Energy Imbalance Market Overview for WAPA DSW
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ISO EIM Agenda

Part 1 – General Briefing
• Foundational Concepts
• Market Efficiencies
• Governance Structure
• Stakeholder Process
• Extended Day-Ahead Market

Part 2 – EIM Training Concepts
• EIM Readiness
• EIM Resources: Participating vs. Non-Participating
• EIM Market Timing
• Resource Plans
• EIM Tools

Part 3 – Reference
• Information
The Western Energy Imbalance Market

- Automated dispatch minimizes cost, facilitates renewables, resolves imbalance, avoids congestion
- Situational awareness enhances reliability
- Harmonizes with bilateral trading and regional reserve sharing groups
- Preserves Balancing Authority Area (BAA) autonomy, including compliance, balancing and reserve obligations
- Benefits from EIM operation total $801 million through Q3 2019

https://www.westerneim.com/pages/default.aspx
Market efficiencies depend on robust transmission

<table>
<thead>
<tr>
<th>Path</th>
<th>Estimated Max Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path 24 (west to east)</td>
<td>100</td>
</tr>
<tr>
<td>Path 24 (east to west)</td>
<td>35-90</td>
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<tr>
<td>Eldorado</td>
<td>797</td>
</tr>
<tr>
<td>Path 35 (west to east)</td>
<td>580</td>
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<tr>
<td>Path 35 (east to west)</td>
<td>538</td>
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<tr>
<td>Gonder-Pavant</td>
<td>130</td>
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<tr>
<td>PACW to PGE</td>
<td>320</td>
</tr>
<tr>
<td>Path 66 (ISO to PGE)</td>
<td>627</td>
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<tr>
<td>Path 66 (PGE to ISO)</td>
<td>296</td>
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<tr>
<td>Path 66 (ISO to PACW)</td>
<td>331</td>
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<tr>
<td>Path 66 (PACW to ISO)</td>
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<tr>
<td>Path 17</td>
<td>0-400(^1)(^2)</td>
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<tr>
<td>PSE to PACW</td>
<td>300</td>
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<tr>
<td>Eldorado 500-Moenkopi</td>
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<tr>
<td>Palo Verde, N. Gila</td>
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<tr>
<td>Path 78 (PACE to APS)</td>
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<td>Path 78 (APS to PACE)</td>
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<td>Navajo-Crystal</td>
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<tr>
<td>Mead 500</td>
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<td>Mead 230 (APS &lt;-&gt; ISO)</td>
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<tr>
<td>Mead 230 (ISO to NVE)</td>
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<tr>
<td>Mead 230 (NVE to ISO)</td>
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<td>IPCO to PACW (Path 75)</td>
<td>1,500</td>
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<tr>
<td>PACW to IPCO (Path 75)</td>
<td>400-510</td>
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<tr>
<td>PACE to IPCO</td>
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<tr>
<td>IPCO to PACE</td>
<td>1,550</td>
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<tr>
<td>NVE to IPCO</td>
<td>262</td>
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<tr>
<td>IPCO to NVE</td>
<td>390-478</td>
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<tr>
<td>Powerex &lt;-&gt; PSE</td>
<td>150</td>
</tr>
<tr>
<td>Powerex &lt;-&gt; ISO</td>
<td>150</td>
</tr>
</tbody>
</table>

\(^1\) Is an optional path available for PACE-PACW EMM transfers and the capacity is a subset of PACW-IPCO/IPC/PACE and Path-75 capacity.

\(^2\) When in use, the available capacity on PACW-IPCO/IPC/PACE and Path 75 will be subsequently reduced by the used amount on Path 17, and not double counted.

Current as of October 2019
Western EIM governance structure

**EIM Governing Body (GB)**
- 5 independent, non-stakeholder members
- Delegated authority over EIM-related market rules
- Selected by stakeholder nominating committee, confirmed by EIM Governing Body
- Provides western entities a decision-making voice

**EIM Body of State Regulators (BOSR)**
- Advises the EIM Governing Body and ISO Board of Governors on matters of interest
- Currently eight state officials from EIM states
- Provides a state regulatory perspective

**Regional Issues Forum (RIF)**
- Public vehicle for discussion of EIM-related issues, including impacts to neighboring balancing authority areas
- Organized by ten self-selected sector liaisons
- May produce opinions for EIM governing body or ISO Board of Governors
Stakeholder input is essential to ISO planning, processes and enhancements

New initiatives and policy updates implementation

http://www.caiso.com/informed/Pages/StakeholderProcesses/Default.aspx

Broad market enhancements

EIM enhancements

Process and tool enhancement implementation

Updates are made based greatly upon the input of our customers
EIM provides a low-cost, low-risk option that balances load and resources automatically and economically in the real-time market

ISO BAA footprint
Day-ahead & Real-time Market

- ISO optimizes energy transfer and generation output between all EIM participants in multiple increments

- Single optimization across EIM footprint improves quality and helps overall system reliability

- Currently applies to real-time market only, but a new initiative proposed to extend EIM to day-ahead
Extended Day-Ahead Market (EDAM)

• Extend EIM to include DA market
• Same foundational concepts as EIM:
  – BAA autonomy
  – Voluntary entry
  – No exit fees
• EIM will be maintained as a stand-alone service
• Stakeholder process initiated in October 2019, running through early 2021
• Major topics
  ➢ Transmission availability and pricing
  ➢ Resource sufficiency
  ➢ Greenhouse gas
  ➢ Governance

Onboarding & Training

EIM READINESS
EIM Onboarding Tracks

Visit our Western EIM site to find documents detailing these tracks

Track 1: Project Management & Planning
Track 2: Agreements, User Access & DMM
Track 3: Full Network Model
Track 4: Integration and Testing
Track 5: Metering & Settlements
Track 6: Training & Readiness

EIM
ISO provides robust initial and ongoing EIM training programs to ensure readiness

- **Level 100**
  - Computer Based Training (CBT) Fundamental Concepts
  - Settlements 101 Instructor Led Training

- **Level 200**
  - Computer Based Training (CBT) Advanced Concepts
  - Settlements 201 Instructor Led Training

- **Level 300**
  - Train-the-Trainer Course
  - Instructor Led Scenario Training
Training is based on rules, regulations, processes and best practices

Reliability and safety requirements

Rules and stakeholder guides

Step-by-step instructions & best practices

Federal and Regulatory Standards

ISO Tariff and Business Practice Manuals

Operating Procedures Knowledge Articles

FERC NERC WECC
Participating vs. Non-Participating

EIM RESOURCES
Who is participating and what does that mean?

**Participating Resource**
A resource that submits bids that allow the EIM market to dispatch or not dispatch the resource in real-time.

**Bidding makes resources available to resolve energy imbalances**

**Non-Participating Resource**
A resource that intends to operate in the BA but does not allow the EIM market to dispatch or not dispatch the resource in real-time.

**Submits base schedules to ensure BA balancing calculations are accurate**
The ISO settles with scheduling coordinators who allocate payments and charges to their customers.

EIM Entities allocate the cost based upon their Open Access Transmission Tariff (OATT).
How are base schedules settled?

**Participating Resource**

- The Market Operator will settle the deviations from base schedules for participating resources at the locational marginal price at the corresponding locations.

**Non-Participating Resource**

- The EIM Entity Scheduling Coordinator will be responsible for the settlement of deviations from base schedules for these resources.

 Charge codes allow for greater granularity in the breakdown of charges and payments for greater transparency.

Real-Time Market

EIM MARKET TIMING
The ISO Markets – Where does EIM fit?

**Day-ahead market (DAM)**
- **T - 8 days**
- **10:00**
  - Bids, schedules, resource plans submitted
  - DAM process begins
  - Clear the market
- **13:00**
  - Publish market results

**Real-time market (RTM)**
- **T-1 after 13:00**
  - Bids/Base schedules submitted
- **T-75min**
  - RTM processes begin
  - Clear the market
  - Receive dispatches
- **Beginning at midpoint of each 5min period**

Triggers real-time market

Now let’s talk about real-time markets

Post Market Processes
Real-time markets do the following:

- Procure “balancing” energy to meet the forecasted real-time grid energy demand
- Send dispatch signals to resources to move up or down to meet current system conditions
- Maintain the security of the system (no normal or post-contingency overload)
- Protect operating reserves that the market is aware of
The ISO market looks at resource future targets

The market is always looking down the road

Advisory solutions are best estimates of the future, but...

...they can and do change

The real-time market allows for operators to look ahead at resource usage and commitments.
Intertie transactions that are **hourly**:
- Submitted by EIM entity
- Critical to be accurate used as baseline

For each **fifteen minute interval** we are:
- Starting-up or shutting down resources
- Transitioning multi-stage generators
- STUC has longer time horizon

For each **five minute interval** we are:
- Issuing real-time dispatch instructions
- No start-ups/shut downs/transitions
Hourly process for real-time market leading up to operating hour (EIM components)

T-75: Base schedules and energy bids due (Resources)

T-55: Updated base schedules are submitted if necessary (Resources)

T-40: Updated base schedules are submitted if necessary (Entity SC)

T-20: E-tagging deadline (Entity SC)

01:45

01:48

02:05

02:08

02:20

02:23

02:37.5

02:40

15-minute scheduled awards published

Start of 15 minute market

Results of all base tests published

Results of all base tests published

T

RTPD7

RTPD6

RTPD5

RTPD4

3:00

4:00

Market operator

EIM Market participants

Hour ending
Balancing, Inputs and Outputs, and Resource Sufficiency

EIM ROLES AND RESPONSIBILITIES
The BAA’s Reliability Responsibilities

To ensure frequency is maintained throughout the interconnection it is the responsibility of the balancing authority to ensure the balancing authority area does not exceed the Balancing Authority ACE Limit (BAAL) for more than 30 consecutive minutes.

NERC reliability standard BAL-001-2
What are some of the EIM roles and their functions?

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Real-time Market Operator (RTMO)

- EIM Operator
- Trader / Marketer
- Scheduler
- Settlements
Inputs and outputs of the real-time market

From **day-ahead**:  
- System info  
- Energy schedules  
- Reserves awards  
- Master file

From **real-time**:  
- State estimator  
- Energy Bids  
- Base schedules  
- Outages  
- Transmission limits

Real-time market  
- Real-time awards & dispatches  
- Start-ups/shut downs  
- Multi-stage generator transitions  
- Settlements
The BAA’s resource plan ensures the balance, feasibility and flexibility of your base schedules and bids for prior to each operating hour

- **Base schedules**
  - Include hourly forecasts of load, hourly generation schedules and hourly interchange schedules.
  - Used as the baseline for financial settlements

- **Bids**
  - Indicators of willingness to buy/supply energy and capacity into the energy market
Load forecasts help determine the base schedule

• Demand forecast is used to determine the amount of supply that will be needed.

• The ISO forecasts demand on an hourly basis for the next 3 days.

• For load and renewable resources, EIM entities can choose to use:

  ISO Forecast  or  EIM Entity Forecast
Evaluations are conducted to ensure adequate resource are available to meet forecasted needs.
Every hour, EIM entities demonstrate they have adequate capacity to balance load and manage contingencies in their own BAA

4 tests run 3 times per hour:

- **Balancing** ensures each BAA has the capability of balancing their area for each operating hour to avoid leaning on neighbors

- **Bid capacity** ensures a flexible bid range, both up and down on participating resources

- **Flexible ramp** is an aggregation of all resources to meet the slope of the load curve

- **Feasibility** ensures your base schedule would not overload a line
Situational Awareness and Troubleshooting

EIM TOOLS OVERVIEW
The ISO provides a network of applications that provide situational awareness

- BAAOP is an example of one of the many applications the ISO makes available to its market participants.
- This user interface provides the link between the market and EMS for EIM real-time market operators.
- Integrated system information aids critical thinking and effective decision making
WHERE CAN YOU FIND MORE?
Visit the ISO website for information and resources
Find helpful EIM resources on the Western EIM website

Steps and documentation for joining the ISO

https://www.westerneim.com/pages/default.aspx
Visit our Learning Center to find online resources and comprehensive training programs

Continuous development of training that is relevant to our customers relies on feedback – let us hear from you today!

- Western Energy Imbalance Market
  - Explore topics pertaining to the real-time energy imbalance market that enables participants to buy and sell energy when needed.

Public EIM training resources

http://www.caiso.com/participate/Pages/LearningCenter/default.aspx
Open Access Same-time Information System (OASIS) provides public access to a variety of transmission system data

http://oasis.caiso.com/mrioasis/logon.do
Today’s Outlook provides users with a broad view of supply and demand conditions impacting the ISO.

Available for download on your phone!

http://www.caiso.com/TodaysOutlook/Pages/default.aspx
Business Practice Manuals (BPMs) provide detailed rules, procedures and examples

- Market participants are encouraged to participate in our Proposed Revision Request (PRR) process

- Visit the ISO calendar to find monthly meeting dates to discuss PRRs

Sign up for the Daily Briefing to get a once-a-day summary email of what is happening at the ISO.
For more detailed information on anything presented, please visit our website at:

www.caiso.com

Or send an email to:
CustomerTraining@caiso.com