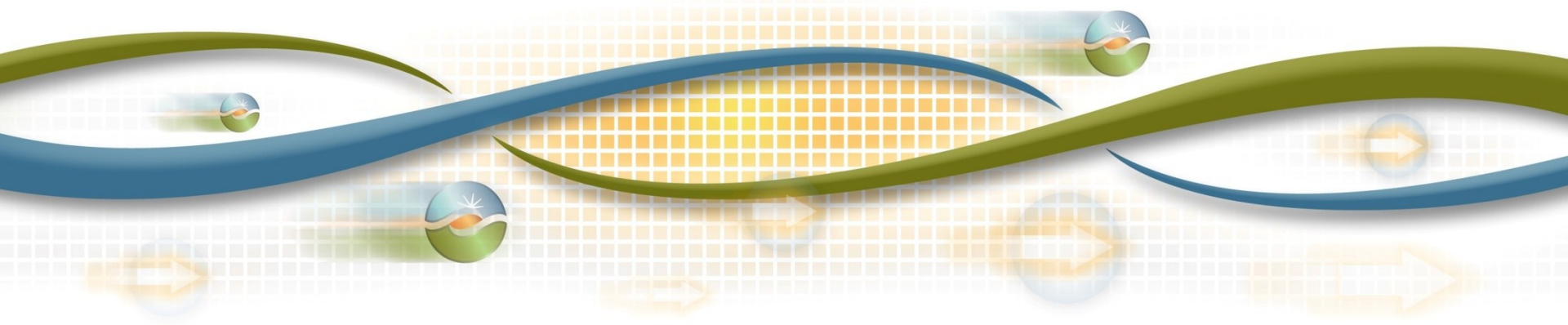
California ISO
Shaping a Renewed Future

California ISO Energy Imbalance Market Operations Overview

June 10, 2014 Webinar



Objectives

1. EIM Overview

2. CAISO's process in mitigating Unscheduled Flow (USF)

3. WebSAS tool: how dynamic and pseudo tie schedules are handled during active USF events.

Energy Imbalance Market Benefits

- **Improved renewable integration** – Helps integrate renewable resources by capturing the benefits of geographic diversity

- **Cost savings** – Benefits all by serving energy imbalance needs from the most economic resources in a larger pool.

- **Increased reliability** – provides information that improves operational awareness and responsiveness to grid conditions across a large footprint

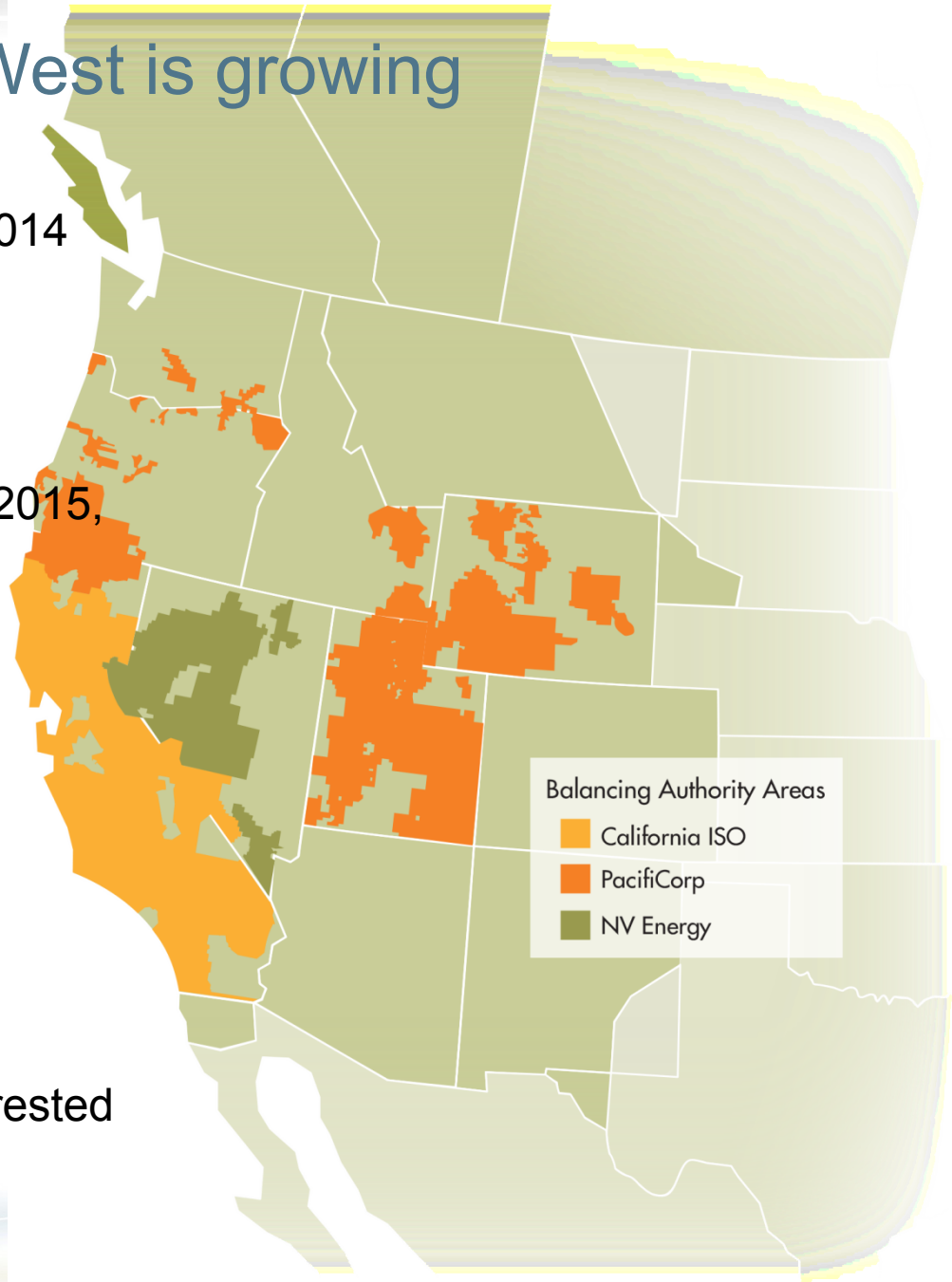
Scale of EIM in the West is growing

PacifiCorp: Go-Live October 1, 2014
1.7 million customers
9,500 MW peak demand
10,600 MW generating capacity

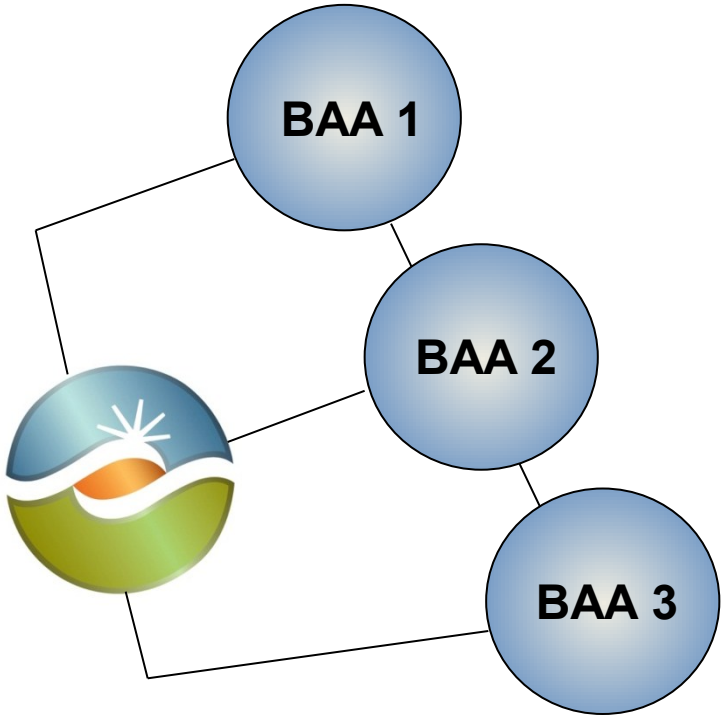
NV Energy: Go-Live October 1, 2015, subject to regulatory approvals
1.2 million customers
8,148 MW peak demand
5,815 MW generating capacity

CAISO: existing market
11.4 million customers
50,280 MW peak demand
58,246 MW generating capacity

CAISO is working with other interested parties



EIM preserves participants' autonomy and current practices



- Balancing authorities balance and provide their own ancillary services
- Balancing authorities can trade bilaterally
- Participants retain all physical scheduling rights

Implementation Status

- Full Network Model representing CAISO, both PacifiCorp BAAs, BPA and other interconnected BAAs
  - Modeling to 3 megawatt generator level
  - Complete SCADA overlay
  - Exporting 17,000 points via ICCP from PAC to CAISO
  - CAISO state estimator currently running and solving
  - Continuous tuning and translation improvements to state estimator solutions

Implementation Status

- Entity generation control upgrades to RTUs, DCSs, and AGC
  - Digital communication of plant status, Pmax/Pmin, reserve capabilities in real-time
- Upgrades to revenue metering
  - ~150 meters replaced
  - ~100 meters reprogrammed
  - ~10 new meters installed
  - New meter data management system
- New situational awareness tools for operators that utilize the enhanced data now available

CAISO Responsibilities

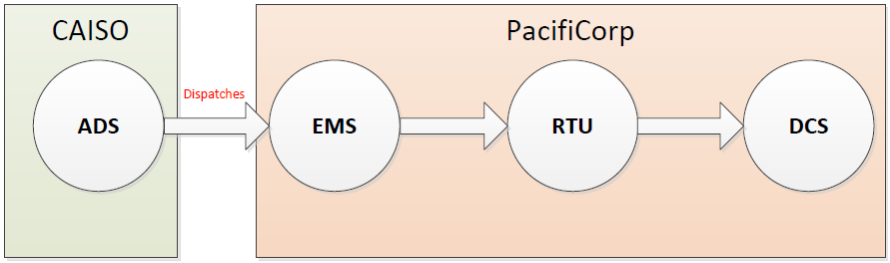
- Under EIM, CAISO operates the real-time:
  - Security constrained unit commitment and economic dispatch every 15 minute
  - Security constrained economic dispatch every 5 minutes
  - Publishes market results (for both PAC and CAISO, the EIM footprint)
- CAISO will manage their ACE, voltage, flows and all other BAA functions within their BAA

PacifiCorp Responsibilities

- Under EIM, PAC will manage the following in real-time:
  - Area control error,
  - System voltage,
  - System flows,
  - Outage submission and approvals, and
  - All reliability responsibilities for their BAA.
- PAC will manage their reserves
  - No impact to NWPP RSG

Responsibilities

- Redispatch under EIM has same reliability impacts as existing dispatch today, however:
  - EIM is source of automated redispatch instruction
  - PAC retains ultimate control of all Balancing Area functions
  - Increased visibility and situational awareness

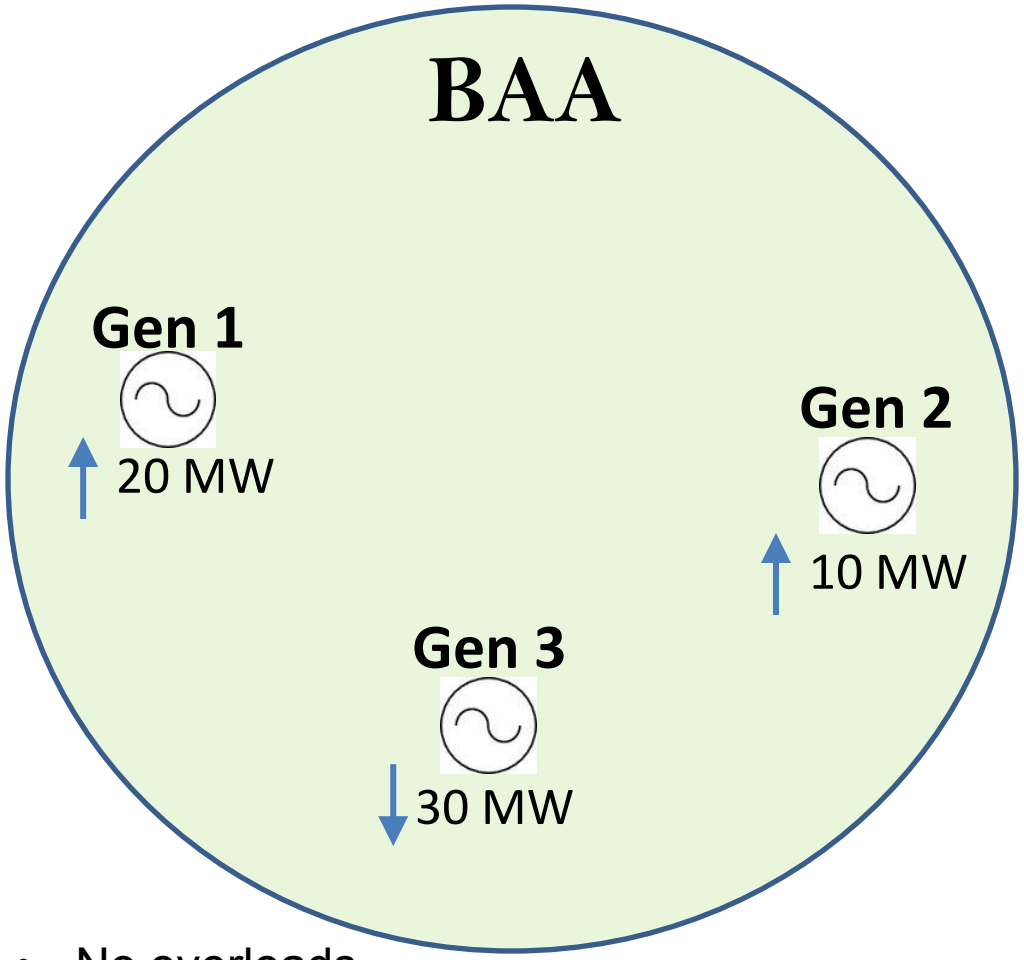


- Required to e-tag inter-BAA transactions, as done today

Transmission Management

- EIM will operate to transmission system limits
- EIM will operate within transmission rights made available to it
- EIM will coordinate transmission usage with EIM participants' Transmission Service Providers (e.g., BPA in PAC's case, as discussed in BPA's stakeholder meetings)
- EIM will not exacerbate transmission congestion

Transmission Management



- No overloads
- No change in NSI

Load forecast = 100mw

Gen schedules:

Gen 1 = 30

Gen 2 = 25

Gen 3 = 45

Total = 100

After Redispatch due to change in system conditions:

Gen 1 = 50

Gen 2 = 35

Gen 3 = 15

Total = 100

External Paths

- Connecting the EIM BAAs (PACE, PACW, and CAISO)
- PACE-PACW e-Tag
  - RTM and RTPD will dispatch energy within the existing transmission rights (200 MW).
- PAC-CAISO COI e-Tag
  - RTM and RTPD will dispatch energy within PAC's COI rights, using a dynamic schedule.
  - CAISO and PAC will coordinate COI usage with BPA in its role as Transmission Service Provider

External Paths

- Total load of 300mw
- Base schedules:

Gen A = 100mw

Gen B = 100mw

Gen C = 100mw

Total = 300

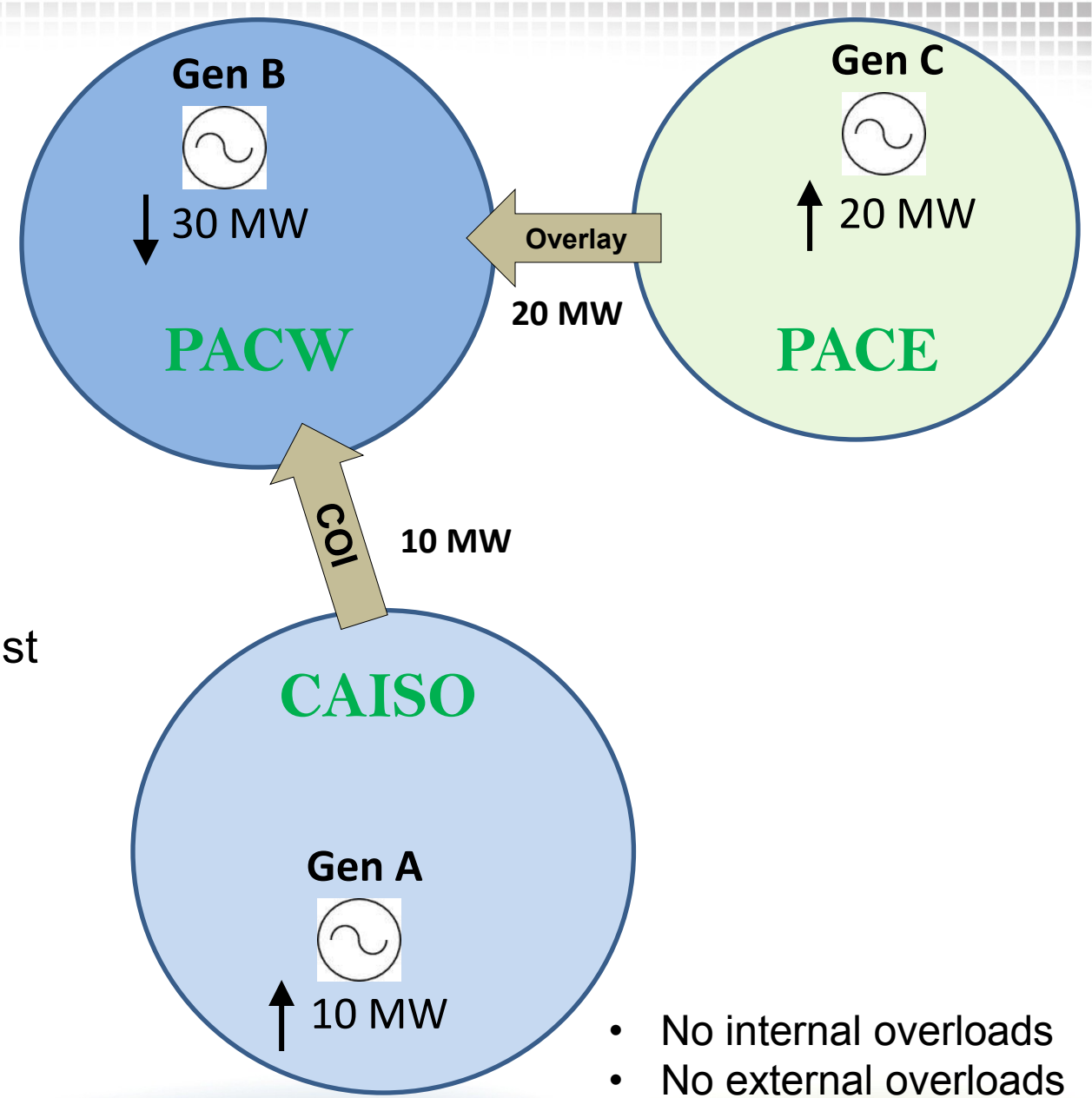
- Real Time, wind increases over forecast in CAISO and PACE.
- After Redispatch:

Gen A = 110

Gen B = 70

Gen C = 120

Total = 300



- No internal overloads
- No external overloads

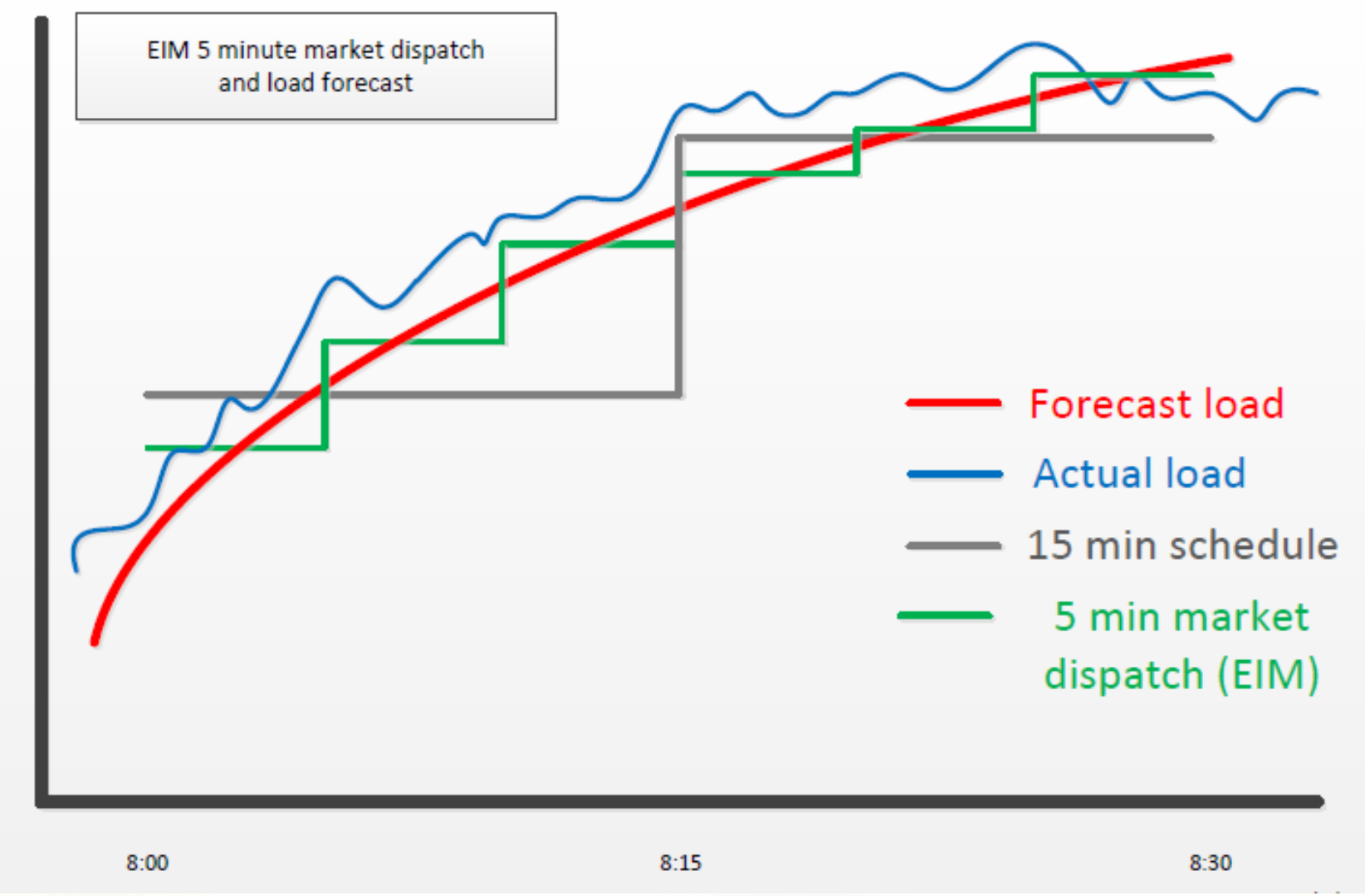
External Paths

- EIM enhances load/resource forecasts and state estimator modeling integration
- EIM improves transmission/generation outage management
- EIM is forward-looking, proactively dispatching generation to forecasted load within remaining transmission capacity, system operating limits, and transmission rights

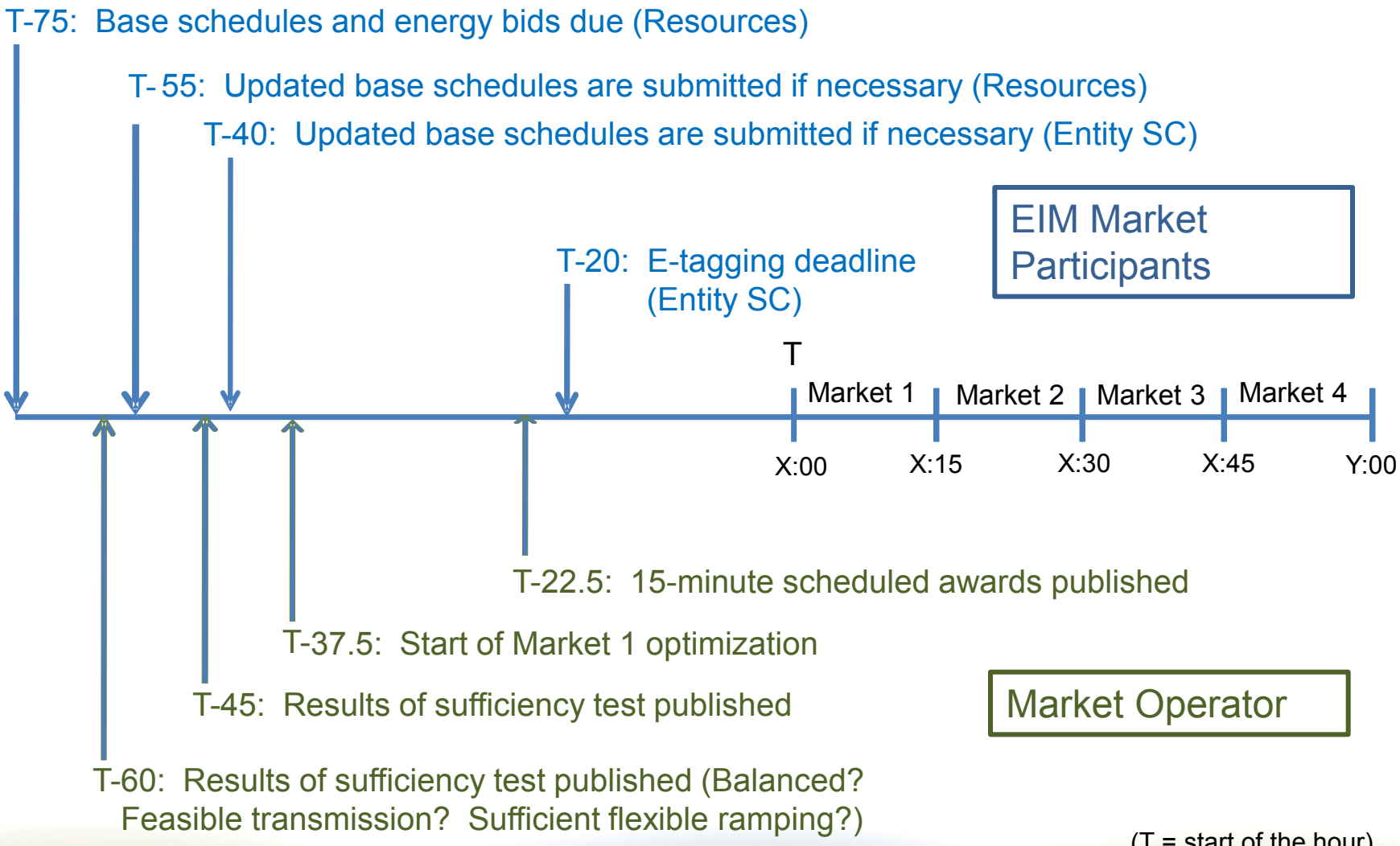
External Paths

- EIM can dispatch multiple generators simultaneously to have a positive impact on transmission constraints
- EIM provides reduced area control error deviations (ACE)
- EIM broadens generation ramping and regulating capacity in conjunction with smaller ramps

Redispatch


EIM 5 minute market dispatch and load forecast
Forecast load
Actual load
15 min schedule
5 min market dispatch (EIM)
8:00
8:15
8:30

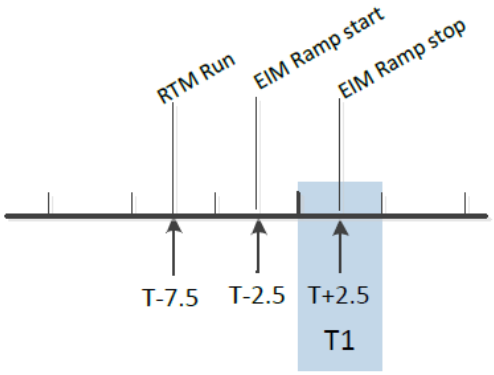
RTM Timeline: Submission of hourly base schedules

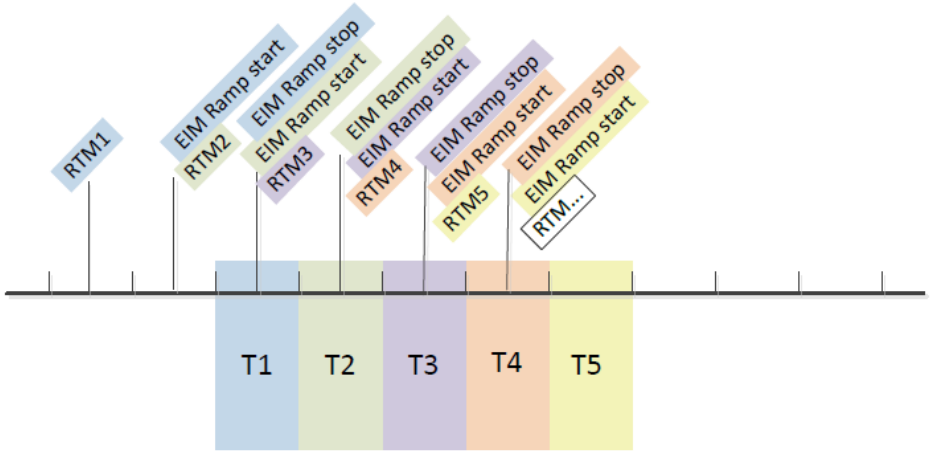


(T = start of the hour)

RTD Timeline: Dispatches issued every 5 minutes

Real-time dispatch instructions





This timeline shows the Real-time Dispatch instructions. On the left portion you can see the RTD is calculated at T-7.5, the ramp starts at T-2.5, and the ramp ends at T+2.5, all for time period T1. On the right portion you can see the sequencing of all the RTDs, ramps, and time periods.
(Note: this timeline can be thought of as a continuation of the previous timeline, but as you can derive from the right portion, this process is continuous and on-going.)

Real-Time Market Concept - Summary

- The Fifteen Minute Market will commit and dispatch to meet forecasted load.
  - Intertie bids (only in CAISO footprint)
  - Fast start generation
- The 5 minute market will re-dispatch online generation to balance.
  - Load forecast changes
  - Renewable changes
  - Generation and transmission outages

CAISO USF Mitigation Procedure 3510

- Provides guidelines for implementing the WECC Unscheduled Flow Mitigation Procedure (USFMP) and for determining Qualified Path Values for Unscheduled Flow
  - To maintain consistency with USF mitigation, energy profile of dynamic e-Tags for EIM Transfers will reflect the expected total transfer between BAAs, based on forward-looking advisory dispatches
- Specifies the requirements for monitoring, notifications and coordination of USF as Path Operator for Path 66
- Specifies the required actions of Scheduling Coordinators (SCs) during active USF events

CAISO USF Mitigation Procedure 3510

Once CAISO meets the accommodation requirements of USF Step 4 or greater and Path 66 flow is >= 95% of the transfer limit, CAISO will notify the RC and:

CAISO Actions
1st Level Contributing Schedule Reductions Interchange Scheduler: • **Issue** a USF Event Step 4 via WebSAS (a WECC Net Message is automatically sent via OATI) each hour, at least XX:24:59 after the top of the hour for the next Operating Hour. • **Curtail** "Off-Path Tags" to meet the relief obligation of Schedules sinking in the CAISO Balancing Authority Area and contributing 30% or greater (normally calculated by WebSAS or refer to Table 1). SC's may request alternate Schedule changes to meet their relief obligation in lieu of Curtailments.

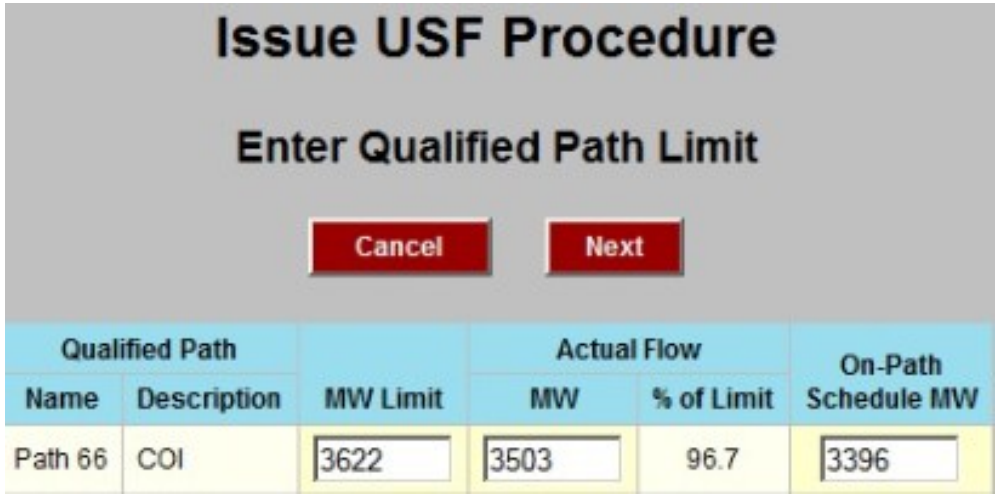
CAISO USF Mitigation Procedure 3510

To issue a USF Step 4 or greater, the CAISO Interchange Scheduler obtains:

- Path Transfer Limit
- Path Actual Flow
- Path Total Schedule

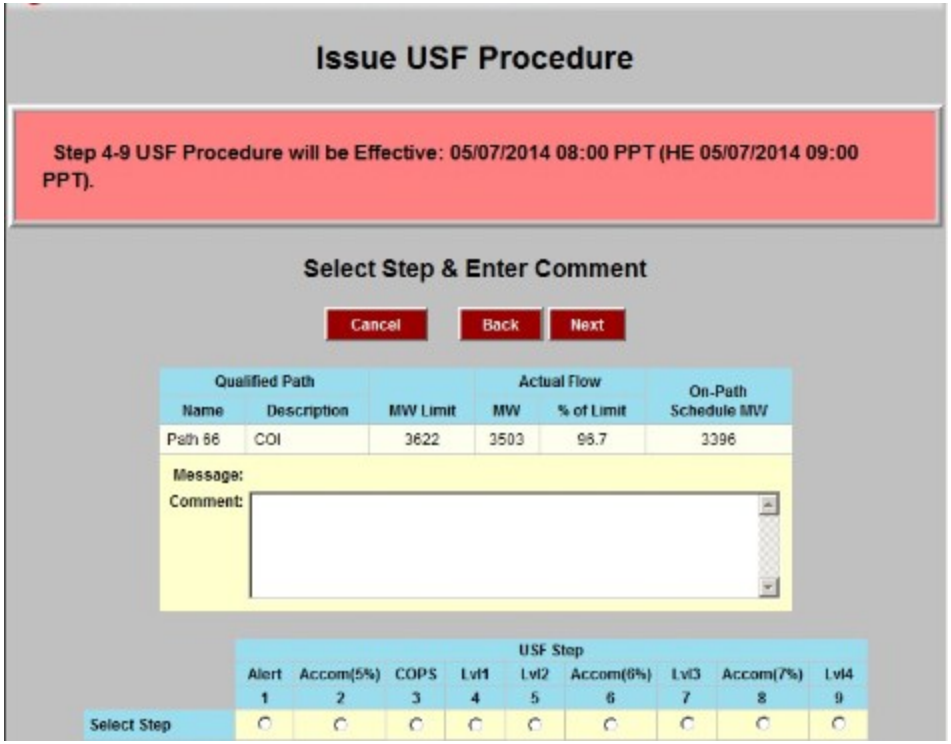
CAISO USF Mitigation Procedure 3510

The values are then entered into webSAS via the Issue USF Procedure window



CAISO USF Mitigation Procedure 3510

The next screen is populated with the appropriate USF step and comments. CAISO will note if any additional mitigation is being done such as on-path curtailments, deploying TRMs, and circulation on the Pacific DC



CAISO USF Mitigation Procedure 3510

- Once the RC approves the activation of the USF procedure, the curtailments are issued via webSAS.
- Curtailments issued via webSAS include dynamic and static schedules including EIM dynamic transfer.
- All parties on e-Tag are notified of curtailment.
- All EIM Transfer e-Tags affected by webSAS curtailments are communicated to MO to
- Dispatches will reflect these constraints.
- ECC Tool:
  - The EIM design will be compatible with ECC implementation and all other future regional tools.