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# EIM Resource Sufficiency Enhancements

## EIM Offer Rules Technical Workshop

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April 30th, 2018

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# The Objectives and General Structure of the Resource Sufficiency Framework Appear Sound

**A.** **Three key tests** verify that the applicable BAA has sufficient energy, capacity and flexibility to serve load and meet its imbalances on a standalone basis

**B.** A defined **Diversity Credit** reduces the Resource Sufficiency requirement in a ***safe*** and ***equitable*** manner

**C.** **Failure Consequence** ***prevents leaning***, sending critical signal to entities of the actions that must be taken ahead of time

CAISO's EIM Resource Sufficiency framework supports multiple, complementary objectives:

**A.** **Promotes Reliability** by protecting the broader EIM Area from having insufficient energy, capacity or flexibility to meet real time needs (as a result of entities "going short" and leaning on EIM)

**B.** **Ensures Fairness** by ensuring that some BAAs are not held to a higher standard than is necessary, while others are held to a lower standard

**C.** **Complements Resource Adequacy Activities** by providing appropriate incentives to contract for sufficient energy, capacity and flexibility ahead of each hour (through bilateral transactions or other forward commercial activities)

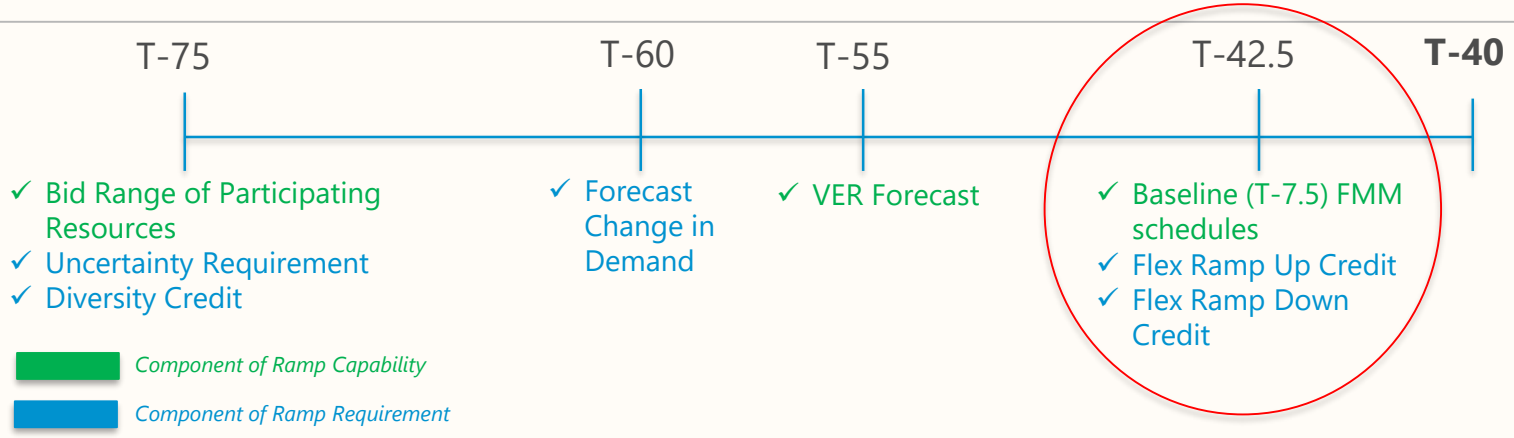
# Enhancements to Resource Sufficiency should **not** change the level of Resource Sufficiency required

- **Not all BAAs are situated similarly**
  - Some BAAs are facing growing capacity and flexibility challenges
  - Other BAAs may have surplus capacity and/or flexibility they are seeking to monetize
- **Raising or lowering the bar will create "winners and losers"**
  - Increasing the Resource Sufficiency requirements may increase costs for entities without surplus capacity/flexibility, while increasing opportunities for others to sell capacity/flexibility/energy
  - Decreasing the Resource Sufficiency requirements may reduce costs for some entities experience capacity/flexibility challenges, while reducing opportunities for others to sell capacity/flexibility/energy
- **Resource Sufficiency Enhancements should be focused on:**
  1. **Improving "workability" of the Resource Sufficiency Framework**
  2. **Addressing gaps in the existing framework**
  3. **Ensuring Resource Sufficiency is effectively and consistently applied to all entities**
  4. **Providing additional transparency and metrics**

# Potential Enhancements to EIM Resource Sufficiency

1. Improving Timeliness of Flexible Ramping Sufficiency Requirements
2. Improving the Uncertainty Calculations for Wind Resources
3. Modification of Net Import and Net Export Capability
4. Fully Separating Capacity and Flexibility Requirements
5. Flex Credit Should be Applied Symmetrically
6. Improvements to Enforcement Must Be Carefully Considered
7. Ensuring Resource Sufficiency Tests are Applied in an Equitable Manner

# 1. Improving Timeliness of Flexible Ramping Sufficiency Requirements




- Diversity benefits ***are effectively negated*** if participants need to carry a "buffer" of flexibility and capacity due to an inability to calculate Flexible Ramping Requirements in advance
- CAISO has already made ***significant improvements*** to workability by "freezing" several inputs to the test such as Load and VER Forecasts in advance of T-55
- Several components of both the Ramp Capability and Ramp Requirements for the Flexible Ramping Sufficiency Test ***remain unknown*** until shortly before the binding test is performed

# 1. Improving Timeliness of Flexible Ramping Sufficiency Requirements

- The various input data necessary for the test are retrieved from **multiple** CAISO applications:
  - *FMM solution, ALFS, BSAP, SIBR, Real Time Scheduling Interface, OASIS*
- Relying on multiple data sources and "just in time" data means that a data failure or delay in any one of those systems can lead to inconsistent inputs and incorrect test results

**Potential Solutions:**

**Option 1:** ***Replace the reference point*** (Interval 4 FMM binding solution) with the previous **advisory** solution (produced 15 minutes earlier, at **T-57.5)**

- All inputs to test would be known by **T-55**

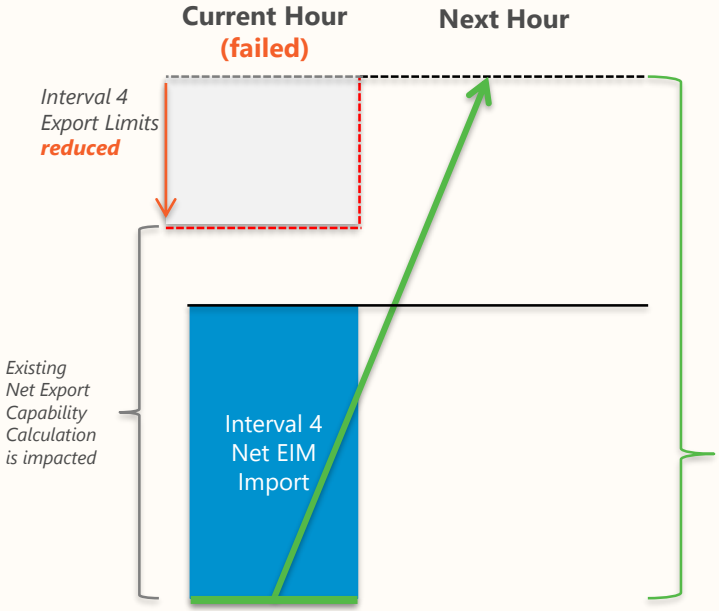
**Option 2:** Determine **all** FRST requirements ***prior to T-75*** (bid deadline)

- Likely requires measuring ramping requirements from current hour base schedule as the reference point (instead of FMM Interval 4 solution)
- Uncertainty requirements may require modification to recognize the additional forecast error associated with advance forecasts of Load, VER and generator output
- Increased uncertainty requirements would hopefully ***be more than offset*** by reducing the need to carry a "buffer" to meet requirements

# 2. Improving the Uncertainty Calculations for Wind Resources

- Uncertainty requirements are currently calculated using hourly histograms of load and VER deviations
  - Approach is generally sound for load and solar output that follows a predictable "hour-of-the-day" profile
  - E.g., uncertainty in HE 7 **yesterday** is likely a reasonable indicator of uncertainty in HE 7 **today**
- Time of day is ***not a good indicator*** of wind uncertainty
  - Wind forecast for HE 7 yesterday is not indicative of wind forecast for HE 7 today
- CAISO should calculate wind uncertainty histograms by bucketing forecast error relative to the **level** of forecast instead of hour of the day
  - How uncertain is a forecast at ***0%, 50%, 100%*** of nameplate capacity?
- Will ***better align*** upward and downward requirement to ensure test reflects true uncertainty needs depending on forecast
  - If wind is forecast at 0% output, no INC reserves are necessary (but perhaps more DEC reserves)
  - If wind is forecast at 100% output, no DEC reserves are necessary (but perhaps more INC reserves)
  - A wind forecast of 50% of capacity may be more uncertain than if wind is forecast at very low or very high levels

# 3. Modification of Net Import and Net Export Capability

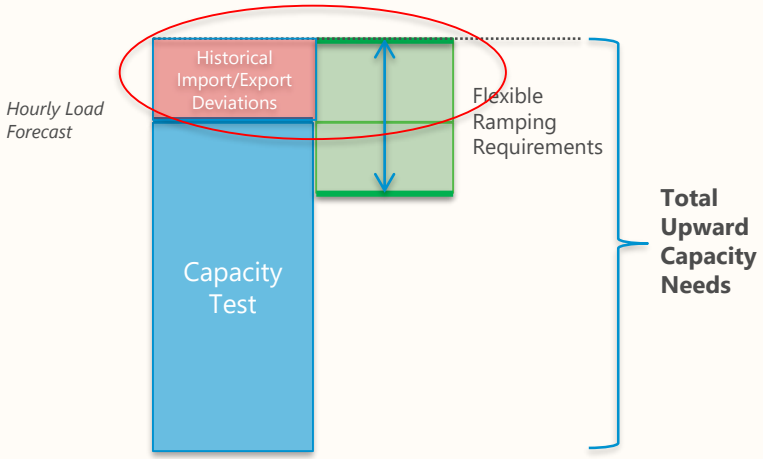



- DMM has recently raised* that the Net Import Capability and Net Export Capability can be impacted by a Flex Test failure in the current hour
  - Import(export) capability is currently calculated as the difference between total import(export) limits and net EIM Transfers during FMM Interval 4 of the current hour
  - Can result in a **current** hour failure **"blocking"** access to diversity in the Flex Test for the **next hour** (via reduced transfer capability)

Should Net Import Capability and Net Export Capability instead be calculated as the difference between total import (export) limits in the **next hour** and the actual EIM Transfers from interval 4 of **current hour**?

**SOURCE: Q4 2017 Report on Market Issues and Performance*

# 4. Fully Separating Capacity and Flexibility Requirements




The Capacity Test measures only whether a BAA has sufficient capacity to meet its **hourly average load forecast**

- Assessing whether a BAA has sufficiency capacity ***within the hour*** can only be determined by evaluating the combined results of the Capacity Test and the FRST

This approach results in ***two significant gaps*** in the current test framework:

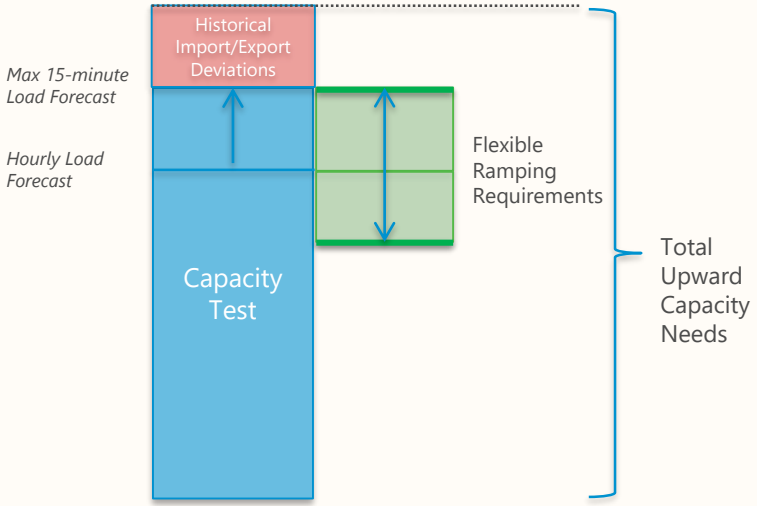
**Gap 1**: Hourly Import/Export Deviation Histogram is only added to Capacity Test

- The same bid range can be simultaneously ***double-counted*** toward meeting both the flexibility requirements of FRST, and towards the historical import/export deviation requirements in the Capacity Test

**Gap 2**: Capacity Test is ***not applied*** at all times

- Entities that elect to use a BAA forecast rather than CAISO's forecast do not currently face the Capacity Test (including Powerex)
- Entities that balance ***exactly*** against the CAISO load forecast do not face the Capacity Test

# 4. Fully Separating Capacity and Flexibility Requirements




**Solutions**

**1 -** Capacity Test should be modified to verify that the BAA has sufficient capacity to meet its expected needs ***throughout the operating hour***

*Max 15-min load forecast + uncertainty + historical import/export error*

**2 -** Capacity Test should be ***applied to all BAAs***, and ***at all times***, regardless of forecast used

- The Flexible Ramping Sufficiency Test would therefore ***only measure*** ramping **flexibility** for each 15-minute interval

**Benefits**

- Separation of Capacity and Flexibility needs would allow enforcement mechanisms to be ***more finely tuned*** between failures to procure sufficiency hourly capacity, versus failure of 15-minute ramp requirements
- Properly separating Capacity and Flexibility Requirements will eliminate double-counting to ensure that the RS test that is ***effective*** and ***consistently applied*** to all BAAs

# 5. Flex Credit Should be Applied Symmetrically

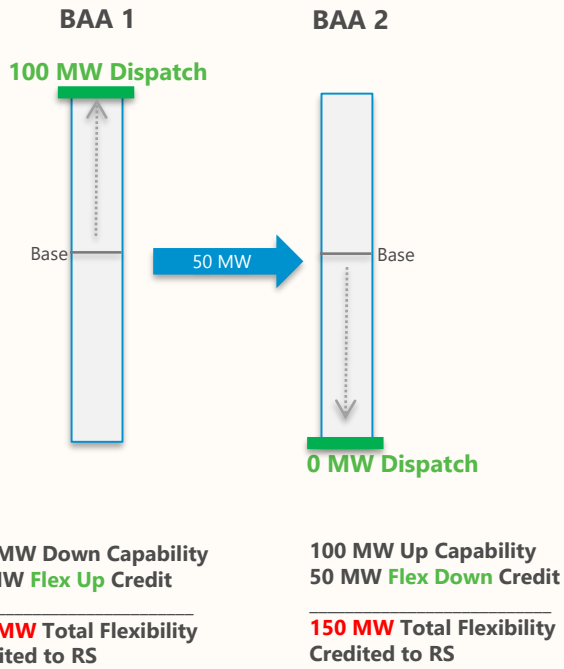
The Flex Up Credit recognizes the source BAA's ability to **reduce exports to increase its upward ramp capability** but ***fails to recognize*** that this would also ***decrease*** the upward ramp capability of the receiving BAA

Example: Two BAAs, each with a single 100 MW resource and a Base Schedule of 50 MW

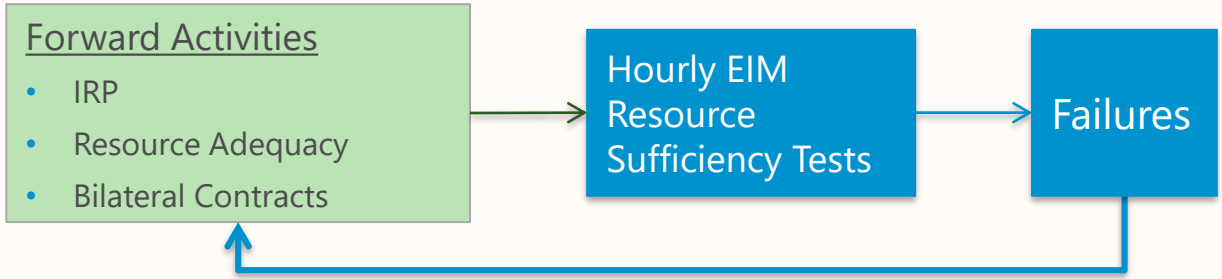
- BAA 1 dispatch = 100 MW
- BAA 2 dispatch = 0 MW
- EIM Export of 50 MW from BAA 1 to BAA 2
- BAA 1 receives credit for its **entire** downward flexibility range of 100 MW, **and** a Flex Up Credit of 50 MW
- BAA 2 receives (a) credit for its **entire** upward flexibility range of 100 MW, **and** (b) a Flex Down Credit of 50 MW

Both BAA 1 and BAA 2 count 150 MW towards the RS flexibility tests for a total of **300 MW** of flexibility, which ***exceeds the total flexibility of the physical resources by 100 MW***

A Flex Credit provided to one BAA should be included as a **ramp requirement** by the opposite BAA to ***avoid double-counting***



# 6. Changes to Enforcement Must Be Carefully Considered




- **Preventative** enforcement of RS is critical to ensure that entities continue to have **appropriate incentives** to contract for sufficient energy, capacity and flexibility ahead of each hour (through bilateral transactions or other forward commercial activities)
- Reducing or eliminating requirements or consequences of failure will result in longer term impacts by **reducing the critical feedback mechanism** that RS provides to forward planning activities
- Allowing EIM Transfers to occur despite an RS failure introduces **leaning as an economic choice** that **reduces incentives** to improve and implement effective forward planning programs

# 7. Ensuring Resource Sufficiency Tests are Applied in an Equitable Manner

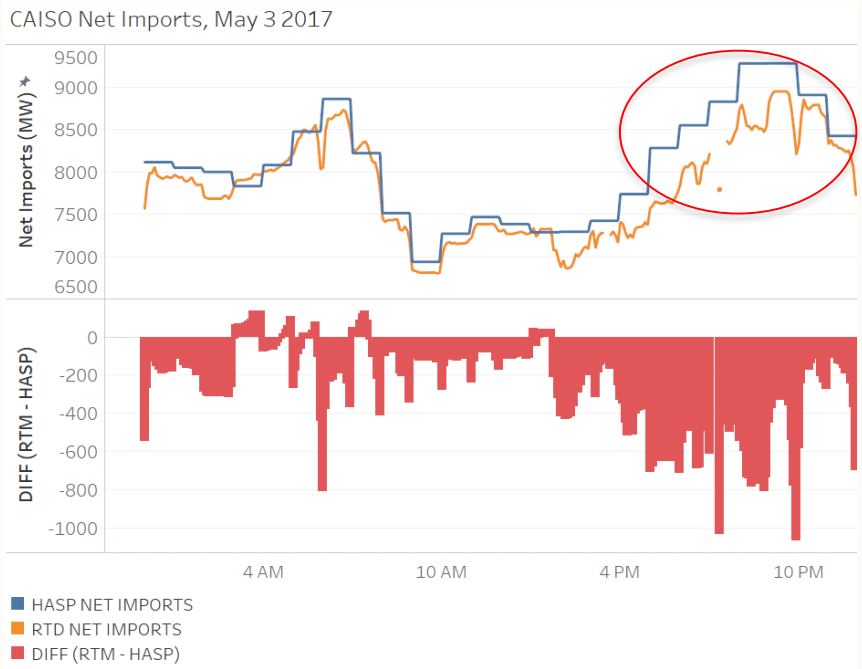
- A ***consistent*** and ***equitable*** application of RS is **critical** to ensure that the framework does not result in "winners" and "losers"
  - Are some BAAs held to a higher standard (i.e., above P95) while others are held to a lower standard (i.e., below P95)?
- There are key structural differences between CAISO and other EIM Entities that may result in the RS test being ***less effectively applied*** to the CAISO BAA
  - e.g., bilateral transactions vs intertie bidding framework
- Available data suggests (but is not conclusive) that the CAISO BAA may be incorrectly passing the RS tests during periods of capacity and flexibility challenges
  - During hours with high net load and/or high ramping requirements, CAISO receives large EIM imports*, yet there are still price spikes in the CAISO BAA, reflecting flexibility or capacity challenges

**For example, CAISO OASIS data shows EIM Imports to CAISO BAA reaching 763 MW during emergency conditions on May 3, 2017*

# 7. Ensuring Resource Sufficiency Tests are Applied in an Equitable Manner

**Supply** counted toward meeting the EIM RS Requirements **may be overstated** for the CAISO BAA

- Using intertie bid framework, marketers may ***seek to acquire*** supply only ***after*** a bid is awarded and potentially only after the CAISO BAA has ***counted on that supply*** to pass the RS Tests
- Data suggests that actual imports to CAISO have **fallen significantly short** of expected deliveries during critical periods
- By contrast, EIM Entities typically make bilateral transactions that involve **advance communication** regarding the characteristics of the physical supply and transmission used for delivery
- CAISO and EIM Entities **should not be permitted** to include import supply in the RS Test if the physical resource and transmission is not identifiable



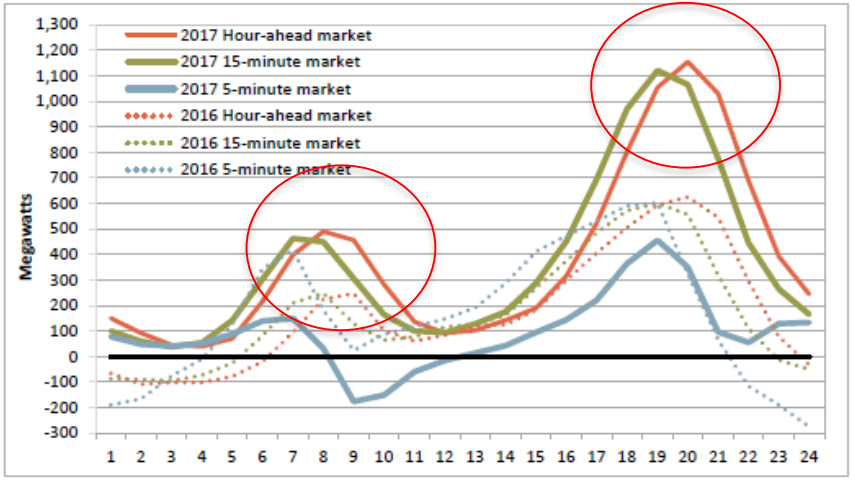

*Source: CAISO OASIS*

# 7. Ensuring Resource Sufficiency Tests are Applied in an Equitable Manner

Upward capacity and flexibility **requirements** may be **understated** for the CAISO BAA

- CAISO has systematically load biased in the upward direction during peak periods, increasing the quantity of upward capacity and flexibility dispatched by the market to meet load in the CAISO BAA
- This can lead to an **ongoing, systemic gap** between the load forecast used for the RS test **(lower)**, and the load used for EIM binding dispatch **(higher)**
- Should systemic load bias be **added** to the load forecasts used in the RS Tests?

Figure 1.7 Average 3rd quarter hourly load adjustment (2016 – 2017)




*Source: Q3 2017 Report on Market Issues and Performance – Department of Market Monitoring*

# 7. Ensuring Resource Sufficiency Tests are Applied in an Equitable Manner

- Other issues and concerns regarding Resource Sufficiency requirements have materialized
  - Some EIM Entities have expressed concerns with the approach used to determine uncertainty requirements for their respective BAAs
  - DMM has recently published a detailed report* regarding **systemic** and **material errors** in the calculation of uncertainty since FRP was introduced in 2016
- Transparent data are critical to provide confidence to EIM Entities that the Resource Sufficiency framework is functioning properly and being applied equitably
- The first step is a straightforward data analysis to verify whether the total RS requirements are set at the right level for each BAA (each hour of the day)
- This analysis ***need not*** measure whether an entity passed or failed the test, but instead should measure whether the ***requirement itself*** is set at the right level based on actual imbalance needs

**Flexible Ramping Product Uncertainty Calculation and Implementation Issues – April 18, 2018*

# 7. Ensuring Resource Sufficiency Tests are Applied in an Equitable Manner

| Resource Sufficiency Components | Category | (A) Current Hour Reference Point | (B) Next Hour Projected Schedule | (C) Resource Sufficiency Test Inputs | (D) EIM RTD Dispatch | (E) Actual Flexibility Needs |
|---|---|---|---|---|---|---|
| **FRST Requirements** | Forecast Load | FMM interval 4 of current hour | 15-minute Sufficiency Forecast | B – A | RTD Load Forecast | D – A |
| | Uncertainty | N/A | N/A | Calculated based on historical net load deviations | | |
| **Capacity Test Requirements** | Historical Import/Export Errors | N/A | N/A | Calculated based on historical tag changes after T-40 | | |
| **Forecast Movement of Non-Dispatchable Resources** | VERs | FMM Interval 4 of current hour | VER Forecast at T-55 | B – A | RTD VER Forecast | D – A |
| | NPR Scheduled Output | FMM interval 4 of current hour | Base Schedule | B – A | RTD Dispatch | D – A |
| | Change in Imports | FMM interval 4 of current hour | Import Schedules as at T-40 | B – A | Actual RTD Imports | D – A |
| | Change In Exports | FMM interval 4 of current hour | Export Schedules as at T-40 | B – A | Actual RTD Exports | D – A |

**Bid Range required to pass RS Tests**

**Actual imbalances served by EIM**

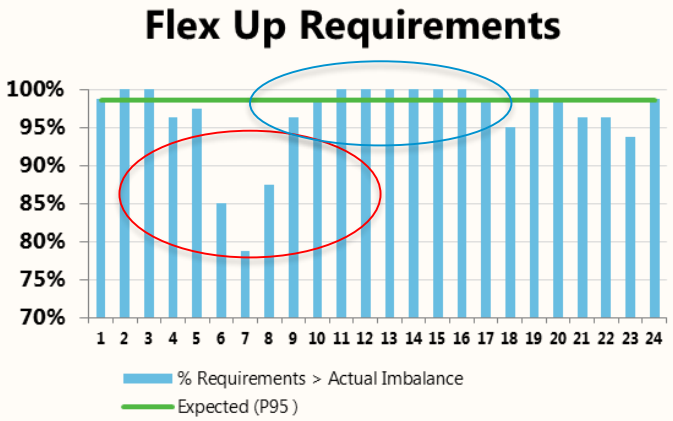
**The actual flexibility** (i.e., bid range) required to meet imbalances within each BAA should be less than or equal to the bid range necessary to **pass Resource Sufficiency** 95% of the of the time, on average

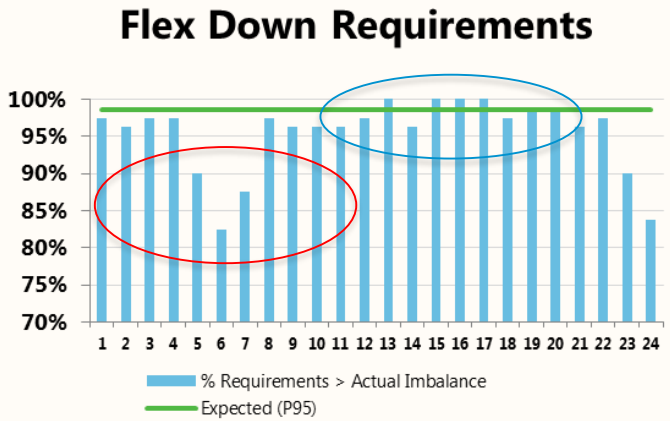
# 7. Ensuring Resource Sufficiency Tests are Applied in an Equitable Manner

**Powerex performed initial analysis for its requirements for April 4 – 23**

- During morning hours, Flexible Ramping Requirements appear ***lower*** than P95
- Flex Ramping Requirements in other hours appear ***higher*** than P95

*Powerex cautions that **available data is very limited**. These illustrations are only intended to demonstrate the approach.*



# Conclusion

- **The objectives and general structure of the Resource Sufficiency Framework appear sound**
- **Enhancements should focus on improving workability and addressing existing gaps**
- **Additional transparency is an important first step to:**

1. Verify whether the existing Resource Sufficiency tests are functioning fairly and consistently across EIM Entities and CAISO
2. Facilitate on-going review and assessment of the Resource Sufficiency framework as it continues to evolve
3. Provide confidence that the EIM Resource Sufficiency framework is robust and could be extended to EDAM

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# Thank You

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