



California ISO

Energy Imbalance Market (EIM) Entity Readiness Criteria

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1 Introduction

The Energy Imbalance Market (EIM) is a real-time market to dispatch economic bids voluntarily offered by participating resources to efficiently balance supply, transfers between balancing authority areas (BAA), and load across its footprint. The EIM was launched on November 1, 2014 with PacifiCorp as the first EIM Entity. Soon after the initial launch, the CAISO sought a pricing waiver prompted by operational conditions that were not fully anticipated by the implementation. On December 1, 2014 the Federal Energy Regulatory Commission (FERC) granted the CAISO's petition for limited waiver of the pricing parameters as they pertain to EIM.

As part of the ensuing regulatory process, FERC provided the CAISO a directive to create readiness criteria. The directive requires the CAISO and new EIM Entities to develop readiness criteria that includes a robust market simulation and period of parallel operation for the new EIM Entity; defined criteria developed with the comments of interested stakeholders in a stakeholder process; and a requirement that the CAISO and the new EIM Entity submit a certification of readiness of the EIM Entity's processes and systems, including all communication systems and transparency to the CAISO of unit status, at thirty days before the EIM Entity fully activates its EIM operations.

To develop the readiness criteria, the CAISO has commenced the discussion with stakeholders by providing an outline of the stages of implementation contemplated by its implementation agreement with new EIM Entities. The stages of implementation include rigorous processes to develop and integrate a full and accurate network model of the EIM Entity's balancing authority area into the CAISO's network model; develop all software systems required by the EIM Entity and any of its registered participating resources to communicate with relevant CAISO systems; integrate and perform end-to-end testing of those systems to ensure successful communication; train system operators for EIM operations; and perform market simulation to ensure that the operators and software consistently perform according to anticipated market outcomes in various anticipated normal and constrained scenarios. The foregoing stages of implementation incorporate as applicable lessons learned from the implementation and operational experience of prior new EIM Entities and of the CAISO. In addition, software design and testing includes incorporating market and operations design changes developed during the EIM Year 1 Enhancements stakeholder process, in anticipation of authorization of those changes by FERC.

Implementation of expansion of the EIM to new EIM Entity balancing authority areas has already benefited by seven full months of EIM operation and the EIM Year 1 Enhancements stakeholder process. The CAISO and the existing EIM Entity are no longer in the position of implementing a new tariff, and have observed and developed appropriate responses to many of the operational issues that may arise within the EIM footprint. As shown by the market performance reports supporting the FERC directive to develop measurable readiness criteria, the occurrence of price excursions in EIM operations has decreased considerably as a result of experience and efforts to better understand how conditions and operations affect market outcomes. This understanding not only augments and strengthens the implementation plan for

entering and future EIM Entities, but also adds to the efficiency and success of market simulation and parallel testing. During parallel operations the CAISO will also report on the similar information regarding market performance including observed frequency and causes for any observed infeasibilities during parallel operations.

At the end of implementation, the CAISO and the EIM Entity will certify that its market simulation has demonstrated the systems and individuals involved in operations are ready to operate as anticipated under normal and foreseeable constrained conditions. The stakeholder process strengthens the implementation process by holding the CAISO and the EIM Entity publicly accountable to the implementation activities and how those activities prepare the CAISO and EIM Entity for market operations. Readiness certification is not intended to be, nor can it be, a guarantee of issue-free market operation as of the date of EIM Entity activation. Therefore, the certification will also acknowledge the thirty full days of parallel production that the EIM Entity will engage before implementing a financially binding market. Parallel production will allow the EIM Entity to experience operations in an environment that more closely emulates real time operation than the market simulation. Parallel production does not precisely emulate real time operations, however, and therefore cannot guarantee that the EIM Entity will experience all possible market conditions or operational issues in advance of financially-binding activation. Thus, the length of the parallel operations period is designed to allow the EIM Entity to experience responding to a significant array of foreseeable market conditions at least once before live operations. As discussed further below in the section addressing certification, the CAISO and EIM Entity will not certify as to results or performance during the parallel production phase; the certification will attest, however, that neither the CAISO or EIM Entity will seek to initiate the market at the end of thirty days if (1) any unexpected conditions or issues arise during that period that undermine grid operation or market operation within the existing EIM or CAISO footprint, and (2) any such issues are neither corrected nor verified as resolved as of the scheduled go-live date.

This document along with the requirements outlined in the Implementation Agreement constitutes the measurable readiness criteria¹ requested by FERC in the FPA 206 Proceedings to be used to predicate entry of a new EIM Entity into EIM (the “Readiness Criteria”). The content of this document will eventually be added to the CAISO EIM Business Practice Manual.

2 Readiness Criteria Categories

The readiness criteria are intended to support readiness certification prior to implementation. Leading to certification, the EIM Entity and CAISO will conduct appropriate steps to ensure that each criteria is evaluated compared with the metric and threshold.

- EIM Entity Full Network Model Integration – in order to participate in EIM, the EIM Entity Initiate’s full network model is integrated into CAISO full network model. This activity precedes testing and is demonstrated during market simulation. The incorporation of the

¹ *California Indep. Sys. Operator Corp.*, 150 FERC ¶ 61,191 at P 34 (FPA 206 Proceedings).

EIM Entity's network model into CAISO's production full network model follows the standard promotion process and timing.

- Agreements – prior to the established implementation date, the EIM Entity initiate must execute all necessary agreements in accordance with the timelines described in section 5 of the EIM Business Practice Manual.
- Training –CAISO provides training for EIM Entity Initiate Operators before and during market simulation. All training is to be completed prior to the start of parallel production.
- Forecasts – forecasting capabilities are established and measured during the market simulation.
- Balanced Schedules– balanced schedule capabilities are measured during the market simulation.
- Operating Procedures - the EIM Entity Initiate and CAISO will review and test applicable operating procedures prior to the start of parallel production.
- System Readiness & Integration - the EIM Entity Initiate and CAISO will perform functional and system testing and system integration testing.
- Market Simulation - the CAISO will conduct a market simulation for the EIM Entity Initiate and any participating resource scheduling coordinators registered with the EIM Entity Initiate prior to that new EIM Entity Initiate entering EIM.
- Settlements – the CAISO submits a settlement statement to the EIM Entity Initiate including EIM participating and non-participating resources and load. The EIM Entity Initiate will verify the accuracy of the CAISO settlement statement to the EIM Entity Initiate. Prior to financially binding operations, the EIM Entity Initiate will demonstrate it can produce allocations of the CAISO settlement to its customers that are verifiably accurate against available data.
- Monitoring – the CAISO ensures that the CAISO Market Analysis Team and the Department of Market Monitoring have the data that is required to adequately monitor market performance.
- Parallel Operations Planning – the CAISO and EIM Entity Initiate ensure that systems, processes and staff are prepared for deployment of systems, parallel production, and support beyond parallel operations for issues that may arise.
- Communication - the CAISO and EIM Entity Initiate ensure all tools and procedures used for communication between the CAISO and EIM Entity Initiate are in place and tested before the implementation date

2.1 Readiness Metrics, Criteria, and Thresholds

Readiness Criterion Identifier	Readiness Category	Criteria	Metric	Threshold*
1	EIM Entity Initiate 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 EIM Entity Initiate network model file	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
2	EIM Entity Initiate Full Network Model Integration	Comparison of SCADA measurement	SCADA measurements used in EIM Entity Initiate's EMS model matches the measurements observed by the CAISO through the CAISO EMS model	Critical and used SCADA measurements matches 90% to start parallel operation and 95% before full activation, measured in MW, outside of any exception in EMS model
3	EIM Entity Initiate Full Network Model Integration	State Estimator solution	CAISO state estimator solution is equivalent or superior to the EIM Entity Initiate's 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
4	EIM Entity Initiate Full Network Model Integration	Non-Conforming Load, Behind-the-Meter Generation, Pseudo Ties, and Dynamic Schedules	Physical representation of the EIM Entity Initiate's network matches the Base Market Model that accounts for non-conforming load, behind-the-meter generation, Pseudo-Ties, and Dynamic Schedules, as applicable	EIM Entity major non-conforming loads > 5% of EIM Entity total actual load in MW are modeled separately from conforming load in market model

Readiness Criterion Identifier	Readiness Category	Criteria	Metric	Threshold*
5	Agreements	Execution of Necessary Agreements	The EIM Entity Initiate has executed all necessary agreements.	The EIM Entity Initiate will execute all agreements, as outlined in Section 5 of the EIM BPM within the required timelines outlined in Section 5.
6	Operations Training	Mandatory courses completion	EIM Entity Initiate Operators complete CAISO training modules.	<p>EIM Entity Operators complete training and close-of-training assessment in the appropriate timeframes as outlined in</p> <ul style="list-style-type: none"> • “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.
7	Forecasting Capability	Load forecast capability established	<p>Definition of EIM demand forecast boundaries based on the conforming and non-conforming Load characteristics, as applicable</p> <ul style="list-style-type: none"> • 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).

Readiness Criterion Identifier	Readiness Category	Criteria	Metric	Threshold*
8	Forecasting Capability	Variable Energy Resource forecast capability established	Identification of the source of Variable Energy Resource forecasts. (If a participating wind or solar unit requires an CAISO forecast, then BPM/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.
9	Forecasting Capability	Flexible capacity requirements	CAISO has established flexible capacity requirements for the EIM Entity Initiate's Balancing Authority Area and the combined EIM Area including the EIM Entity Initiate	The CAISO has received and stored all historical data from the EIM Entity Initiate necessary and sufficient for the CAISO to perform the flexible ramp requirement.
10	Balanced Schedules	Base schedule balancing capability	The EIM Entity Initiate's Scheduling Coordinator demonstrates its ability to balance EIM Demand and EIM Supply	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 a two day period before full activation. The CAISO will provide examples of MW thresholds for each EIM Entity Initiate 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 interval to the next.
11	Balanced Schedules	Flexible ramping sufficiency test capability	The EIM Entity Initiate's 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 two days before full activation

Readiness Criterion Identifier	Readiness Category	Criteria	Metric	Threshold*
12	Balanced Schedules	Capacity test capability	The EIM Entity Initiate's 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 two 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.
13	Operating Procedures	CAISO Operating Procedures (relevant to EIM operations)	The EIM Entity Initiate signs CAISO non-disclosure agreement and receives appropriate CAISO ISO "public" and "restricted" operating procedures	Operating Procedures NDA signed by EIM Entity Initiate. EIM Entity Initiate receives CAISO Operating Procedures four months prior to the parallel operations date.
14	Operating Procedures	EIM Entity Initiate's Operating Procedures	The EIM Entity Initiate's Operating Procedures are defined, updated, and tested for the EIM Entity Scheduling Coordinator	The EIM Entity Initiate's Operating Procedures are updated tested and implemented prior to parallel operations date.
15	System Readiness & Integration	Functional Testing	The EIM Entity Initiate 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 and workarounds will be developed as appropriate.
16	System Readiness & Integration	System Integration	The EIM Entity Initiate 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 and workarounds will be developed as appropriate.

Readiness Criterion Identifier	Readiness Category	Criteria	Metric	Threshold*
17	System Readiness & Integration	EIM Entity Initiate's system access complete	All EIM Entity Initiate employees who require system access to perform EIM-related job functions identified and have necessary certificates.	<p>All EIM Employees performing job functions for EIM market are identified.</p> <p>All CASIO issued certificates are requested within the appropriate timeframes.</p> <p>All identified employees provided the necessary EIM system access certificates.</p>
18	System Readiness & Integration	ISO - EIM Entity Initiate interfaces	Data interfaces between EIM Entity Initiate systems and CAISO systems tested	<p>ISO and EIM Entity identify significant data interface issues.</p> <p>EIM Entity and CAISO executives to approve exceptions.</p>
19	Market Simulation	Day in the life simulation	EIM Entity Initiate Operators are able to meet the market timelines	The EIM Entity Initiate operations staff complete end-to-end daily market workflow with no critical defects or workarounds.
20	Market Simulation	Structured scenarios simulation	EIM Entity Initiate Operators execute and pass all structured scenarios provided by CAISO	<p>All significant issues resolved or have a feasible workaround.</p> <p>EIM Entity Initiate and CAISO executives approve exceptions.</p>
21	Market Simulation	Unstructured scenarios simulation	EIM Entity Initiate Operators execute and pass all unstructured scenarios provided by EIM Entity Initiate	<p>Significant issues resolved or have a feasible workarounds.</p> <p>EIM Entity Initiate and CAISO executives approve exceptions.</p>

Readiness Criterion Identifier	Readiness Category	Criteria	Metric	Threshold*
22	Market Simulation	Market results reports	Market results are appropriate based on inputs	The EIM Entity Initiate and CAISO executive project sponsors approve the market results reports during market simulation.
23	Market Simulation	Market quality review	Prices are validated based on input data	Market simulation prices and MWs schedules/dispatches are validated by CAISO market quality team for entry into parallel operation
24	Settlements	ISO Settlement Statements and Invoices published to EIM Entity and EIM Participating Resources	The CAISO Settlement statements and invoices match the operational data 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 are verifiably accurate against available data.
25	Settlements	EIM Entity Settlement Statements and Invoices reflecting allocations to EIM Entity customers are accurate prior to financially binding operations.	Verification that settlement statements and invoices accurately reflects system and market data	The EIM Entity Initiate's Settlement Statements and Invoices that allocate charges and credits to its customers accurately reflect system and market data during parallel operations. .
26	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.
27	Parallel Operations Plan	Deployment plan	CAISO will publish system outage timelines within operational limits prior to parallel operations	Parallel operations runs consistently within market disruption tolerances as defined by the CAISO's tariff and BPM.

Readiness Criterion Identifier	Readiness Category	Criteria	Metric	Threshold*
28	Outage Management System	Transmission and generation outage submittal and retrieval	EIM Entity Initiate will verify its ability to submit and retrieve outage information with the CAISO	The EIM Entity Initiate 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.
29	Communications between the CAISO and the EIM Entity Initiate	Voice and/or electronic messaging	Process and procedures used for voice and/or electronic messaging are implemented	The process and procedures are incorporated into the EIM Entities Initiate's business processes before the start of market simulation.
30	Communications between the CAISO and the EIM Entity Initiate	Communication tools	Staff are trained on communication procedures and tools	The EIM Entity Initiate operations staff are trained on the relevant Operating Procedures and tools used for EIM related communications before the start of parallel operations.

Exceptions to Thresholds

Any exceptions to the adherence to the thresholds listed above will be explained in the readiness certification process to the Federal Energy Regulatory Commission. **(Process is TBD)** With each new EIM Entity implementation, the CAISO will revisit the readiness thresholds and make modifications based on stakeholder feedback.

2.2 Readiness Reporting, Determination & Certification

Welcome to the *Readiness Certification* section of the *CAISO BPM for the Energy Imbalance Market*. In this section you will find the following information:

- Timeline in which CAISO will report on the status of readiness criteria
- Timeline in which the CAISO and the EIM Entity Initiate will determine readiness
- Timelines in which CAISO and the EIM Entity Initiate will submit readiness certification to the Federal Energy Regulatory Commission

Readiness Reporting

CAISO will report at least monthly during market simulation and at least twice a month during parallel operations on the status of the readiness criteria. The reporting will be on the public CAISO web site (www.aiso.com), and will consist of current progress towards readiness thresholds and any exceptions or deviations from the readiness thresholds.

Readiness Determination

At least 30 days prior established implementation date and after an adequate period of parallel operations, the CAISO and EIM Entity Initiate will jointly determine whether the EIM Entity Initiate's systems and processes will be ready for participation in the Energy Imbalance Market. This decision will establish a timeline to file for readiness certification.

Readiness Certification

CAISO and EIM Entity Initiate will track their progress and report on readiness criteria prior to filing for EIM readiness certification. Both parties will file a market readiness certificate with the Federal Energy Regulatory Commission 30 days in advance of the EIM Entity Initiate established implementation date. The readiness certification will cover the following information:

- The status of all readiness criteria
- Any known issues that are expected to be resolved prior to the established Implementation Date
- Any exceptions or deviations from the readiness thresholds outlined in the most current CASIO EIM BPM

If, based on completion status of the readiness criteria the CAISO or the EIM Entity Initiate agree to a change in the implementation date, the CAISO will notify the Federal Energy Regulatory Commission of the delay, the reason for the delay, and whether it will postpone submission or withdraw its readiness certificate.

3 Market Simulation

The CAISO conducts market simulations on a regular basis as part of its process of bringing new initiatives to its markets. The market simulation process for EIM Entities provides each EIM Entity an opportunity to test their systems and procedures in advance of the market implementation. The market simulation process serves a number of purposes for both the CAISO and new entrants. It also facilitates an effective market operations dress rehearsal and helps expedite a smooth production launch.

The EIM Entity and any participating resource scheduling coordinators registered with the EIM Entity actively participate in the market simulation testing and related activity. The CAISO will hold regular calls during the market simulation period to discuss the activity, the results

observed, and any responses or adjustments to software or market operation necessitated by those results. The CAISO announces these calls and makes them open to all interested stakeholders.

The benefits of market simulation designed for new EIM Entities include:

- Allowing for system or procedural problem identification and mitigation before the market is operationally or financially binding.
- Enabling market participants to observe the behavior of CAISO systems and markets in a simulated production environment, particularly in regard to new functions and features introduced through the addition of the modifications.
- Establishing confidence in the operational processes and systems associated with the new market functionality implementation.
- Providing a hands-on environment to allow the EIM Entity and its registered participating resources to interact with new and unique features and functionality.
- Providing an environment where market participants can scrutinize and tailor their own tools, applications, and business practices to participate in new market functionality.
- Providing a means of capturing additional market participant input and feedback regarding the implementation of the new market features and functionality, beyond what might have been received in the stakeholder process.
- Providing the EIM Entity and its registered market participants the tools to help determine:
 - Proper exchange of market related data and validation of new timelines.
 - Common understanding of data submittal requirements and timelines.
 - Familiarity with market rules and timelines.

The primary purpose of market simulation is to provide external participants the ability to test their systems while familiarizing themselves with CAISO's new functionality. Each simulation generally has two phases: Structured and Unstructured Market Simulation Scenario Testing.

- Structured Market Simulation Scenarios - CAISO provides all data input files including bids while modeling market conditions to test the desired scenarios results. Structured scenarios impact multiple CAISO systems and generally end with a published Settlement statement. CAISO then provides the participants the specifics of the scenario as well as bid inputs for their requested resources in a secure manner.
- Unstructured Market Simulation Scenarios - Similar to structured scenarios but provides market participants the ability to submit bids on behalf of their participating resource bids. CAISO also works with market participants directly if they would like to see specific resources dispatched or market conditions modeled to meet their desired results. Settlement statements may be provided as requested by market participants and accepted by the CAISO and EIM Entities. The CAISO typically conducts public calls during market simulation to report status and address any questions or issues so that all market participants are informed of the results that the CAISO is observing and the issues that are identified. Issues are submitted via the CAISO's Customer Issues, Disputes and Inquires (CIDI) tool. The CAISO typically reports on:
 - Stability of market runs during monitored hours
 - Participation levels during the market simulation

- Missing SCADA points, mismatches in network model and ongoing efforts to remedy them
- Significant issues and expected timeline to resolve.
- Structured market simulation results, associated analysis and CAISO's determination of success/failure.

4 Supplementation Documentation

EIM Training Catalog: additional information regarding training provided by the EIM Market Operator to new EIM Entities, including a description, highlights, suggested audience, delivery method and prerequisites. It is available at this link:

<http://www.caiso.com/Documents/EnergyImbalanceMarketTrainingCatalog.pdf>

Day in the Life: additional information regarding EIM testing conducted prior to market entry. This document provides CAISO applications and functionality, system interfaces, and market timeline information that is the basis for testing. It is available at this link:

http://www.caiso.com/Documents/DayInTheLife_EnergyImbalanceMarket.pdf

EIM Structured Market Simulation Scenarios: additional information regarding EIM bid to bill Structured scenarios conducted prior to market entry. This document provides the description, EIM Entity action, CAISO action and expected outcome for each structured scenario. The Structured scenarios planned for the 2015 implementation with NV Energy are posted at this link:

<http://www.caiso.com/Documents/EIM-NVEand1YearEnhancementsStructuredScenarios11.pdf>

Fall 2015 Release Market Simulation Plan: additional information regarding the market simulation plan leading to the October 1, 2015 entry of NV Energy as an EIM Entity is posted at:

http://www.caiso.com/Documents/MarketSimulationPlanExternalFallRelease2015_draftv1.pdf