California Independent System Operator Corporation

February 28, 2020

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 the City of Seattle, by and through its City Light Department'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.[1] The CAISO, in consultation with the City of Seattle, by and through its City Light Department (Seattle), has determined that, following market simulation and an adequate period of parallel operations, the CAISO and Seattle 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 of Technology, and the sworn Seattle affidavit of Emeka Anyanwu, Energy Innovation and Resources Officer. This filing certifies the readiness of the CAISO and Seattle to proceed with Seattle's participation in the CAISO's Energy Imbalance Market (EIM) on April 1, 2020, without exception, consistent with the requirement to do so at least 30 days prior.

[1] 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).

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.[2] In a March 16, 2015 order,[3] the Commission concluded that certain readiness safeguards are necessary prior to activating a prospective EIM entity in production.[4] 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.[5] Following two compliance filings, the Commission accepted the CAISO's proposed readiness criteria.[6] These criteria appear in section 29.2(b)(7) of the CAISO Tariff.

II. Readiness Reporting, Determination, and Attestations

The CAISO and Seattle ran market simulation scenarios from December 9, 2019 to January 31, 2020. Parallel (*i.e*., financially nonbinding) operations, which began on February 1, 2020, will run through at least February 28, 2020 and, in any event, will continue to be supported and available to Seattle until April 1, 2020. During market simulation and parallel operations the CAISO and Seattle 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

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2 *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).

3 *Cal. Indep. Sys. Operator Corp.,* 150 FERC ¶ 61,191 (2015) (March 16 Order).

4 March 16 Order at P 30.

5 *Id.,* n.85.

6 *Cal. Indep. Sys. Operator Corp.*, 153 FERC ¶ 61,205 (2015).

"dashboard," showing progress towards meeting the readiness criteria.[7] 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 Seattle'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 Seattle to validate performance of the systems and processes under a variety of structured scenarios. The market simulation dashboard dated January 31, 2020 demonstrated that the CAISO and Seattle were ready to enter parallel operations. Having achieved the benefits from market simulation, the CAISO and Seattle transitioned to parallel operations on February 1, 2020.

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 Seattle 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 Seattle 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 Seattle to identify and resolve software issues. The dashboard dated February 14, 2020 showed the progress during initial parallel operations as additional readiness criteria were met. The final dashboard, dated February 24, 2020, 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 Seattle's compliance with criteria. The dashboard shows that all readiness criteria have been satisfied or will be satisfied by April 1, 2020.

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

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[7] 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 Seattle entry for 2019 at: http://www.caiso.com/informed/Pages/ReleasePlanning/Default.aspx.

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 Seattle affidavit of Emeka Anyanwu, Energy Innovation and Resources Officer, 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 Seattle is prepared to enter financially binding production EIM operations on April 1, 2020. 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 Seattle has identified any exception to any of the readiness criteria.

III. Market Quality Report on Parallel Operations

Parallel operations allowed the CAISO and Seattle to identify and resolve numerous input, process, and software issues prior to the commencement of financially binding operations.[8] The CAISO and Seattle worked diligently during parallel operations to identify the cause of the infeasibilities that arose. The attached Market Quality Report 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.

The CAISO validated both prices and schedules based on the data input to the market systems throughout the first 14 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 Seattle are ready to operate in production.

V. Attachments

Attachment A: Readiness Dashboard Report

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[8] The market quality report on parallel operations dated February 21, 2020 explains how each of these issues impacted the market results and how they were resolved by the CAISO and Seattle.

Attachment B: Affidavit of Petar Ristonavic

Attachment C: Affidavit of Emeka Anyanwu

Attachment D: Parallel Operations Market Quality Report

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 will notify the Commission in the event of any subsequent determination that the implementation of Seattle into the EIM on April 1, 2020 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

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Counsel for the California Independent System Operator Corporation

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, CA this 28th day of February, 2020.

/s/ Martha Sedgley

Martha Sedgley
California ISO
250 Outcropping Way
Folsom, CA 95630

ATTACHMENT
A

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. Any Discrepancies are accounted for in terms of imbalance adjustment	**CAISO**	**Complete**	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 Seattle City Light 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	**CAISO**	**Complete**	CAISO provided reports indicating critical and used SCADA measurements Seattle City Light is publishing match 100% 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	**CAISO**	**Complete**	CAISO provided reports CAISO State estimator has been solving on 29-second continuous basis since 02/18/2020 on the CAISO EMS PROD system. The solution is converging 96.55% of the runs since February 18, 2020.	**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	**CAISO**	**Complete**	Seattle City Light confirmed that the non-conforming loads (steel mill and wind tunnel) have been modeled separately from the SCL conforming load and their associated hourly base schedules are submitted to BSAP. SCL confirms that the historical actual load measurements that SCL provided does not include the non-conforming load	**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 are complete with executed agreements as evidence.	**Tariff section 29.2(b)(7)(K)(i)**

Readiness Criterion Identifier	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 "100 series"– an introduction to Energy Imbalance Market training "200 series"– the specific hourly and daily tasks and duties for normal operation training module; and "300 series"– the assessment of market results and response to contingencies and abnormal situations training module.	**SCL**	**Complete**	Seattle City Light 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. • Accuracy of the CAISO forecast of EIM demand based on historical actual load data for the defined EIM demand forecast boundaries. • Identification of weather station(s) locations used in forecasting, if applicable.	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**	The ISO Short-Term Forecasting team provided screen shots from Forecast Monitoring showing accurate measurements to satisfy this criterion.	**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.)	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**	Seattle City Light do not have any VER resources. Email confirmation available as evidence.	**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.	**CAISO**	**Complete**	CAISO provided an email stating that they have received and stored all historical data from Seattle City Light, sufficient for the CAISO to perform the flexible ramp requirement.	**Tariff section 29.2(b)(7)(K)(iv)**

Readiness Criterion Identifier	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.	**SCL**	**Complete**	Seattle City Light 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.	**SCL**	**Complete**	CAISO provided reports indicating that Seattle City Light 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.	**CAISO**	**Complete**	indicating that Seattle City Light 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.	**SCL**	**Complete**	SCL 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 complete and will not have any issues deemed significant. Any exceptions will be explained or have an interim solution that is functionally equivalent.	**SCL**	**Complete**	Seattle City Light 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 Identifier	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 complete and will not have any issues deemed significant. Any exceptions will be explained or have an interim solution that is functionally equivalent.	**SCL**	**Complete**	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 CAISO 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 Seattle City Light staff have required access for Parallel Operations. Seattle City Light 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**	Seattle City Light 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**	Seattle City Light 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**	SCL and the ISO have successfully executed the operational components of all Structured Market Simulation Scenarios successfully. Evidence 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.	**SCL**	**Complete**	SCL 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	**CAISO**	**Complete**	CAISO provided an email summarizing the market results 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 operations	**CAISO**	**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)**

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**		**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**	SCL 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	Monthly settlement statement and invoice with corresponding daily statements produced during market simulation and parallel operations are verifiably accurate against available data.	**JOINT**	**Complete**	Seattle City Light 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**	Seattle City Light provided an email stating that Seattle City Light doesn't have third party customers, therefore no allocation of charges and credits is performed or applicable to Seattle City Light.	**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 Market Validation and Analysis team and DMM provided confirmation they have sufficient data available.	**Tariff section 29.2(b)(7)(K)(v)**
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**	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)**

Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
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.	**JOINT**	**Complete**	SCL 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.	**SCL**	**Complete**	SCL 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	**SCL**	**Complete**	SCL 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	3rd 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**	Seattle City Light 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	**SCL**	**Complete**	Seattle City Light provided an email confirming their systems are capable of designating ABC capacity on our participating resources	**Tariff section 29.2(b)(7)(K)(iii)**

ATTACHMENT
B

California ISO

Affidavit of Petar Ristanovic Certifying Readiness of The City of Seattle, by and through its City Light Department (Seattle) 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 Seattle 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 Seattle's April 1, 2020 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 Seattle will be ready to implement Seattle into the Energy Imbalance Market on April 1, 2020.

4. I will ensure that the CAISO maintains resource commitments necessary to sustain readiness through April 1, 2020 and address any unexpected conditions that may arise before April 1, 2020 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 Seattle on April 1, 2020 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 1, 2020.

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

Petar Ristanovic, Vice President of Technology

February 25, 2020

ATTACHMENT
C

AFFIDAVIT OF EMEKA ANYANWU CERTIFYING READINESS OF THE CITY OF SEATTLE, BY AND THROUGH ITS CITY LIGHT DEPARMENT ("SEATTLE") TO OPERATE AS AN ENERGY IMBALANCE MARKET ("EIM") ENTITY

I, Emeka Anyanwu, Energy Innovation and Resources Officer of Seattle, hereby certify as follows:

1. As the Energy Innovation and Resources Officer of Seattle, I am ultimately responsible at Seattle for ensuring that all the systems and processes that support and enable the Seattle Balancing Authority Area to participate in EIM are established and ready for EIM operations. As such, I have overall responsibility for the implementation of Seattle'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 Seattle's April 1, 2020, 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 Seattle will be ready to implement Seattle's entry into the EIM on April 1, 2020.

4. I will ensure that Seattle maintains resource commitments necessary to sustain readiness through April 1, 2020 and address any unexpected conditions that may arise before April 1, 2020 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 Seattle's entry on April 1, 2020 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 1, 2020.

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

Emeka Anyanwu

February 26, 2020

ATTACHMENT
D

Market Validation of Parallel Operations For Seattle City Light (SCL) EIM Entity

February 21, 2020

Contents

Executive Summary

Parallel operations activities of the Energy Imbalance Market (EIM) started on February 1, 2020; this effort provides an opportunity to assess the readiness of the Seattle City Light (SCL), the prospective EIM Entity, to participate in the Energy Imbalance Market. One of the readiness criteria require the ISO to provide a market performance report for the period of parallel operations carried out for the integration SCL Balancing Authority Area (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 SCL (BAA).

The ISO validated both prices and schedules as part of the overall market performance based on input data that fed to the market systems parallel operations from February 1 through February 14. 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 SCL 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 SCL with an opportunity to go over specific day-to-day processes and activities required for the operation of the EIM. This set-up provides SCL 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 have 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 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 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 fourteen days of parallel operations, the SCL resources were not following the ISO dispatch instructions, however, the market applications were operated in two configurations. First, from February 1 through February 11, the market application was using the resource actual telemetry as the input but the resources were not following the market instructions. Second, starting on February 11, the ISO implemented 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.

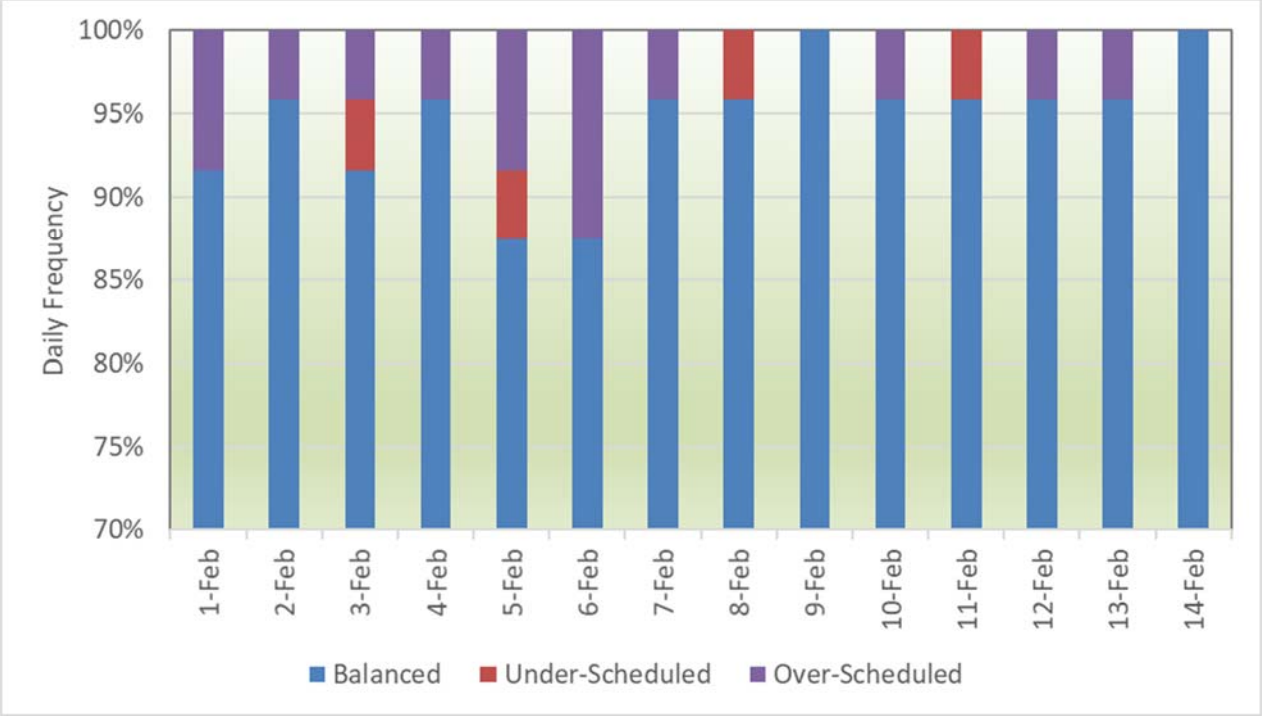
iv) During the period of parallel operations, the prospective EIM entities bids and base schedules are merged with the bids and base schedules from the current production systems to simulate the actual production environment. The process of combining information from two systems needs some time to synchronize 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. The Market Trends section provides metrics that capture SCL's market performance during parallel operations; also, it includes various system issues that were identified during parallel operations and that affected market performance. The Market Validation section provides a summary of issues identified during parallel operations.

Market Trends

Figure 1 shows the performance of SCL 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 24 hours the number of hours where the prospective EIM entity was under-scheduled, over-scheduled and passed the balancing test.

Figure 1: Daily frequency of power balancing test results



The balancing test provides a reference of how well balanced (energy supply defined by the hourly base schedules meets the demand defined by the 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

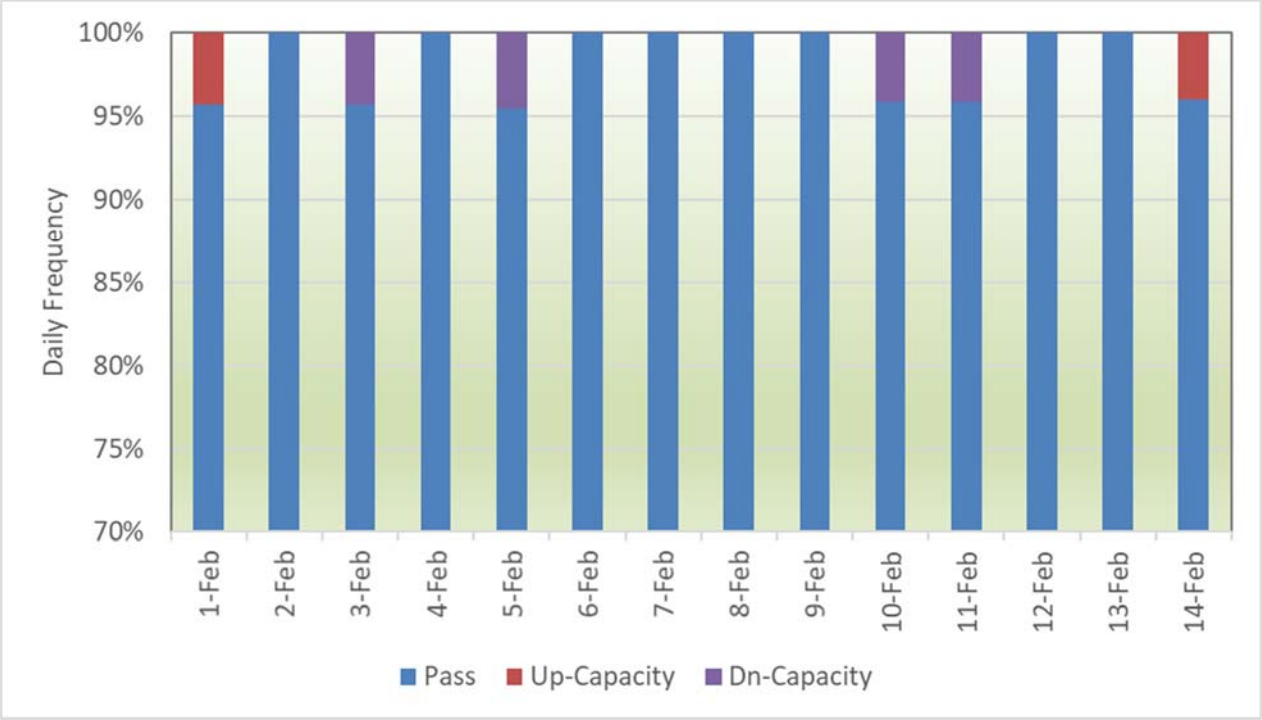
real-time market will be the last resort to balance the area incrementally. The incremental balancing of supply will come from the bid-in capacity made available in the market in addition to the base schedule or EIM transfers between the participating EIM entities' BAAs.

During the two weeks of parallel operations, SCL passed the balancing test for 94.64 percent. On February 2, 5, and 6, for separate hours, SCL operators reduced the base schedule on specific resources forty minutes before the trading hour, which resulted in SCL being under-balanced. On February 11, SCL operators inadvertently entered an outage for a couple of resources, which disqualified the base schedules that drove under-balancing test failure. On February 2, 3, and 6, a resource had zero base schedule, but, at the same time, this resource had a minimum manual dispatch in the market.

The balancing test considers the maximum of either the base schedule or the manual dispatch for the trading hour, so even though from the BSAP application, it appeared SCL was balanced; when the balancing test results were performed by BAAOP, SCL was over-balanced. The ISO market application performs a balancing test three times, first at 75 minutes before the trading hour, second at 55 minutes before the trading hour, and finally 40 minutes before the trading hour. The results from 75 minutes before the trading hour and 55 minutes before the trading hour are considered advisory findings and provides an opportunity for operators to adjust base schedules to pass the balancing test. On February 5, 6, 7, 10, 12, and 13, for different hours on each day, the advisory balancing test result indicated that SCL would fail the balancing test if base schedules were not adjusted. However, the operators either unable to make an adjustment or made an adjustment that was not sufficient to pass the balancing test. All occurrences of balancing test failures were identified as an opportunity for SCL to improve their balancing test processes.

A second test carried out before running the real-time market is the capacity test. The daily Frequency of passing the capacity test is provided in Figure 2. SCL passed the capacity test in 98.21 percent of hours between February 1 and February 14. There are four main issues identified as the root cause for failing bid-range capacity tests. First, SCL uses an application developed by its vendor to submit its bids to the ISO Scheduling Infrastructure and Business Rules (SIBR) application. Due to an issue with this application, no bids were submitted to SIBR. This issue affected the bid-range capacity test failure on February 1, 5, and 11. Second, as mentioned in the previous section, on February 11, SCL operators inadvertently entered an outage for two resources that drove bid-range capacity test failure for one hour. Third, on February 14, SCL failed the bid-range capacity test in the down direction because the sum of available downward bid capacity from the energy base schedule was less than the requirement. Fourth, all EIM market participants use (SIBR) application to submit bids to the ISO market. After the deadline to submit bids for each trading hours, an automated process transfers these bid sets to various applications for downstream market processes. On February 10, 2020, hour ending 15, in the ISO parallel operations environment, this automated process failed to transfer bids to the BAAOP application that performs the capacity test. This resulted in a capacity test failure for SCL.

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 ramping 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 flexible ramp up test failures observed in the first two weeks of parallel operation for the SCL BAA and Figure 4 shows

the daily frequency of flexible ramp down test failures observed in the first two weeks of parallel operation for the SCL BAA. From February 1 through February 14, SCL passed the flexible ramp-up test in 97.92 percent of the hours and passed the flexible ramp-down test in 96.43 percent of the hours. An analysis of flex sufficiency failures for SCL pointed to two issues. First, On February 6, SCL failed the flexible ramp down test in six hours, there were a couple of resources with self-schedules above their base schedules. As a result, SCL had limited downward ramping capability on its resources, so the BAA failed the flexible ramp down test. Second, on February 1, 3, 5, 10, 11, and 14, SCL failed the flexible ramp sufficiency tests because it failed the bid-range capacity. The root cause of the capacity test failures area captured in the prior section.

Figure 3: Daily frequency of flexible ramp up test results

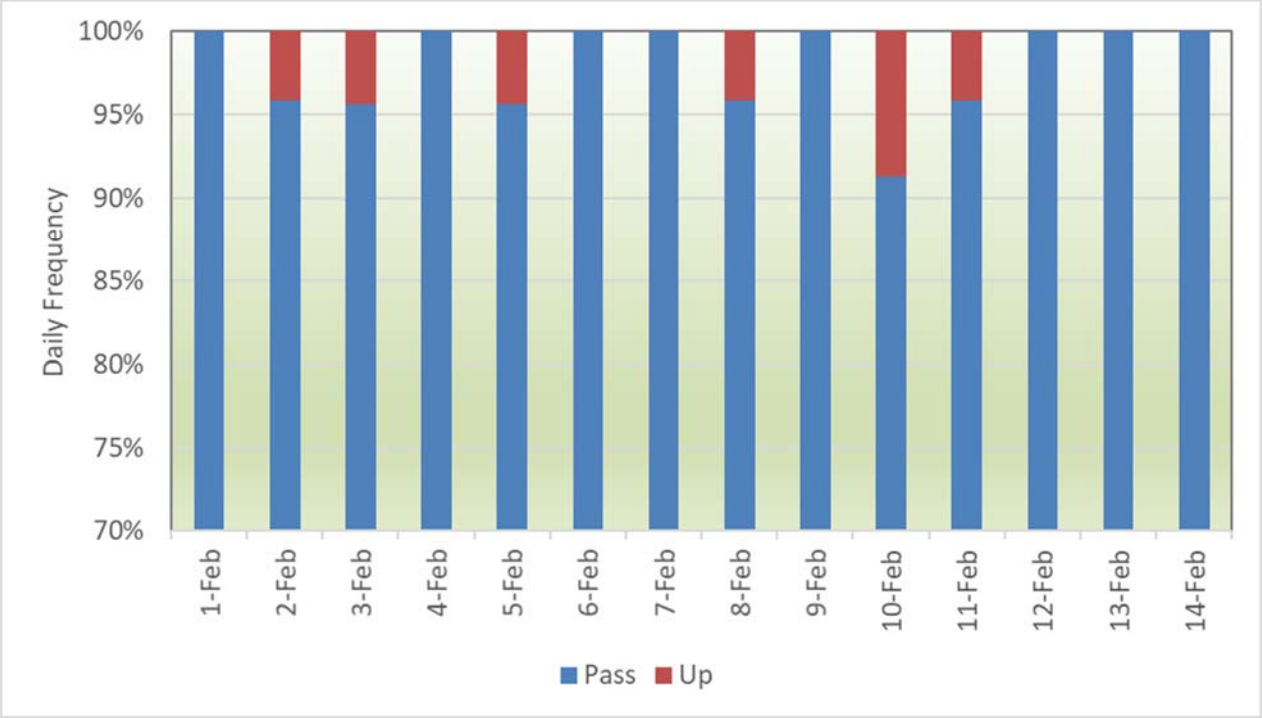


Figure 4: Daily frequency of flexible ramp down test results

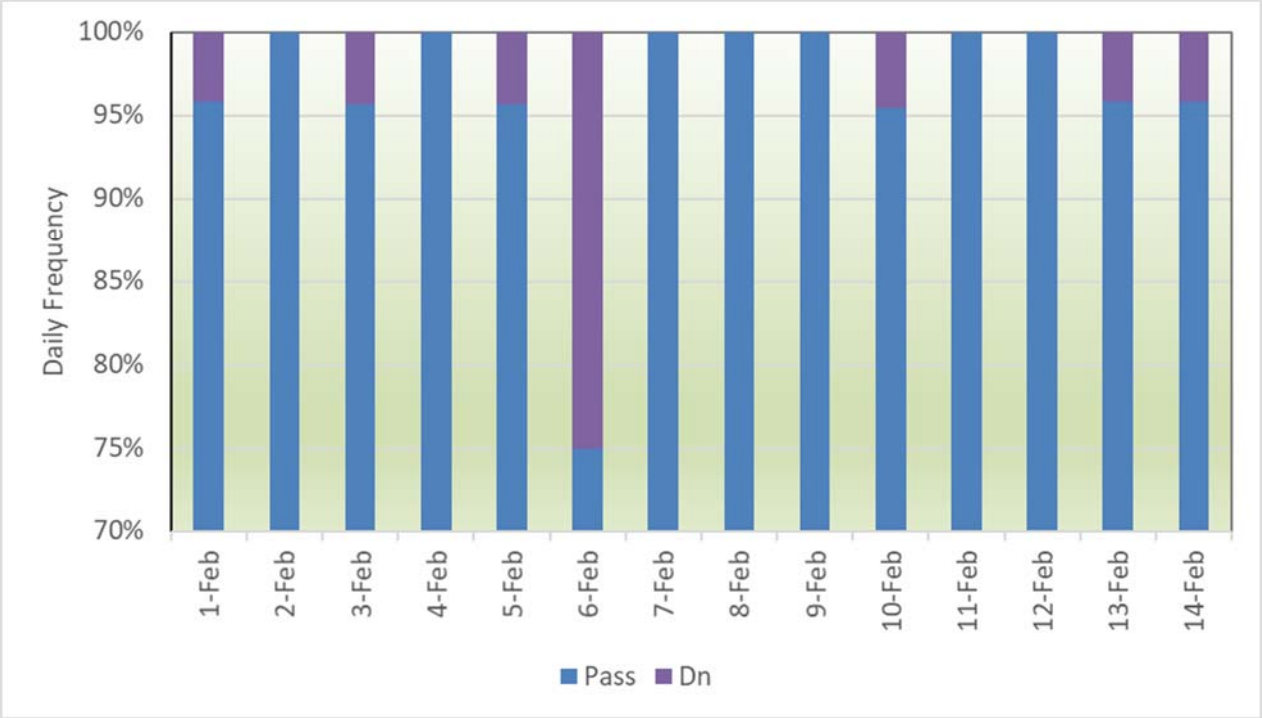
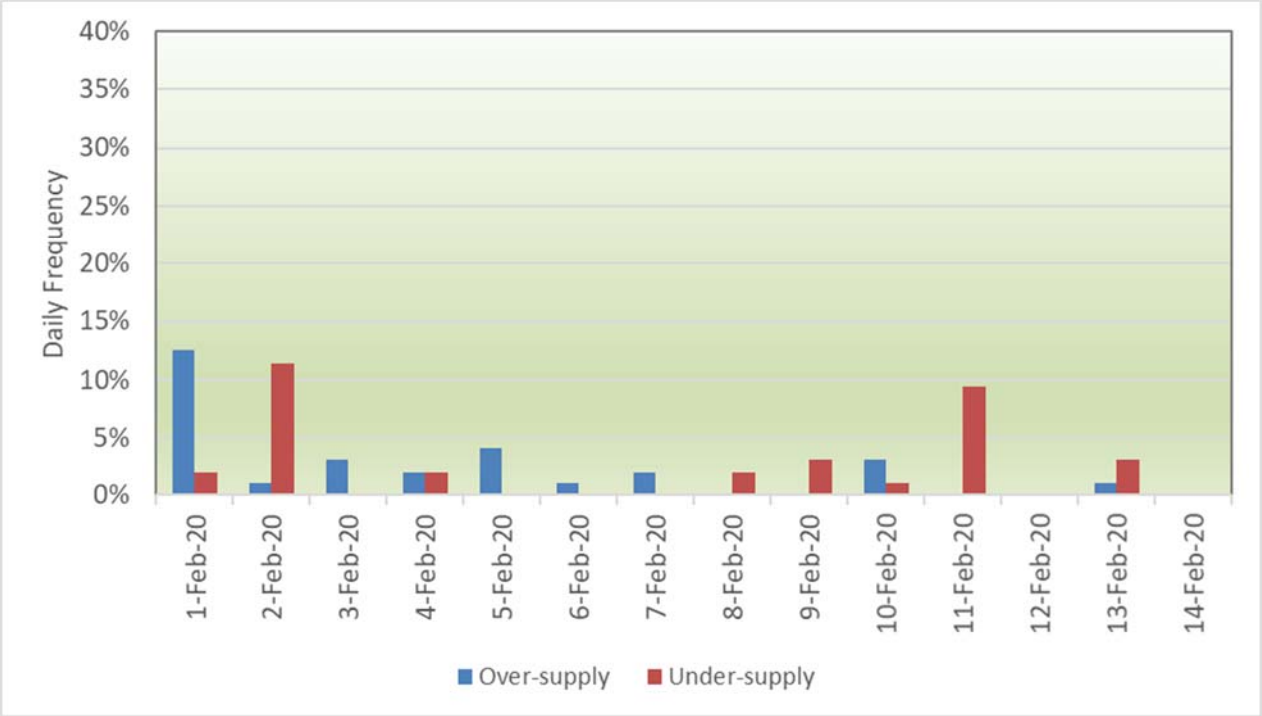


Figure 5 and 6 shows the frequency of power balance infeasibilities for both under-generation and over-generation conditions in both the FMM and RTD markets. The power balance constraint infeasibilities are pegged to the corresponding penalty prices, of $1000/MWh for under-supply infeasibilities, and about -$150/MWh for over-supply infeasibilities. However, during parallel operations, the EIM market for SCL has been set-up to run under the conditions reflecting the price discovery mechanism that is in effect under the transitional 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[1] 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.

[1] *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 14 for the Fifteen Minute Market (FMM), SCL had under-supply power balance infeasibilities for 2.16 percent of intervals and over-supply infeasibilities for 2.46 percent of intervals. For the five-minute market, SCL had under-supply power balance infeasibilities for 6.62 percent of intervals and over-supply power balance infeasibilities for 10.34 percent of intervals.

There are six main drivers for under-gen and over-gen infeasibilities observed for the SCL BAA. Fist, some of the SCL resources have Forbidden Operating Regions (FOR) that limit the dispatch ability range in the market. Let us consider one resources with a FOR from 40 MW to 150 MW. On February 2, in hour ending one, SCL had under-gen infeasibilities because this resource received an award at the lower end of FOR. If the resource was dispatched at the upper end of FOR SCL would observe an over-gen infeasibility. For these market intervals SCL could not rely on EIM transfers to meet its imbalance energy requirements because its EIM transfers were locked. Second, on February 3, hour ending 1, February 5 hour ending 10, February 10 hour ending 15, SCL was missing economic bid in the fifteen minute market; the root cause of missing bids is explained in the previous section. Since there were no economic bids to respond to hourly imbalances, SCL observed either an under-gen or over-gen infeasibilities. Third, for few FMM intervals, SCL had limited capacity to meet either the incremental or decrement imbalance requirement, at the same time, its EIM transfers were locked. The over-gen and under-gen infeasibilities for February 4, 7 and 9 were driven by this condition. Fourth, some of the FMM infeasibilities were driven by telemetry set-up in parallel operations. On February 8 in hour ending 7 and 9, market was receiving telemetry from SCL resources, at the same time, these resource were not following ISO market instructions. There were a couple of units online based on the telemetry but these units had no base schedules. In order to account

for this energy, market considers this unit will operate at its telemetered value, thus there was excess generation online, which drove the over-gen infeasibility. Fifth, on February 11 between hour ending 17 through 19, SCL operators inadvertently entered an outage for two resources, which limited the pool of available resources to meet the imbalance energy requirements. Sixth, for some market intervals, there were unusually large adjustment to demand such that there was not enough room on the supply side to meet this additional imbalance requirement. On February 2 in hour, ending one there was an imbalance conformance of -155 MW, which drove the over-gen infeasibility.

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

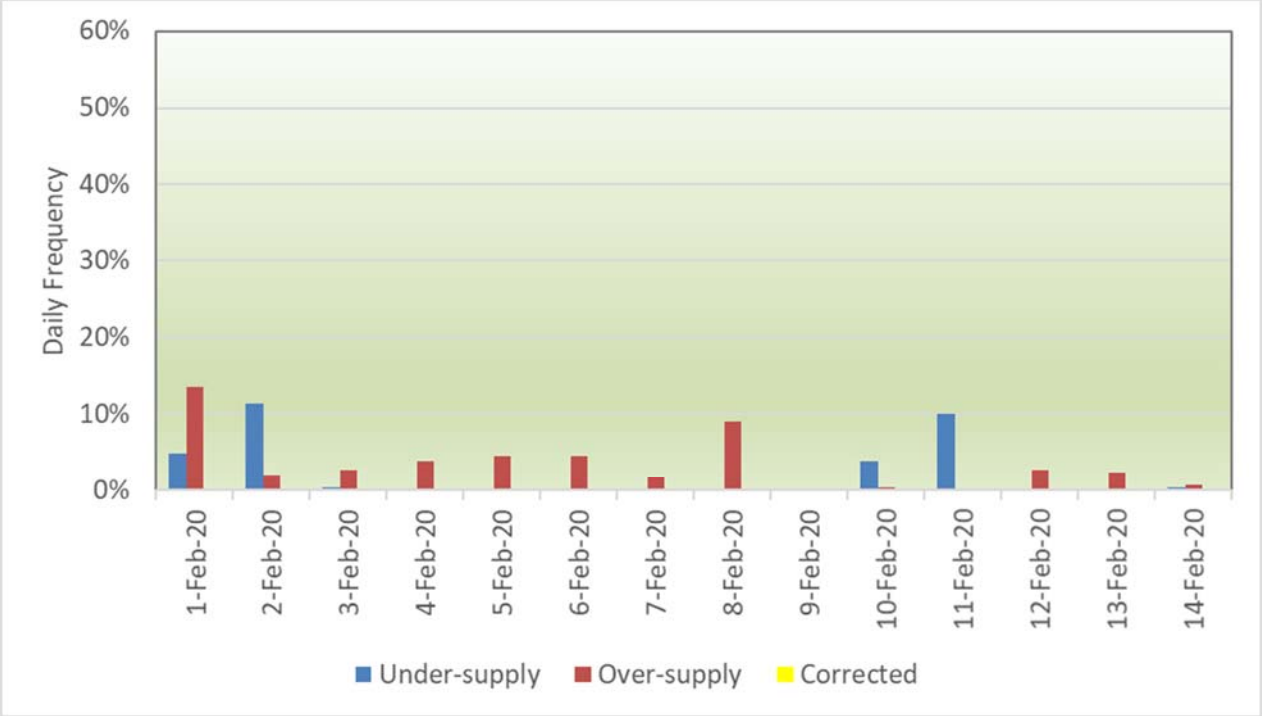


Figure 7 and 8 show the daily average ELAP LMPs for the fifteen-minute market and the five-minute markets. The average daily prices from February 1 through February 14 in the fifteen market were between -$9.11/MWh and $34.44/MWh. The average five-minute prices were between -$35.73/MWh and $249/MWh.

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. For all trade dates between February 1 through February 14, 89 percent of intervals observed prices between $0/MWh and $50/MWh, 11 percent of intervals observed prices between -$30/MWh and $0/MWh. Similarly, for all trade dates between February 1 through February 14, about 70 percent of intervals observed prices between $0/MWh and $50/MWh, 11 percent of intervals observed prices less than -$30/MWh and $0/MWh and the remaining 19 percent of intervals observed prices in rest of the price bins.

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

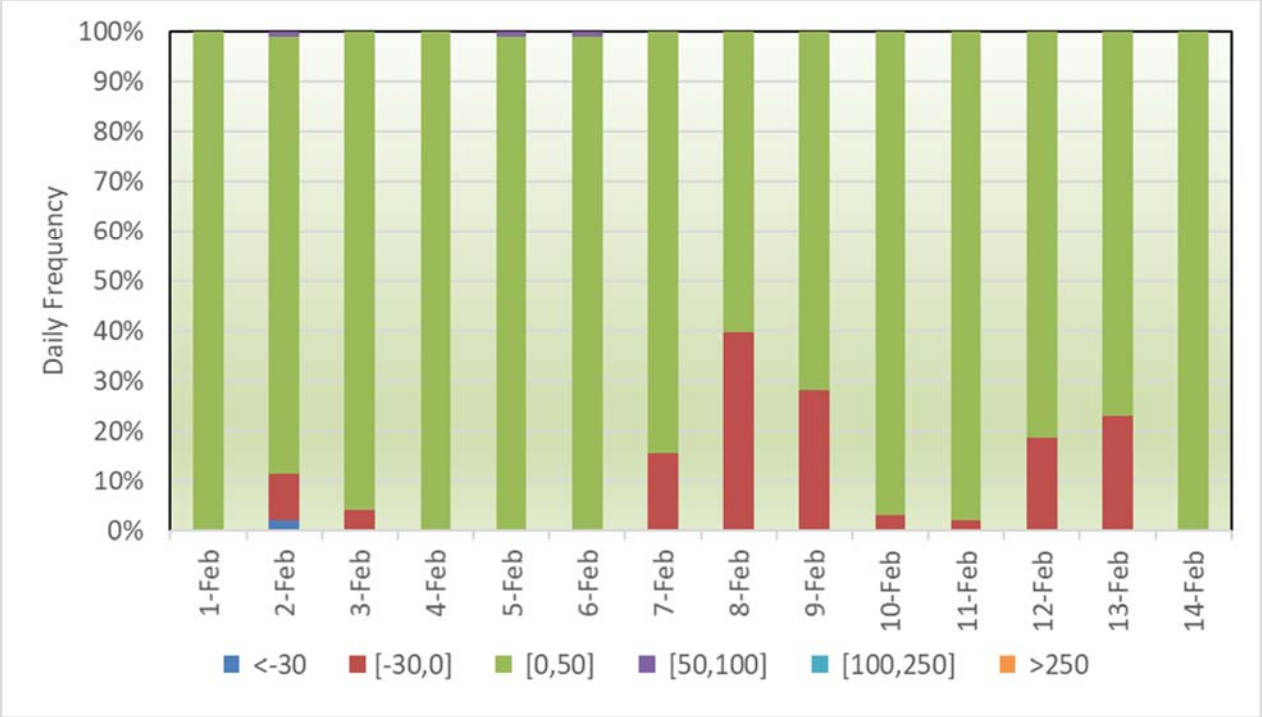
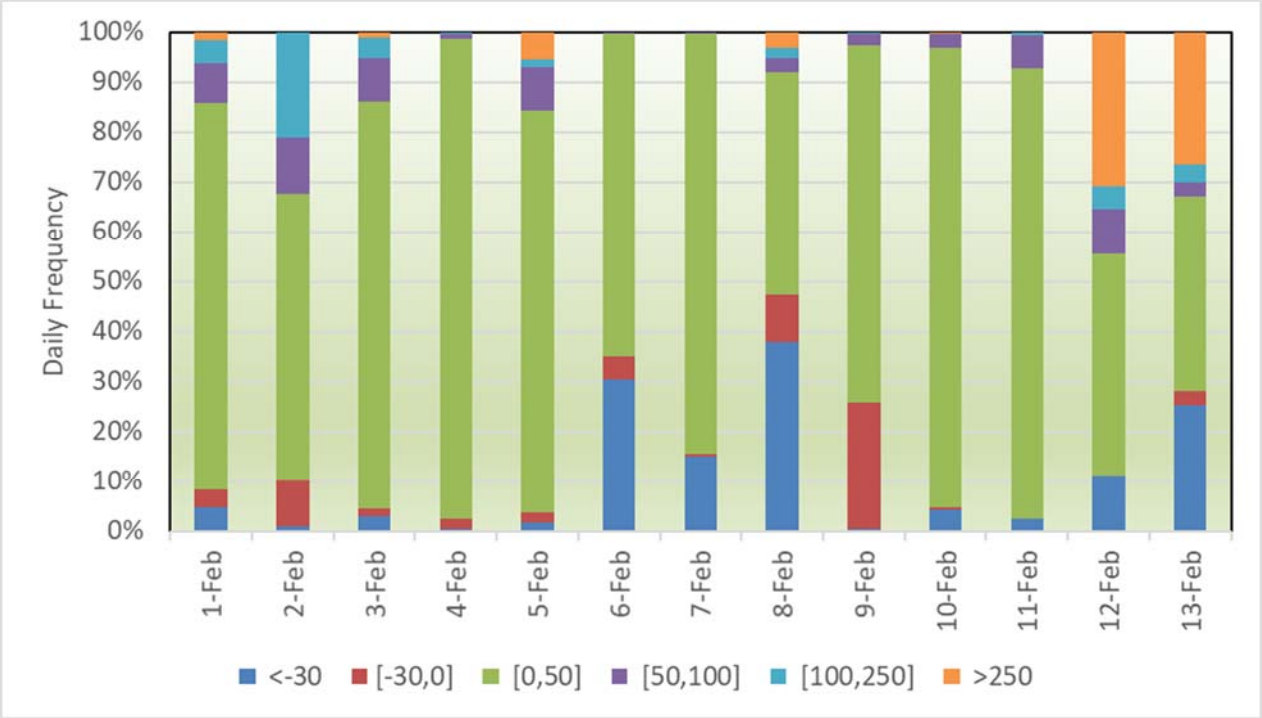


Figure 9: Daily frequency of five-minute prices organized by price ranges



Market Validation Items

1. SCL Bids
   Type of issue: Bid submission issue

   SCL manages its bid submission process through a software application developed by its vendor. For some trading hours, the SCL bid submission application failed to submit resource bids to the ISO SIBR application. Because of this issue, SCL failed the bid-range capacity test, the flexible ramp sufficiency test, and observed power-balance infeasibilities in both fifteen and five-minute markets.

2. SCL Resource Set-up
   Type of issue – Self-schedules impacting capacity test

   EIM entities submit energy base schedules in order to pass balancing tests. All resources with energy base schedules above zero are considered to be always online, but their dispatch level in both fifteen and five minute market are based on incremental bids. EIM resources also have the option to submit self-schedules that provides a signal to the market that the resource would like to operate at its self-scheduled level and not based on incremental bids. When resources have self-schedules in the market it limits the total available bid-in capacity towards the bid-range capacity test.

Type of issue - Forbidden region

Some of the SCL resources have a Forbidden Operating Regions (FOR), for instance one resources has an FOR from 40 MW to 150 MW. Market cannot dispatch the resource in the FOR, in other words, for any given market interval the resource has be dispatched either below 40 MW or above 150 MW. This poses a challenge to the market solution because in some instances if the resource is dispatched at 40 MW, it may create conditions for under-gen balance infeasibility. On the other hand, when the resource is dispatched to 150 it may lead to over-gen infeasibility. Thus having FOR reduces the available flexibility in the BAA. There were some fifteen-minute market intervals in which SCL observed over-gen infeasibility because of this FOR.

3. Outage set-up
   Type of issue – inadvertent outage
   SCL operators inadvertently entered an outage for two resources even though these resources had energy base schedules. When a resource has energy base schedules, market expects these resources to be online. As a result of these outages, SCL observed balancing failures, bid range capacity failures and under-supply power balance infeasibilities.

4. Resource Telemetry

   Type of issue: Incorrect Telemetry
   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 simulation issues, bad telemetry data was used for several resources. It caused erroneous starting points for resources and resulted in over-supply and under-supply infeasibilities.

5. Base Schedule submission
   Type of issue: Data transfer
   All EIM participants submit their base schedules to the ISO's Base Schedule Application Portal (BSAP) for each trading hour before the submission deadline. Subsequently, this information is passed on to various downstream applications that perform various resources sufficiency test, including the balancing test. For a couple of isolated hours, the data transfer between BSAP and BAAOP failed. As a result, SCL failed the balancing test even though SCL had balanced base schedules in BSAP. This issue impacted one bid-range capacity test failure for February 11, 2020.

6. VER resource Forecast

Type of issue: VER Forecast

For the duration of parallel operations, the ISO market application was receiving forecast for resources of one BAA but was missing the forecast data for the rest of resources in the other BAAs. Therefore, in both the fifteen- and five-minute markets, VER resources were dispatched based on their bids received in the production system. Also, for several intermittent five-minute intervals, the market was receiving wind forecast information only for ISO resources; as a result, there was a significant difference in the VER dispatches between two consecutive five-minute intervals. In

addition, the same issue resulted in large differences in VER dispatches between fifteen and five-minute markets.

Type of issue: VER persistence

Starting on February 12, 2020, in the parallel-operations environment, the ISO market application was using a telemetry simulator. 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 13, 2020.

7. Software Defects

During parallel operations, one software defect was identified that impacted the market solutions.

a. 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 substantially 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 SCL, and it failed the flex ramp down sufficiency test. This issue was reported to our software vendor on February 18, 2020. The software vendor has fixed this issue and provided an update to the current production software version. The ISO is currently testing these updates, and once this software version passes ISO's validation process, it will be deployed in production before the SCL go-live date of April 1, 2020.

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 14. 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 SCL are capable of operating in production.