforming loads that meet the criteria.	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.	Joint	Complete	All agreements have been executed with executed agreements as evidence.	Tariff section 29.2(b)(7)(K)(i)

Readiness Criterion ID	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
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>	SMUD	Complete	BANC-SMUD provided evidence that all necessary training has been completed.	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).	ISO	Complete	The ISO Short-Term Forecasting team provided screen shots from Forecast Monitoring showing accurate measurements to satisfy this criteria.	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 in addition to current hour and next hour forecast. <p>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.</p>	ISO	Complete	CAISO provided an email with a sample chart, indicating that VER forecasts have been submitted and the data flow has been demonstrated.	Tariff section 29.2(b)(7)(C)(iv)
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.	ISO	Complete	CAISO provided an email stating that they have received and stored all historical data from BANC-SMUD, sufficient for the CAISO to perform the flexible ramp requirement.	Tariff section 29.2(b)(7)(K)(iv)





Readiness Criterion ID	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
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.	SMUD	Complete	CAISO provided reports indicating that SMUD has met the base schedule balancing criteria.	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	SMUD	Complete	CAISO provided reports indicating that SMUD has met the flexible ramping sufficiency test (both Up and Down)	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.	ISO	Complete	CAISO provided reports indicating that SMUD has met the capacity test capability	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.  The prospective EIM Entity receives CAISO operating procedures four months prior to the parallel operations date.	Joint	Complete	Signed non-disclosure agreement has been provided as evidence.	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.	SMUD	Complete	BANC-SMUD provided email and screen shots confirming that their operating procedures are complete and uploaded to Accellion	Tariff section 29.2(b)(7)(K)(ii)
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.	SMUD	Complete	BANC-SMUD provided their EIM Test Results Summary document showing all test cases have been executed and passed.	Tariff section 29.2(b)(7)(E)(i)

Readiness Criterion ID	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
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.	SMUD	Complete	BANC-SMUD provided their EIM Test Results Summary document showing all test cases have been executed and passed.	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.	Joint	Complete	CAISO provided evidence that all necessary SMUD staff have required access for Parallel Operations. SMUD confirmed the access is in place and plan is in place for production.	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.	Joint	Complete	BANC-SMUD provided the testing timeline summary document reflecting that all interface testing completed.	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.	Joint	Complete	BANC-SMUD provided the testing timeline summary document reflecting that Day-In-The-Life testing was complete and successful.	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.	Joint	Complete	BANC-SMUD and the ISO have successfully executed the operational components of all Structured Market Simulation Scenarios successfully. Evidence is uploaded to the EIM Accellion site.	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.	SMUD	Complete	SMUD sent an email stating that all scenarios met their intended training during Market Simulation	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	ISO	Complete	The CAISO provided an email summarizing the market results during market simulation.	Tariff section 29.2(b)(7)(I)(v)

Readiness Criterion ID	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
23a	Market Simulation	MS 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	ISO	Complete	CAISO Market Quality team provided a report validating that the market prices and MW schedules/dispatches observed during market simulation meets the requirements.	Tariff section 29.2(b)(7)(I)(vi)
23b	Parallel Operations	PO 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	ISO	Complete	CAISO Market Quality team provided a detailed market quality report and an email summarizing that CAISO validated both prices and schedules and the market solution is consistent with market rules as designed.	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	Joint	Complete	BANC-SMUD provided the final updated schedule 1 form and an email confirming this criteria has been met.	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	Sample monthly settlement statement and invoice with corresponding daily statements produced during market simulation and parallel operations are verifiably accurate against available data.	Joint	Complete	BANC-SMUD provided evidence that they have completed validation of the settlement statements and invoices.  CAISO Settlement lead confirmed.	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.	Joint	Complete	SMUD provided an email stating that SMUD doesn't have third party customers, therefore no allocation of charges and credits is performed or applicable to SMUD.	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.	ISO	Complete	CAISO Market Validation and Analysis team and DMM provided confirmation they have sufficient data available.	Tariff section 29.2(b)(7)(K)(v)



Readiness Criterion ID	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.	ISO	Complete	CAISO provided an email with supporting reports stating the CAISO has verified that the Parallel Operations ran consistently within normal CAISO disruption tolerances.	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 raterates, and generation out-of-service outage tickets within the required timelines.	Joint	Complete	BANC-SMUD submitted outages in the Map Stage environment. The CAISO confirmed that these were received and processed in the CAISO systems.	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.	SMUD	Complete	BANC-SMUD sent email evidence that these processes are in place.	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	SMUD	Complete	BANC-SMUD sent email evidence that their staff has been trained on the communication procedures and tools	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	Joint	Complete	BANC-SMUD provided an email confirming that SMUD does not have any 3rd party transmission customers.	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	SMUD	Complete	BANC-SMUD provided an email confirming their systems are capable of designating ABC capacity on our participating resources (SMUD does not have any non-participating resources).	Tariff section 29.2(b)(7)(K)(iii)

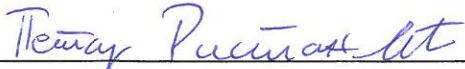
**Attachment B – Affidavit of Petar Ristanovic**  
**EIM Readiness Certification for Balancing Authority of Northern California**  
**California Independent System Operator Corporation**

Affidavit of Petar Ristanovic Certifying Readiness of  
Balancing Authority of Northern California (BANC) 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 responsibility for the implementation of BANC 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 or are expected to be satisfied as of BANC's April 3, 2019 implementation date.
3. Based on the readiness dashboard and other materials and my own review of relevant information and direct involvement with the readiness efforts, including testing, market simulation, training and parallel operations, and barring unforeseen developments, the systems and processes of the CAISO and BANC will be ready to implement BANC into the Energy Imbalance Market on April 3, 2019.
4. I will ensure that the CAISO maintains resource commitments necessary to sustain readiness through April 3, 2019 and address any unexpected conditions that may arise before April 3, 2019 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 BANC on April 3, 2019 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 April 3, 2019.

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

February 28, 2019

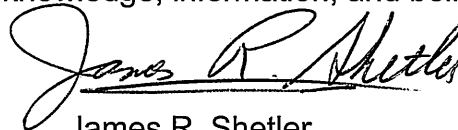
**Attachment C – Affidavit of James R. Shelter**  
**EIM Readiness Certification for Balancing Authority of Northern California**  
**California Independent System Operator Corporation**

**AFFIDAVIT OF JAMES R. SHETLER CERTIFYING  
READINESS OF THE BALANCING AUTHORITY OF  
NORTHERN CALIFORNIA ("BANC") TO OPERATE AS AN  
ENERGY IMBALANCE MARKET ("EIM") ENTITY**

I, James R. Shetler, General Manager of BANC, hereby certify as follows:

1. As the General Manager, I am ultimately responsible to the BANC Commission<sup>1</sup> for ensuring that all the systems and processes that support and enable the BANC Balancing Authority Area to participate in EIM are established and ready for EIM operations. As such, I have overall responsibility for the implementation of BANC's entry into that market.
2. I have reviewed the readiness dashboard and find that it is accurate and complete. All applicable readiness criteria set forth in the California Independent System Operator's ("CAISO") tariff and business practice manual for the EIM have been satisfied or are expected to be satisfied as of BANC's April 3, 2019, implementation date.
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 CAISO and BANC will be ready to implement BANC's entry into the EIM on April 3, 2019.
4. I will ensure that BANC maintains resource commitments necessary to sustain readiness through April 3, 2019 and address any unexpected conditions that may arise before April 3, 2019 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 BANC's entry on April 3, 2019 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 April 3, 2019.

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



James R. Shetler  
General Manager  
February 28, 2019

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<sup>1</sup> BANC is a joint powers agency created pursuant to Section 6500 *et seq.*, of the State of California Government Code. BANC operates as an independent government agency with an appointed Commissioner from each of its member entities, which include the Modesto Irrigation District, the City of Redding, the City of Roseville, the City of Shasta Lake, the Sacramento Municipal Utility District and the Trinity Public Utilities District. The General Manager reports directly to the BANC Commission.



**Attachment D – Parallel Operations Market Quality Report**  
**EIM Readiness Certification for Balancing Authority of Northern California**  
**California Independent System Operator Corporation**

# **Market Validation of Parallel Operations For BANC-SMUD EIM Entity**

**February 22, 2019**

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## Executive Summary

Parallel operations activities of the Energy Imbalance Market (EIM) started on February 1, 2019 for purposes of evaluating the readiness of Sacramento Municipal Utility District (SMUD) which is part of the Balancing Authority of Northern California (BANC), 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 BANC SMUD(BAA) into 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 BANC SMUD (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 February 1 through February 15. 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 as expected and indicate that the systems and processes of BANC SMUD are capable of operating in production.

## Background and Scope

The intent of parallel operations is to run the market to simulate as close as practically possible actual operating conditions of the system, and to provide BANC-SMUD with an opportunity to go over specific day-to-day processes and activities required for the operation of the EIM. This set-up provides BANC-SMUD 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 these 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 feedback to the market systems may or may not be related to the dispatch instruction issues through the parallel operations environment. For the first fifteen days of parallel operations, the BANC-SMUD resources were not following the ISO dispatch instructions, however, the market applications was using an echo back system which fed back the resource dispatch operating target as its telemetry thereby creating a scenario of a perfect response by resources for every dispatch instruction.
- 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.
- iv) During the period of parallel operations, the prospective EIM entities bids and base schedules are merged with the bids and base schedules from the current production systems to simulate the actual production environment. The process of combining

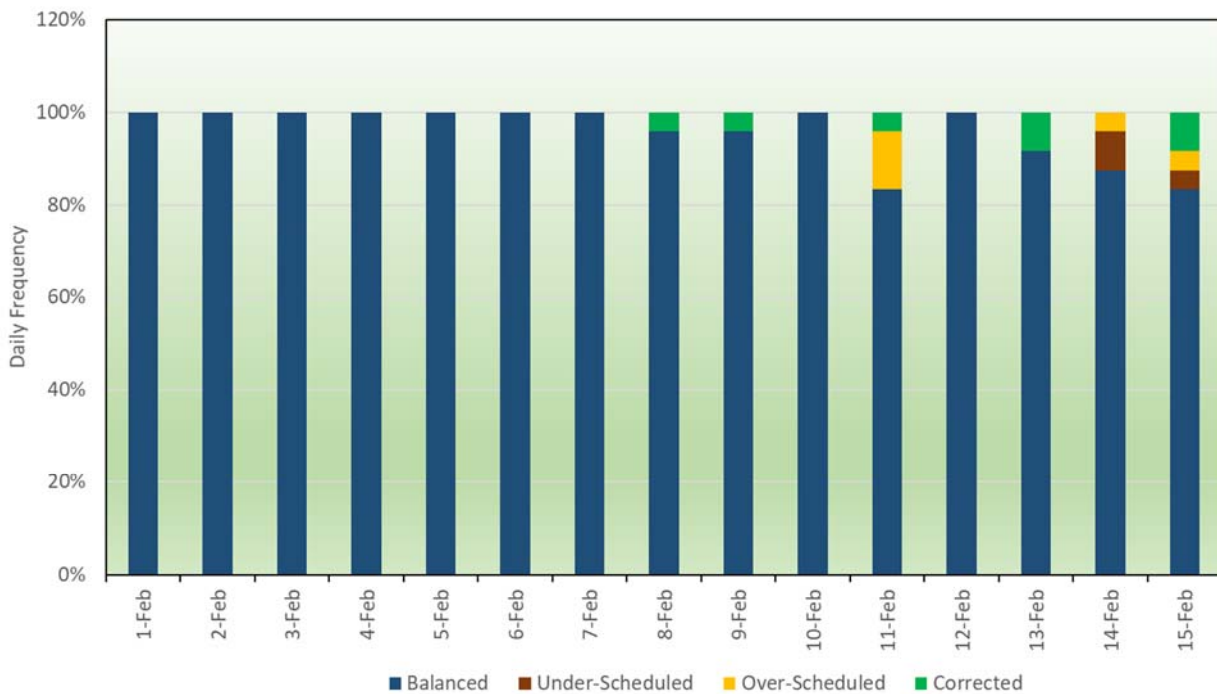
information from two systems needs some time to synchronize the data flow across various applications.

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 performance of BANC-SMUD BAA for the balancing test as 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.

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

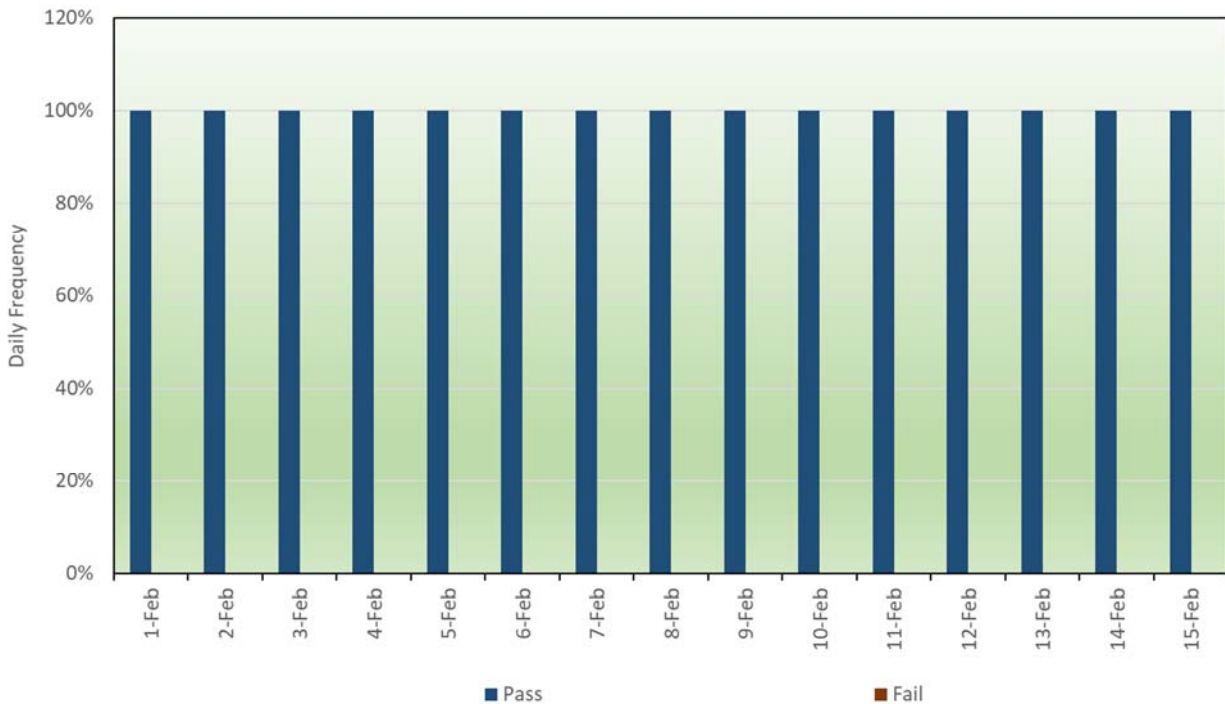


The balancing test provides a reference of how well balanced (energy supply and demand defined by the hourly base schedules and forecast respectively) the EIM entity BAA is going to come into the real-time energy imbalance market. Having a large percentage of positive imbalance means the real-time market will be the last resort to balance the area incrementally. 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. During the first fifteen days of parallel operations, BANC-SMUD passed the balancing test for 98.61 percent. There were primarily two system issues that were impacting SMUD's ability to pass the balancing test: first, the ISO performs two advisory tests: 75 minutes before the trading hour and 55 minutes before trading hour followed by the final test which is performed at 40 minutes before trading hour. SMUD failed to balance their BAA in hour ending 20 on February 8, hour ending three on February 9, and hour ending 4 on February 11 because Real-Time Balancing (RTBS) application did not receive the updated changes to resource base schedules from the BANC-SMUD operators which were modified based on the advisory test performed 55 minutes prior to the trading hour. As stated in the previous section, in parallel operations, the ISO systems merge bids from productions systems with bids from the parallel operation system to mimic the production environment for the entire EIM footprint. Since BANC-SMUD is the only EIM BAA participating in the parallel operations, bids for the rest of the system is obtained from the production environment. The issue with the timely merging of information from parallel and production environment resulted in SMUD failing the balancing test at T-40 even though SMUD operators had taken the necessary steps to pass the test. Second, BANC-SMUD failed the balancing test in the hour ending three and four on February 13 and hour ending 11 and 12 on February 15 because of a software defect which was incorrectly rejecting the base schedules from an hourly inter-tie transaction. If these schedules were considered in the balancing test, BANC-SMUD would have passed the balancing test. All hours impacted by CAISO software issues are captured as corrected intervals in Figure 1 and the software issues impacting BANC-SMUD's balancing test outcomes were reported to the market application vendor.

A second test carried out prior to running the real-time market is the capacity test. BANC SMUD passed the capacity test in all hours (100 percent) between February 1 and February 15.

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

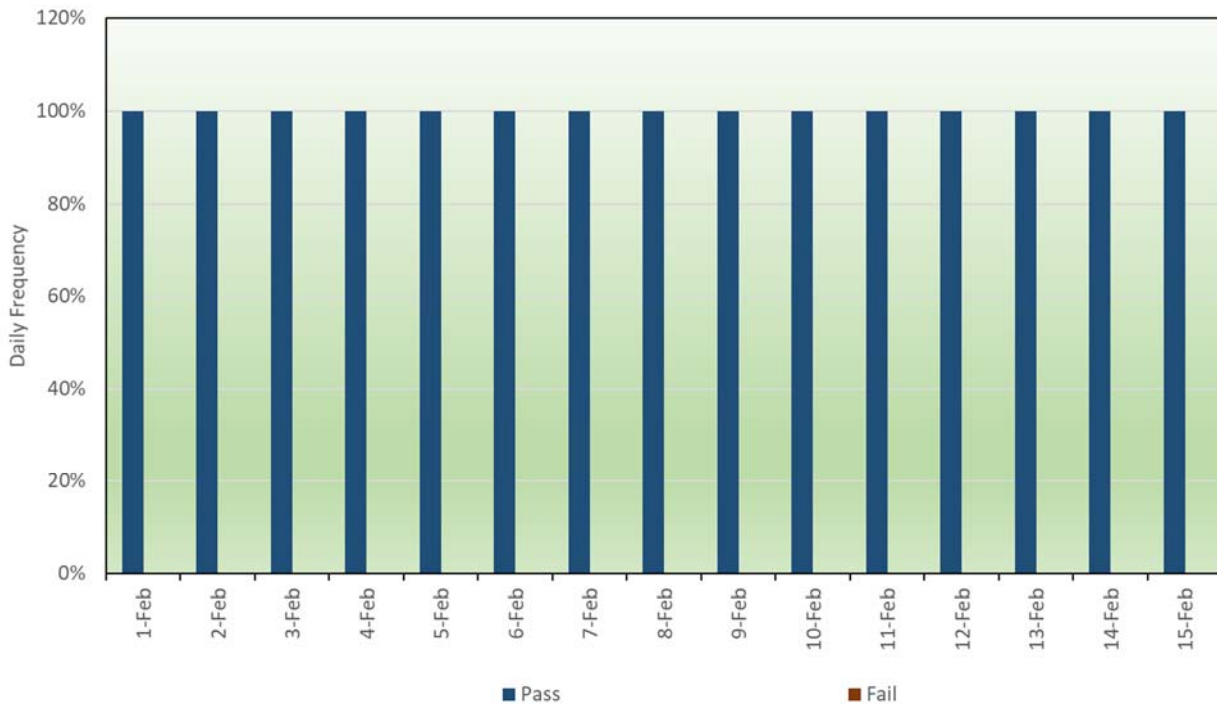


A third test carried out before running the real-time market is the flexible ramp sufficiency test as required by section 27.34 (m) of the ISO tariff. The flexibility test evaluates whether the EIM entity has sufficient flexible capacity to meet its both upward and downward ramp requirements based on optimized resource schedules before the trading hour. Figure 3 shows the daily frequency of flex ramp up test failures observed in the first 15 days of parallel operation for the BANC-SMUD BAA, and Figure 4 shows the daily frequency of flex ramp down test failures seen in the first 15 days of parallel operations. From February 1 through February 15, BANC-SMUD passed the flexible ramp up test in 100 percent of the hours and passed the flex ramp down test 99.58 percent of the hours. BANC-SMUD failed the flex ramp down test for only four hours out of a total of 360 hours. An analysis of flex ramp down failures for SMUD pointed to two sets of issues which were impacting its ability to pass this test. First, during the first six days of parallel operations, the flexible ramp down uncertainty requirement was unusually high for the BAA. The uncertainty requirement is one of the components used to determine the flexible ramp requirements. The ISO Balancing Area Ramp Requirement (BARR) tool requires data for sixty days from the production system, which is free from errors, to calculate the uncertainty requirement. However, at the beginning of parallel operations BARR does not have this data. In the absence of good data, on the



seventh day of parallel operation, the ISO capped the uncertainty requirement to a value in proportion relative to the size of the BAA load. Second, the net export capacity for a BAA is another component used to calculate the flexible ramp requirement for the BAA; this component essentially reduces the total downward capacity requirement. Due to a software defect, the Real-Time balancing application was using a lower number which resulted in a higher requirement for BANC-SMUD. Otherwise, BANC SMUD would have passed the flex ramp down test. All flex ramp down failure hours impacted by CAISO software issues are captured as corrected intervals in Figure 4 and the software issues impacting BANC-SMUD's flex ramp down test outcomes were reported to the market application vendor.

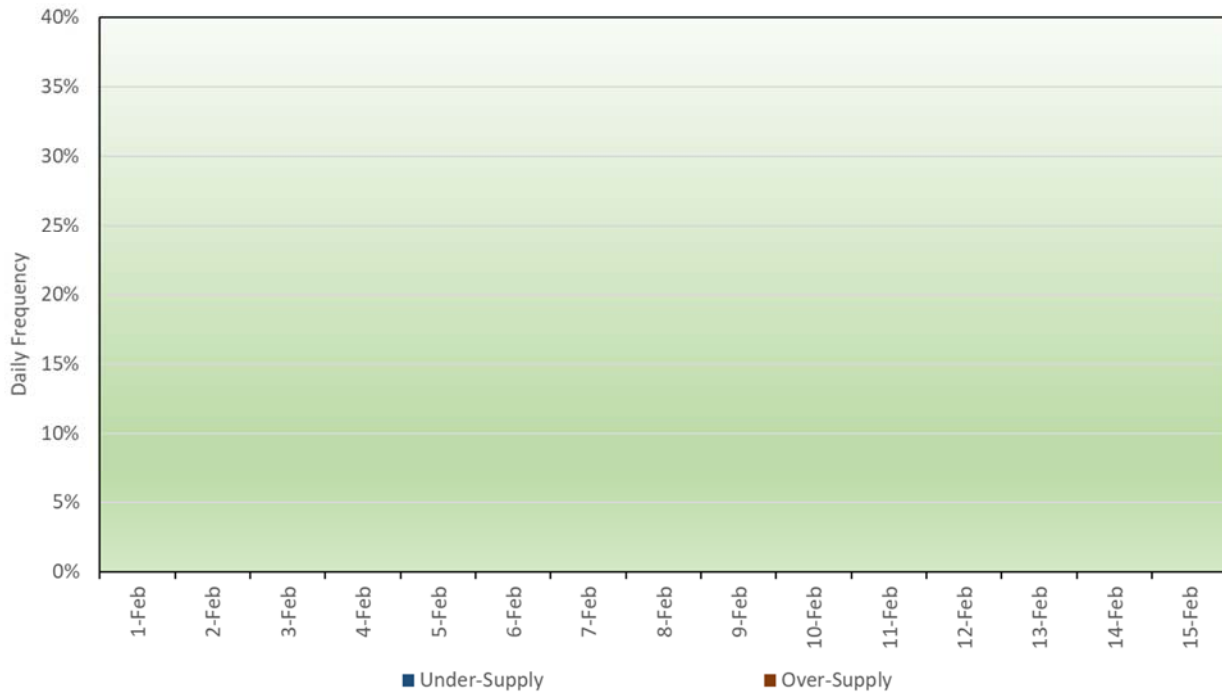
**Figure 3: Daily frequency of flexible ramp up test results**



**Figure 4: Daily frequency of flexible ramp down test results**


Figure 5 and 6 shows the frequency of power balance infeasibilities for both under-generation and over-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 BANC-SMUD 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 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 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 while 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.

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

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


During February 1 through February 15 there were no infeasibilities in the fifteen-minute market for either under-supply or over-supply conditions. For the five-minute market, there were under-supply infeasibilities on February 1, 2 and 14. Most of the infeasibilities were impacted by the following ISO system issues: missing data of ETSR limits in the beginning of parallel operation, bad telemetry data for several resources in market simulation environment, conflict of VER persistence feature and telemetry simulator. All intervals impacted by CAISO system issues are captured as corrected intervals in Figure 6. Under normal production environment, the infeasibilities caused by data or software issues would be deemed to be in error and subject to price corrections. The ISO system issues and software defects observed during the first fifteen days of parallel operations are explained in detail in the Market Validation items section of this report.

On February 14, 2018 there were two five-minute intervals with under-gen infeasibility due to the forced outage of a generating unit.

Figure 6: Daily frequency of supply infeasibilities in the five-minute market

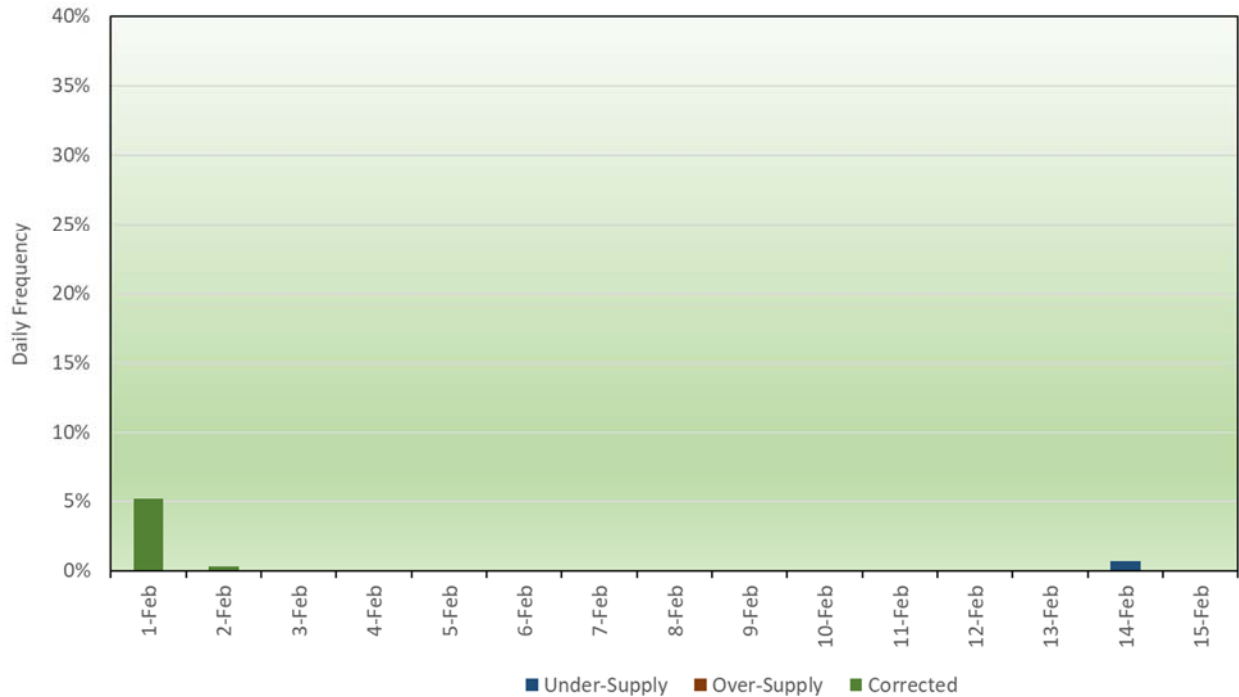


Figure 7 and 8 show the daily average ELAP LMPs for the fifteen-minute market and the five-minute markets. The average daily prices from February 1 through February 15 in the fifteen market were between \$33.18 and \$154.57. The average five-minute prices were between \$30.82 and \$124.55.

Figure 7: Daily average of fifteen-minute prices

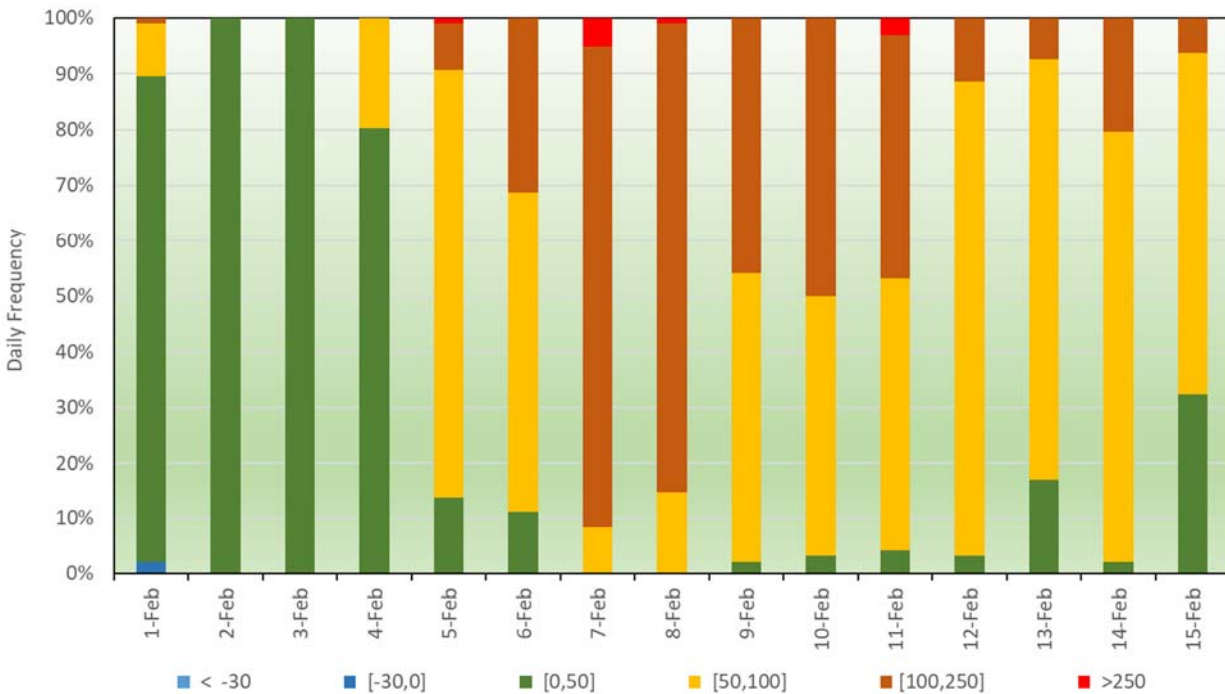


Figure 8: Daily average of five-minute prices

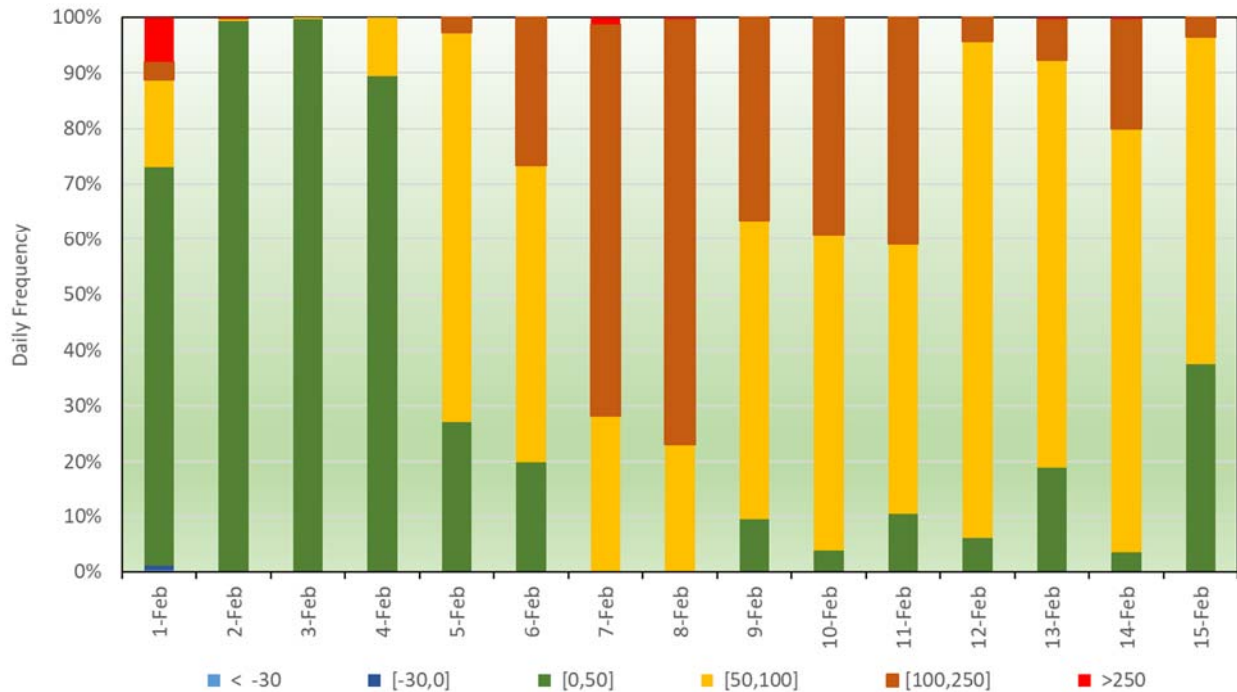


Figure 9 shows the fifteen-minute ELAP prices classified by price bins and Figure 10 shows the five-minute ELAP prices classified by the same price bins.

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



For all trade dates from February 1 through February 15, 72.7 percent of the FMM intervals observed prices were between \$0 and \$100 and 26.5 percent of intervals observed prices between \$100 and \$250. At the same time, 77 percent of the FMM intervals observed prices were between \$0 and \$100 and 22 percent of intervals observed prices between \$100 and \$250. Between February 5 through February 15, in both the five-minute and fifteen-minute markets, more than twenty percent of the intervals observed LMPs between \$100/MWh and \$250/MWh. During these intervals, SMUD EIM Transfer constraint was not-binding, hence, the SMUD ELAP LMP was set by a marginal bid from resources located BAA outside of BANC-SMUD. For these days, we observed higher natural gas prices due to unusually cold temperatures in California and rest of the states in Western United states. These high natural gas prices drove system-wide prices, along the BANC-SMUD ELAP prices, in the range of \$100/MWh to \$250 MWh range.

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


## Market Validation Items

1. Balancing failures due to set-up issue.

Type of issue: Hourly Inter-Tie Transaction

During the period of parallel operations, the prospective EIM entities bids and base schedules are merged with the bids and base schedules from the current production systems to simulate an actual production environment. For some balancing tests at T-40 on February 8, RTBS did not get the latest base schedule information due to a timing issue that caused the parallel operation merge process of most up to date base schedules submitted by BANC-SMUD on parallel operations system and rest of the existing EIMs on production system to come late and miss the T-40 test. This was an ISO issue related to the parallel operation environment and was fixed on February 12.

2. Resource Telemetry

Type of issue: Telemetry swings

The Real-Time application uses the resource telemetry information to calculate the initial operating point for the resource which is used as the starting point in the five-minute market. Due to a simulation issues, bad telemetry data was used for several resources. It caused erroneous starting

points for resources and resulted in under-supply infeasibilities and EIM transfer swings for BANC-SMUD. This Issue was resolved by updating several workflows on February 2, 2019.

### 3. ETSR limits

Type of issue: ETSR limit mismatch

For the first couple of hours of market simulation, the fifteen-minute market had an ETSR limits set to 9999 MW as a result, BANC-SMUD BAA was relying on EIM transfers to meet its imbalance requirements. However, in the five-minute market ETSR limits were set to 0 MW, at the same time, there was not enough generation online in the five-minute to meet the imbalance needs. This was an input data issue which was fixed on February 1, 2019.

### 4. Generating Resource unit connectivity status in Full Network Model.

Type of issue: Unit connectivity (UCON) status for circuit breakers.

Two solar resources in the BANC-SMUD BAAL: ELK\_6\_MCK and ELK\_6\_TWI were electrically disconnected from the network due to data input error at the ISO end. These units were online and generating but in the market model they were disconnected because a switch that connects these resources to the grids was in open position. The ISO resolve this issue by removing the incorrect manual override on the status of circuit breaker on February 4, 2019.

### 5. Price Formation

Type of Issue: Price formation and disconnected Pnodes

Some of the pricing nodes in the BANC-SMUD BAA were disconnected from the network due to either a default open switch position for the season or due to an outage. The ISO has implemented a “replacement Pnode process”, to identify an electrically close Pnode which is connected to the network for each of the disconnected Pnode from a static set of locations. This process is implemented to ensure the ISO can publish a LMPs for pricing nodes even though they may be electrically disconnected from the network. For each Pnode, let’s refer to it as reference Pnode, the ISO maintains a static set of Pnodes which are electrically close to the reference Pnode which would be suitable for LMP substitution in case the reference Pnode is disconnected. For the BANC-SMUD Pnodes, some of the static mapping was incorrect, as a result, the LMPs for the BANC-SMUD were incorrect because a replacement Pnode process was using LMPs from a BAA which was electrically distant from the BANC-SMUD Pnode. This issue was resolved on February 5, 2019.

### 6. VER resource Forecast

Type of issue: VER Persistence feature

For February 1 and 2, there were issues with VER persistence feature and the telemetry simulator which resulted in significant swings in the resource dispatches in the five minute market. This issue was resolved on February 2, 2019.



## 7. Software Defects

During parallel operations, three software defects were identified that impacted that impacted the market solutions.

- a. All EIM BAA's can submit Available balancing capacity (ABC) base schedules which is expected to be dispatched by the market only if the BAA has an under supply or over supply infeasibility because ABC is reserved for dispatch only for that specific BAA dispatch and should not be used for Energy Imbalance Market (EIM) transfers. However, due to a defect, in one of the five-minute market, a resource ABC up was dispatched under normal condition. This turns out to be an existing production issue under specific scenario and the fix will be delivered by March 6, 2019.
- b. Net export capacity is one of the several inputs used to calculate the flexible ramp requirement for the BAA to evaluate the ramp capacity in the BAA; this component essentially reduces the total downward capacity requirement. Due to a software defect, the Real-Time balancing application was using a lower number which resulted in a higher requirement for BANC-SMUD and it failed the flex ramp down sufficiency test. This turns out to be an existing production issue under specific scenario and the fix will be delivered by March 6, 2019.
- c. The Real Time Base Schedule (RTBS) application which performs the resource sufficiency test was erroneously rejecting the base-schedule for certain hourly transaction for BANC-SMUD. For a select few inter-tie transaction resources, there were duplicate records in one of reference tables in the market application database due to a software defect. As a result of this defect, BANC-SMUD failed balancing tests. The duplication occurred when the BANC-SMUD inter-tie ID payload was received the first time. A process was put in place to log the information before the duplicates are deleted on February 20, 2019.
- d. BANC-SMUD BAA had a forced outage on a unit which resulted in a contingency event. When an EIM BAA has a contingency event, the market application locks the EIM transfer at the advisory level and the EIM entity deploys the reserves manually and notifies the market using manual dispatch. For this interval with contingency event enabled, BANC-SMUD had under-supply infeasibility. During the parallel operations the price discovery feature is enabled which implies that BANC-SMUD BAA LMP should be set by the last economic signal, however, the price was set at \$1000 based on the under-supply infeasibility penalty price. This market outcome is incorrect due to a software defect. This issue is fixed and software patch was received on February 26, 2019.

All the instances listed above are being addressed with the market software vendor before the activation date.

## Conclusion

The ISO validated both prices and schedules based on input data that was fed through the market systems parallel operations from February 1 through February 15. 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 fixed or controlled for, the quality of the market solutions are as expected and indicate that the systems and processes of BANC-SMUD are capable of operating in production.

## CERTIFICATE OF SERVICE

I hereby 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 28<sup>th</sup> day of February, 2019.

*/s/ Grace Clark*  
Grace Clark