Energy Imbalance Market Overview

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Overview

- What is the EIM?
- Definitions
- Base Schedules
- Greenhouse Gas Bid
- BAA Sufficiency Tests
- Flexible Ramp Capacity Constraints
- Contingency Dispatch
- EIM Data Interfaces
What is the EIM?

- Extension of the Real-Time Market to participating Balancing Authority Areas (BAAs)
- What is included in EIM?
  - Unit commitment
  - Congestion management
  - 15min market
  - 5min dispatch
- What is not included in EIM?
  - Capacity Ancillary Services (except Flexible Ramping)
  - Contingency Dispatch
Definitions

- **Energy Imbalance Market (EIM)** is operation of the ISO’s real-time market to manage transmission congestion and optimize procurement of energy to balance supply and demand for the CISO and EIM BAAs combined (EIM Area)

- **Market Operator** is the CAISO
Definitions

- **EIM Entity** is a BAA that
  - Represents one or more Transmission Service Providers that make transmission available for EIM
  - Enters into the pro forma EIM Entity Agreement to enable the EIM in its BAA
  - Determines the resources and the transmission service required for eligibility to participate in the EIM
  - By enabling the EIM, real-time load and generation imbalances within the EIM BAA will be settled through the EIM
Definitions

- **EIM Entity Scheduling Coordinator** is the EIM Entity (or a designated third-party) that
  - Is certified by the ISO
  - Enters into the pro forma EIM Entity Scheduling Coordinator Agreement, under which it is responsible for
    - Approving resource plans for the EIM Entity BAA
    - Uninstructed imbalance energy settlement of resources not participating in EIM
    - Distributing costs or revenues from uplift allocations to the EIM Entity BAA
Definitions

- **EIM Participating Resource** is a resource located within the EIM Entity BAA that
  - Is eligible and elects to participate in the EIM
  - Enters into the pro forma EIM Participating Resource Agreement
  - Resource eligibility
    - In the 15/5-minute market, dispatchable resources that can produce/consume energy or provide demand response
    - In the 15-minute market, imports and exports that can be scheduled on a 15-minute basis
Definitions

- **EIM Participating Resource Scheduling Coordinator** is the participating resource (or a designated third-party) that
  - Is certified by the ISO
  - Enters into the pro forma EIM Participating Resource Scheduling Coordinator Agreement
  - The EIM Participating Resource Scheduling Coordinator interfaces with the Market Operator:
    - Submit resource plans
    - Receive market awards and dispatch instructions
    - Receive settlement statements and bills
Definitions

- **EIM Transmission Service Provider** is a transmission owner or customer (may be a 3rd party separate from the EIM Entity) that
  - Controls transmission in the EIM Entity BAA
  - Can voluntarily inform the EIM Entity that it is making its transmission available for EIM

- **EIM Transfer** is a transfer of real-time energy between a BAA in the EIM Area and the rest of the EIM Area using transmission capacity available in the EIM
Definitions

- **Base Schedule** is a forward hourly energy schedule
  - It is the reference for measuring imbalance deviations for EIM settlement
  - It includes generation and interchange schedules, and load forecast

- **Resource Plan** is the combination of
  - Base schedules
  - Energy bids
  - Ancillary services schedules
Definitions

- **Base Schedule Coordinator** is the participating or non-participating resource (or a designated third-party) that submits base schedules and ancillary services schedules.

- **EIM Entity Base Schedule Coordinator** is the EIM Entity (or a designated third-party) that submits base schedules and ancillary services for EIM non-participating resources, and all EIM resources after $T-55'$.
Current EIM Status
Energy Imbalance Market Overview

Compile Hourly Resource Plan

- Demand Forecast
- Variable Energy Forecast
- Transmission Outages
- Generation Outages
- Transmission Limits

- Participating resource hourly base schedule
- Participating resource energy bid range
- Non-participating resource hourly base schedule
- Hourly interchange schedules
Energy Imbalance Market Overview

Hourly Base Schedules

Resource Sufficiency Evaluation

Final Hourly Resource Plan

Test Results

$T-75', T-55'$

$T-40'$
Energy Imbalance Market Overview

Economic Bids
- Demand Forecast
- Variable Energy Forecast
- Transmission Outages
- Generation Outages
- Transmission Limits

15-Minute Schedule
- Unit commitment for short-start resources

EIM 15-Minute Market
Energy Imbalance Market Overview

- Economic Bids
- Demand Forecast
- Variable Energy Forecast
- Transmission Outages
- Generation Outages
- Transmission Limits
- State Estimator

EIM 5-Minute Dispatch

Dispatch Instructions
Energy Imbalance Market Overview

Hourly Base Schedule

15-Minute Schedule

5-Minute Dispatch

Meter

EIM Settlement

EIMPR SC Settlement Statement

EIM Entity SC Settlement Statement for EIMNPR

EIM Entity SC Settlement Statement for EIM BAA Neutrality
Base Schedules

- Used to model hourly BAA generation and load before the RTM
  - Calculated for Non-EIM BAAs
  - Submitted by BSCs for EIM BAAs ($T-75'$, $T-55'$, $T-40'$)
  - Used as reference for Imbalance Energy settlement

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Greenhouse Gas Bid

- EIMPRs submit GHG bid capacity and price adder for exports to CA
- Positive EIM Transfer from all EIM BAAs is distributed optimally to EIMPRs
  - New control variables: EIMPR export allocation
- Marginal GHG cost
  - Shadow price of EIM Transfer allocation constraint
  - 4th LMP component in EIM BAAs (negative)
  - EIMPRs are paid the GHG cost for export allocation
BAA Sufficiency Tests

- **DAM**
  - Feasibility test

- **RTM**
  - Performed for each EIM BAA and CAISO
    - After $T-75'$, $T-55'$, and $T-40'$ for the Trading Hour starting at $T$
  - Feasibility test
  - Balancing Test
  - Capacity Test
  - Flexible Ramping Sufficiency Test
Feasibility Test

- Identify transmission constraint violations due to base and day-ahead schedules in EIM BAAs
  - DAM
  - After RUC
  - RTM
  - After base schedule calculation, but before RTM
- Pass: no transmission constraint violations
- Fail: transmission constraint violations
Balancing Test

- EIM Entity elects ISO demand forecast option:
  - Comparison of base schedules (for EIM generating and intertie resources) with hourly demand forecast
  - Pass: BAA imbalance within 1%
  - Fail: BAA imbalance greater than 1%
    - Over-scheduling/under-scheduling penalty above 5%

- EIM Entity elects own demand forecast option:
  - Success (always)
    - Over-scheduling/under-scheduling penalty always applies
Capacity Test

- EIM Entity elects ISO demand forecast option:
  - Comparison of aggregate incremental/decremental energy bid range from EIMPRs with BAA imbalance between base schedules and demand forecast
  - Pass: sufficient capacity
  - Fail: insufficient capacity
    - EIM Entity fails Flexible Ramp Sufficiency test
- EIM Entity elects own demand forecast option:
  - Success (always)
Flexible Ramping Sufficiency Test

Data used:

- Initial schedules at $T-7.5'$
- EIMPR energy bids and ramp rates
- 15' Flexible ramping up/down requirements
  - Change in demand forecast
  - reduced by any prorated EIM diversity benefit
  - reduced by any credit for net outgoing/incoming EIM transfer at $T-7.5'$
  - reductions limited by the available net import/export capability
Flexible Ramping Sufficiency Test

- Cumulative test for meeting flexible ramping requirements for each 15' interval of the hour
  - 15' ramp from $T-7.5'$ to $T+7.5'$ (1st 15' interval)
  - 30' ramp from $T-7.5'$ to $T+22.5'$ (2nd 15' interval)
  - 45' ramp from $T-7.5'$ to $T+37.5'$ (3rd 15' interval)
  - 60' ramp from $T-7.5'$ to $T+52.5'$ (4th 15' interval)

- Test passes if all four cumulative tests pass
- Test fails if any of the four cumulative tests fail
Flexible Ramping Capacity Constraints

- Formulated for all BAAs in the EIM Area individually and for the entire EIM Area
- BAAs that fail the up/down test
  - Their requirement does not include diversity benefit
  - EIM Transfer is limited from below/above the base at the last 15-min schedule before the hour (at $T-7.5'$)
- BAAs that pass the up/down test
  - Their requirement is reduced by the available net import/export capability (diversity benefit)
Contingency Dispatch

- Contingency in CISO
  - Suspend RTD; invoke RTCD/RTDD
  - Isolate CISO from EIM Area
    - Freeze CISO EIM Transfer at last RTD advisory solution
  - Send previous advisory 5min dispatch for EIMPR

- Contingency in an EIM BAA
  - EIM BAA Operator notifies ISO of contingency status
  - Isolate EIM BAA from EIM Area
    - Freeze EIM Transfer for EIM BAA at last RTD advisory solution
  - Incorporate Manual Dispatch instructions in RTD
ISO – EIM Entity Data Flow
References

- Introduction to EIM (CBT)
- How EIM Works (CBT)
- EIM Draft Final Proposal
- EIM Final Tariff Language
- EIM Go-Live Enhancements
- EIM Business Practice Manual
- Charge Code Matrix for EIM