EIM Resource Sufficiency #3

Step 1: Introduction and Education
Step 2: Description of the Issue
Agenda

- Introduction and Education (Step 1)
  - Background Information
  - Balancing Test
    - Test description
    - Scenario discussion
  - Flex Ramp Sufficiency (FRS) Test
    - Test description
    - Scenario discussion
  - Relationship between Balancing Reserves (BR) and Resource Sufficiency (RS)

- What’s the Issue? (Step 2)
  - ROD: BPA will consider addressing RS on the sub-balancing authority area level
  - ROD: BPA will consider developing policies to ensure it passes the RS evaluations as often as possible
Objectives

- BPA intends to explore all RS tests in future stakeholder meetings, but today is focusing on the most critical RS test questions.

- Transmission feasibility is advisory and will be discussed in later stakeholder meetings.

- We are focusing on the FRS Test over the Capacity Test because, based on our understanding, passing the former almost always means passing the latter.
EIM Resource Sufficiency #3:
Step 1: Introduction and Education
ROD and RS

As part of Phase III, the ROD states that BPA will evaluate the following regarding RS:

- BPA will consider addressing RS on the sub-balancing authority area level
- BPA will consider developing policies to ensure it passes the RS evaluations as often as possible
Resource Sufficiency

- The RS evaluation determines whether each BA has procured, prior to each operating hour, sufficient resources and flexible capacity (both internal and external) to serve their load and load/VERs uncertainty
Resource Sufficiency Tests

The RS evaluation consists of four tests performed every hour:

- **Transmission Feasibility Test** → provides an opportunity to manage potential Transmission constraint violations prior to the operating hour.

- **Balancing Test** → checks that resource base schedules balance to the BA’s load forecast provided by CAISO, otherwise an over/under scheduling penalty may apply.

- **Bid Range Capacity Test (Capacity Test)** → checks that there’s sufficient bid range capacity to manage any imbalance from the Balancing Test and historical interchange deviations.

- **Flexible Ramp Sufficiency Test (FRS Test)** → checks that there’s sufficient within hour ramping capability and bid range capacity to meet intra-hour load ramping needs and historical net load uncertainty.
Why RS Matters

- **Balancing Test → over/under scheduling penalty**
  - Failure results in over/under scheduling penalties
  - Failure does not result in limitations on EIM participation, i.e., CAISO does not limit incremental EIM imports/exports to the BA

- **FRS Test → limitations on EIM participation**
  - Failure does not result in over/under scheduling penalties
  - Failure does result in limitations on EIM participation, i.e., CAISO limits incremental EIM imports/exports to the BA
EIM BA’s Resource Plan

- The EIM Entity (BA) submits a resource plan every hour, which is evaluated for Resource Sufficiency (RS)

- The resource plan contains the resources (Internal generation and Interchanges) that the EIM BA plans to utilize to serve the BA’s load and load/VERs uncertainty:
  - Base schedules for participating resources (PRs), non-participating resources (NPRs) and interchanges
  - Energy bids (bid curves and bid range capacity, which are submitted only by PRs)
  - Ancillary service schedules (submitted by PRs and NPRs)
    - Reserves to provide contingency reserves and regulation service (sub 5-min), which are not bid into the market but are indicated to CAISO
Base Schedules

- A base schedule is an hourly schedule:
  - Includes generation and interchange schedules
  - Both participating and non-participating resources submit base schedules
  - Used as the financial reference for measuring instructed/uninstructed imbalance energy for EIM settlement

- Interim base schedules can be submitted as early as a week in advance and are finalized for each operating hour
  - Participating Resource Scheduling Coordinator can adjust up to T-55’
  - EIM Entity Scheduling Coordinator can make changes up to T-40’

- Base schedules are used by all of the RS tests
Energy Bids

- Participating resources submit energy bids
  - These include the bid price curve and the bid range capacity that’s made available to the EIM
  - Finalized by T-75’

- The bid range capacity is used in the Capacity Test and Flex Ramp Sufficiency Test
RS Evaluation Timeline

- The resource plan is evaluated for resource sufficiency at T-75’, T-55’, and T-40’, at which point it becomes final. Adjustments to the resource plan are allowed up to T-40’.
The Balancing Test
Balancing Test

To perform the Balancing Test, the CAISO conducts 2 checks against the BA’s base schedule:

BA’s base schedule (BS) =
- base schedules for PRs +
- base schedules for NPRs +
- base schedules for interchange (exports/imports)
Balancing Test

First Check:

1. Is the BA’s base schedule within +/-1% of the CAISO’s BA load forecast?

- **Yes**: the BA passes the Balancing Test
  - No over/under scheduling penalty

- **No**: CAISO conducts a second check
  - Possible over/under scheduling penalty
Balancing Test

Second Check (after-the-fact):

2. Was the BA’s base schedule within +/- 5% of the BA’s actual load?

- Yes: the BA is not charged an over/under scheduling penalty
- No: the BA is charged an over/under scheduling penalty

- The penalties have a 2 tier structure
Balancing Test

Over-Scheduling Penalty:
- Tier 1 Threshold: over-scheduled by more than 5% of actual load
  - Penalty = 25% * Hourly LAP LMP * over-scheduled volume
- Tier 2 Threshold: over-scheduled by more than 10% of actual load
  - Penalty = 50% * Hourly LAP LMP * over-scheduled volume

Under-Scheduling Penalty:
- Tier 1 Threshold: under-scheduled by more than 5% of actual load
  - Penalty = 25% * Hourly LAP LMP * under-scheduled volume
- Tier 2 Threshold: under-scheduled by more than 10% of actual load
  - Penalty = 100% * Hourly LAP LMP * under-scheduled volume
Balancing Test Scenarios

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<tr>
<th>Scenario</th>
<th>First Check</th>
<th>Second Check</th>
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<tr>
<td>Scenario 5</td>
<td>✓</td>
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Balancing Test Scenarios

- Assume there are three LSEs within a BA, and there’s no interchange

- CAISO provides a load forecast for the BA

- Each LSE develops its own independent load forecast

- Each LSE submits base schedules to serve its load forecast
Balancing Test: Scenario 1

<table>
<thead>
<tr>
<th>LSEs</th>
<th>LSE1</th>
<th>LSE2</th>
<th>LSE3</th>
<th>BA Total</th>
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<tr>
<td>LSE’s load forecast</td>
<td>3,075</td>
<td>2,950</td>
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<td>7,975</td>
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<td>Base schedules (PR + NPR)</td>
<td>3,075</td>
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Balancing Authority

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<tbody>
<tr>
<td>CAISO’s BA load forecast</td>
<td>8,000</td>
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<tr>
<td>Actual BA load</td>
<td>8,100</td>
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<tr>
<td>Hourly LAP LMP</td>
<td>$30</td>
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Balancing Test: Scenario 1

First Check:
- Is the BA’s base schedule (●) within +/- 1% of the CAISO’s BA load forecast (○) by T-40?

- Yes:
  - The BA passes the first check:
    - No second check
    - No over/under scheduling penalty
Balancing Test: Scenario 2

- LSE2’s load forecast is lower than in Scenario 1

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<td>1,950</td>
<td>7,775</td>
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</tbody>
</table>

**Balancing Authority**

- CAISO’s BA load forecast: 8,000
- Actual BA load: 8,100
- Hourly LAP LMP: $30
Balancing Test: Scenario 2

First Check:
- Is the BA’s base schedule (●) within +/- 1% of the CAISO’s BA load forecast (○) by T-40?
  - No:
  - The BA fails the first check:
    - The CAISO conducts a second check to determine whether an over/under scheduling penalty applies.
Balancing Test: Scenario 2

Second Check (after-the-fact):  
- Was the BA’s base schedule (●) within +/- 5% of the BA’s actual load (○)?

- Yes:
  - The BA passes the second check:
    - No over/under scheduling penalty
Balancing Test: Scenario 3

- Actual BA load for this hour is higher than in previous scenario

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Balancing Test: Scenario 3

First Check:
- Is the BA’s base schedule (●) within +/- 1% of the CAISO’s BA load forecast (○) by T-40?

No:
- The BA fails the first check:
  - The CAISO conducts a second check to determine whether an over/under scheduling penalty applies
Balancing Test: Scenario 3

Second Check (after-the-fact):

- Was the BA’s base schedule (●) within +/-5% of the BA’s actual load (○)?

  - No:

  - The BA was not within +/- 5% of actual load
Balancing Test: Scenario 3

Second Check (after-the-fact):

- Was the BA’s base schedule (○) within +/- 10% of the BA’s actual load (●)?

- Yes:

  The BA was within +/- 10% of actual load
Balancing Test: Scenario 3

- The BA under-scheduled by more than 5%, but less than 10%

- The BA is charged an under-scheduling penalty at the 5% tier threshold

- Penalty charged at the 5% tier threshold:
  - Penalty = 25% * Hourly LAP LMP * Under-Scheduled Volume
  - Penalty = 0.25 * $30/MWh * (8,300 – 7,775) = $3,937.5
Balancing Test: Scenario 4

- LSE2 was unable to base schedule sufficient gen by T-55 to meet its load forecast from the previous scenario

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Balancing Test: Scenario 4

First Check:
- Is the BA’s base schedule (○) within +/- 1% of the CAISO’s BA load forecast (○) by T-40?

- No:

- The BA fails the first check:
  - The CAISO conducts a second check to determine whether an over/under scheduling penalty applies.
Balancing Test: Scenario 4

Second Check (after-the-fact):

- Was the BA’s base schedule (●) within +/- 5% of the BA’s actual load (●)?

  No:

  The BA was not within +/- 5% of actual load.
Balancing Test: Scenario 4

Second Check (after-the-fact):

- Was the BA’s base schedule (●) within +/- 10% of the BA’s actual load (●)?

- No:

- The BA was not within +/- 10% of actual load
Balancing Test: Scenario 4

- The BA under-scheduled by more than 10%

- The BA is charged an under-scheduling penalty at the 10% tier threshold

- Penalty charged at the 10% tier threshold:
  - Penalty = 100% * Hourly LAP LMP * Under-Scheduled Volume
  - Penalty = 1.00 * $30/MWh * (8,300 – 7,375) = $27,750
Balancing Test: Scenario 5

- Conditions are the same as Scenario 4:
  - LSE2 was unable to base schedule sufficient gen by T-55 to meet its load forecast

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<td>$30</td>
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</table>
Balancing Test: Scenario 5

First Check:

- Is the BA’s base schedule (●) within +/- 1% of the CAISO’s BA load forecast (○) by T-55?

No:

7,375  7,920  8,000  8,080
-1% +1%
Balancing Test: Scenario 5

- LSE1 has an agreement with the BA to adjust LSE1’s base schedules after T-55 to meet the Balancing Test.

- The BA adjusts LSE1’s base schedules to balance within +/- 1% of CAISO’s BA load forecast:
  - Base schedule adjustment = 7925 MW – 7375 MW = 550 MW
  - Adjusted LSE1 base schedule = 3,075 MW + 550 MW = 3,625 MW

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<td>2,350</td>
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Balancing Test: Scenario 5

First Check:

- Is the BA’s base schedule (●) within +/- 1% of the CAISO’s BA load forecast (○) by T-40?

- Yes:
  - The BA passes the first check:
    - No second check
    - No over/under scheduling penalty
The Flex Ramp Sufficiency Test
Flexible Ramp Sufficiency Test

The Flexible Ramp Sufficiency Test (FRST) ensures that the EIM BA has sufficient upward/downward flexible ramp capability and capacity to meet load intra-hour ramping and net load uncertainty:

- The EIM BA is tested against the 15-min, 30-min, 45-min, and 60-min ramps within the hour from the T-7.5 FMM reference point of the prior hour.

- Each 15-minute interval is evaluated separately and failures are enforced for only that failed 15-minute interval.

- The FRST ramping requirements can be reduced by the EIM diversity benefit, but only if sufficient Transmission (import/export) capability is made available to the EIM.
Pass:
• There’s sufficient ramp capability and flexible ramping up/down capacity to meet the flex ramp up/down requirements
• No restrictions are placed on EIM Transfers

Fail:
• There was insufficient ramp capability and/or flexible ramping up/down capacity
  – Can fail in one direction or both
• The CAISO places limits on EIM Transfers in the corresponding direction(s) for that 15-minute interval
FRST Scenarios: Requirement

- 6:45 AM: Demand Advisory FMM
- 7:00 AM: Uncertainty Up
- 7:15 AM: Uncertainty Down
- 7:30 AM: Demand Advisory FMM, Prev. Int 4
- 7:45 AM: Uncertainty Up
- 8:00 AM: Uncertainty Down

November 19, 2019  Pre-decisional. For Discussion Purposes Only.
FRST Scenarios

- **Scenario 1**: The BA does not bring sufficient upward capacity to meet the FRST requirement in 2 intervals.

- **Scenario 2**: The BA does not have enough ramp capability associated with its upward capacity to meet the FRST requirement in 1 interval.
**FRST: Scenario 1**

### EIM BA Data

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<th>LSE2</th>
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<tbody>
<tr>
<td>Previous interval 4 award</td>
<td>2975</td>
<td>2900</td>
<td>1825</td>
<td>7700</td>
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<tr>
<td>CAISO BA Forecast</td>
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- **Demand Advisory FMM**
- **Uncertainty Up**
- **Uncertainty Down**
- **Demand Advisory FMM, Prev. Int 4**
FRST: Scenario 1

EIM BA Data

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FRST: Scenario 1

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### FRST: Scenario 1

**EIM BA Data**

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FRST: Scenario 1
FRST: Scenario 1
FRST Scenario 1: Summary

- The BA’s bid range capacity was insufficient

- The BA failed to meet the flex ramp up requirement for the 3rd and 4th 15-min intervals of the next hour, and failed these intervals

- Due to the failure, the BA is limited in incremental imports from the EIM for the 3rd and 4th 15-minute intervals of the next hour
# FRST: Scenario 2

## EIM BA Data

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<td>8:00 AM</td>
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- Previous interval 4 award: 2975, 2900, 1825, 7700
- CAISO BA Forecast: 8000
FRST: Scenario 2

EIM BA Data

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<td>+50</td>
<td>+425</td>
<td>+625</td>
</tr>
<tr>
<td>Downward Bids</td>
<td>-250</td>
<td>-350</td>
<td>-150</td>
<td>-750</td>
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</table>
FRST: Scenario 2

EIM BA Data

<table>
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<tr>
<th>Time</th>
<th>LSE1</th>
<th>LSE2</th>
<th>LSE3</th>
<th>BA Total</th>
</tr>
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<tbody>
<tr>
<td>6:45 AM</td>
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<tr>
<td>7:00 AM</td>
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<tr>
<td>7:15 AM</td>
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<tr>
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<tr>
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<tr>
<td>8:00 AM</td>
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- **Previous interval 4 award**
  - LSE1: 2975
  - LSE2: 2900
  - LSE3: 1825
  - Total: 7700

- **CAISO BA Forecast**
  - Total: 8000

- **Base Schedules**
  - LSE1: 3075
  - LSE2: 2950
  - LSE3: 1950
  - Total: 7975

- **Upward Bids**
  - LSE1: +150
  - LSE2: +50
  - LSE3: +425
  - Total: +625

- **Downward Bids**
  - LSE1: -250
  - LSE2: -350
  - LSE3: -150
  - Total: -750

- **Ramp Rate (MW/15min)**
  - LSE1: 1000
  - LSE2: 500
  - LSE3: 150
  - Total: N/A
FRST: Scenario 2

EIM BA Data

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FRST: Scenario 2

Demand Advisory FMM
Uncertainty Up
Uncertainty Down
Demand Advisory FMM, Prev. Int 4
Upward Bids
Downward Bids
Base Schedule
FRST: Scenario 2

Demand Advisory FMM
Uncertainty Up
Uncertainty Down
Demand Advisory FMM, Prev. Int 4
Upward Bids
Downward Bids
Base Schedule

6:45 AM
7:00 AM
7:15 AM
7:30 AM
7:45 AM
8:00 AM

November 19, 2019  Pre-decisional. For Discussion Purposes Only.
FRST: Scenario 2
FRST: Scenario 2

- Demand Advisory FMM
- Uncertainty Up
- Uncertainty Down
- Demand Advisory FMM, Prev. Int 4
- Upward Bids
- Downward Bids
- Base Schedule

Timeline:
- 6:45 AM
- 7:00 AM
- 7:15 AM
- 7:30 AM
- 7:45 AM
- 8:00 AM

Values:
- 7200
- 7400
- 7600
- 7800
- 8000
- 8200
- 8400
- 8600
- 8800

Notes:
- November 19, 2019
- Pre-decisional. For Discussion Purposes Only.
FRST Scenario 2: Summary

- The BA’s overall bid range capacity was sufficient.
- The BA’s ramp capability was insufficient.
- The BA failed to meet the flex ramp up requirement for the 1st 15-min interval of the next hour, and failed this interval.
- The BA is limited in incremental imports from the EIM for the 1st 15-minute interval of the next hour.
Balancing Reserves and EIM
Balancing Reserves in the EIM

- BPA currently holds balancing reserves in order to balance within-hour variability.
Balancing Reserves in the EIM

- Once in the EIM:
  - the EIM dispatches bid-in resources to meet imbalance
  - the BA dispatches regulation reserves (within-5 min imbalance)

- Non-regulation balancing reserves may be made available to the EIM to count towards meeting Resource Sufficiency
EIM Resource Sufficiency #3:
Step 2: What’s the Issue
ROD: BPA will consider developing policies to ensure it passes the RS evaluations as often as possible

- What is the expectation by BPA or its customers about how often the BA passes resource sufficiency?
  - What options are available to the BA to ensure the BA meets this target?
  - What is the expectation by BPA or its customers about what lengths BPA should go to in order to meet this target?

- What is the expectation by BPA or its customers about if or how costs/penalties associated with not passing resource sufficiency be sub-allocated?
  - Determined as part of Cost Allocation team
ROD: BPA will consider addressing RS on the sub-balancing authority area level

- What options are available to the BA in order to demonstrate resource sufficiency?
- Will the BA assign obligations tied to resource sufficiency to entities within the BA?