



California ISO

WESTERN ENERGY IMBALANCE MARKET (WEIM)

Briefing on resource sufficiency evaluation tests

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Joint ISO Board of Governors and WEIM Governing Body meeting

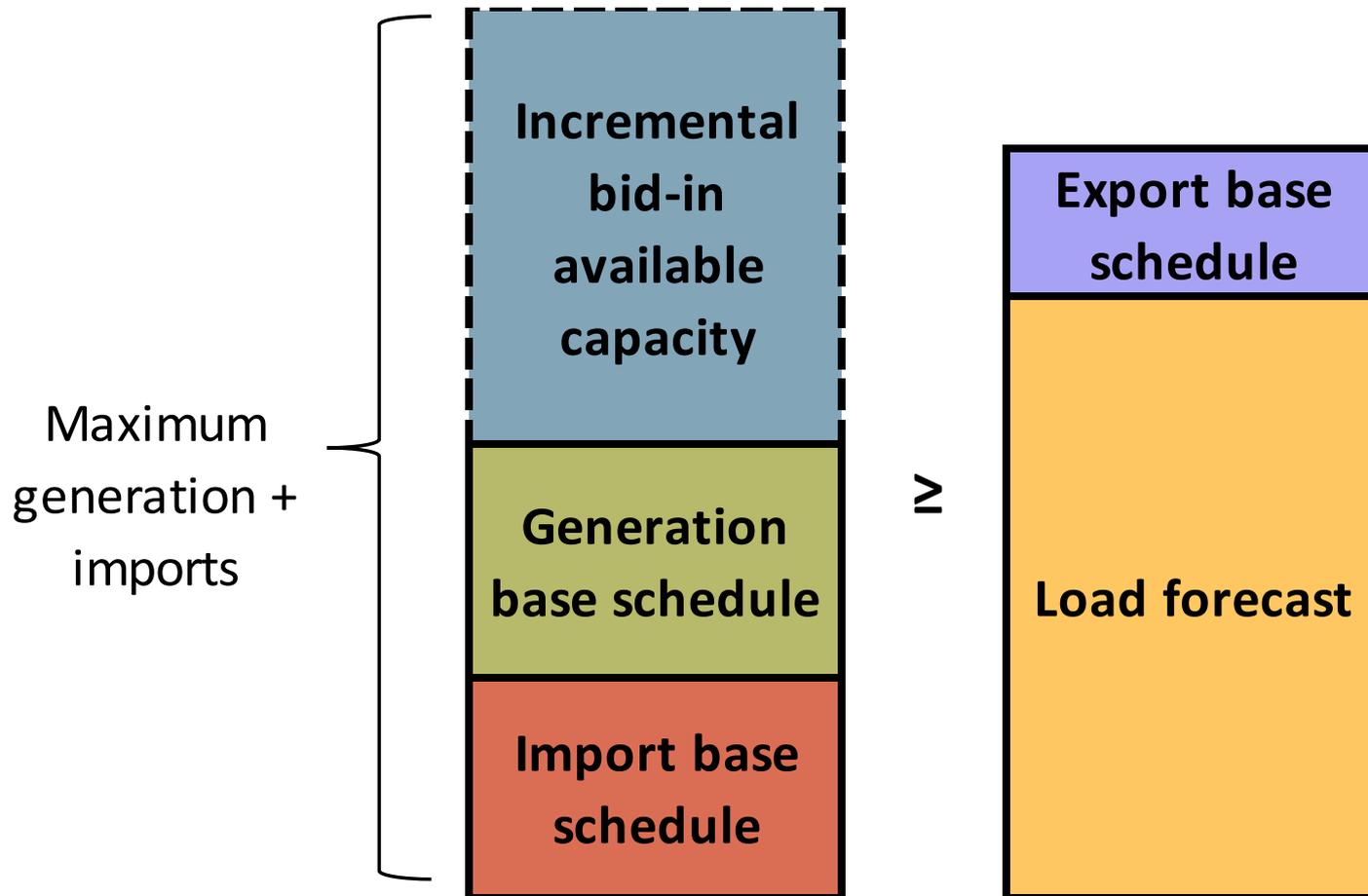
September 20, 2023

Overview

- July 2023 report published
 - <http://www.aiso.com/Documents/Jul-2023-Metrics-Report-on-Resource-Sufficiency-Evaluation-in-WEIM-Aug-31-2023.pdf>
- Quick review of the capacity and flexibility tests
- Recent results
- Changes to the resource sufficiency evaluation
 - New quartile regression based uncertainty calculation implemented on February 1
 - Two RSE enhancements phase 2 (track 1) implemented on July 1
 - Adjustment for lower priority exports in ISO's RSE
 - Assistance Energy Transfers (AET)

Overview of the bid-range capacity test (capacity test)

Incremental bid-in capacity above generation + import base schedules must be \geq export base schedules + forecasted load.



Overview of the bid-range capacity test (capacity test)

Calculation of incremental supply has been improved over time to account for various limitations.

Max operating MW (P_{max})

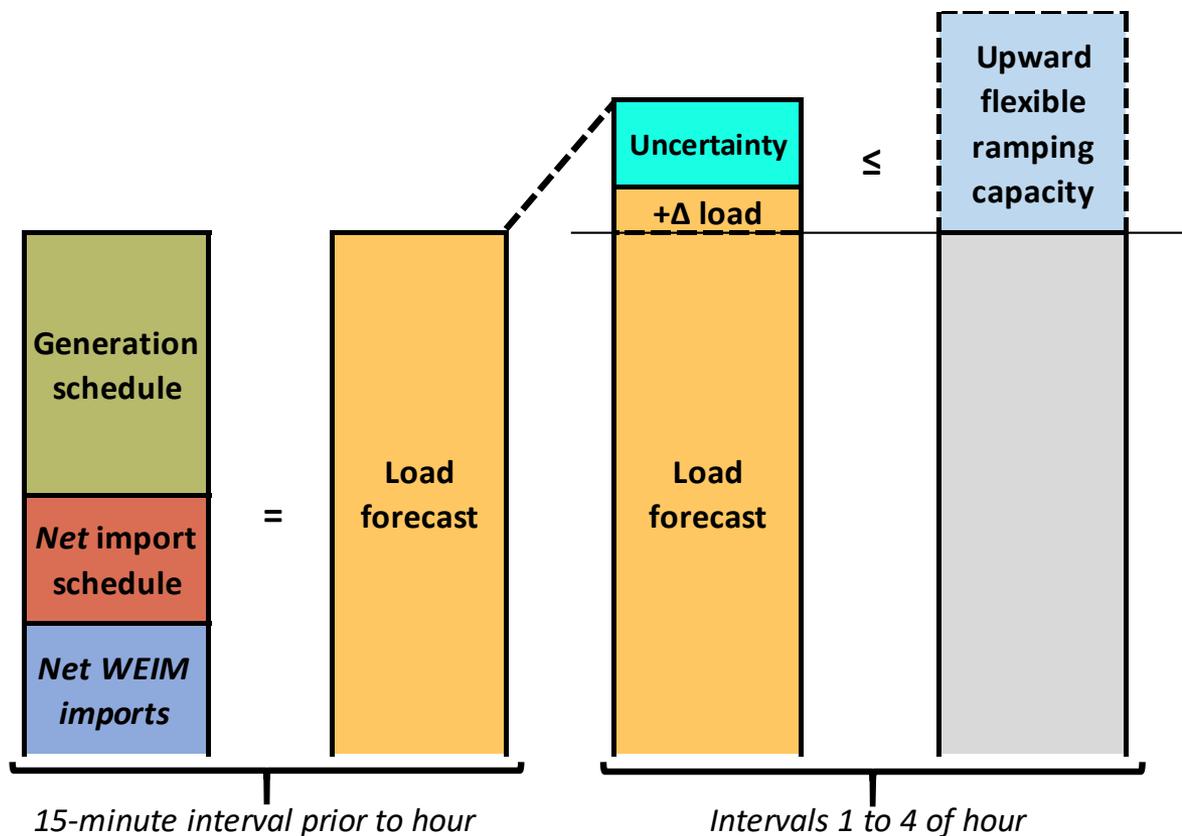
P_{max} derate

Available capacity in the test



Overview of the flexible ramp sufficiency test (flexibility test)

Each area must have ramping capacity to meet forecasted changes in demand plus net load uncertainty from the last interval prior to the hour through the four 15-minute intervals within the evaluation hour.



Failures of capacity and flexibility tests have remained low in summer 2023

Capacity test failures (in percent of 15-minute intervals)

Arizona Publ. Serv.	—	—	—	—	—	—	0.1	0.4	0.5	0.7	0.2	0.0	0.1	—	—
Avangrid											0.0	—	—	—	—
Avista	0.2	0.2	0.0	—	—	—	0.1	—	—	—	0.1	0.0	—	—	—
BANC	—	—	0.0	0.3	—	—	—	—	—	—	—	—	—	—	—
BPA	0.1	—	0.0	0.5	—	—	0.4	—	—	—	0.2	—	0.3	0.4	—
California ISO	—	—	—	0.1	—	—	—	—	—	—	—	—	—	—	—
El Paso Electric											0.0	0.1	0.3	0.8	0.0
Idaho Power	—	—	0.2	0.2	—	—	—	—	—	—	0.0	0.1	—	—	—
LADWP	—	0.0	—	—	—	—	—	0.1	—	—	—	—	—	0.1	0.0
NorthWestern En.	—	—	0.1	0.1	—	0.2	0.1	0.3	0.1	—	—	—	—	0.3	—
NV Energy	0.0	0.1	—	—	—	—	—	—	—	—	—	0.0	—	0.0	0.0
PacifiCorp East	—	—	—	0.1	—	—	0.3	—	—	—	—	—	—	0.0	—
PacifiCorp West	0.0	1.0	0.2	0.0	—	0.0	0.0	0.1	0.1	—	—	—	—	—	0.1
Portland Gen. Elec.	—	—	0.1	—	—	0.3	—	—	0.0	0.0	0.1	0.4	0.1	0.0	—
Powerex	—	—	0.2	—	—	0.0	—	—	—	—	—	0.1	—	—	—
PSC of New Mexico	—	—	—	—	—	—	—	—	—	0.7	0.3	0.2	0.0	—	0.0
Puget Sound En.	0.2	—	—	0.2	0.1	0.0	—	—	0.0	0.2	—	0.1	0.5	1.5	0.5
Salt River Proj.	0.2	0.2	0.4	0.4	0.2	0.0	0.0	1.0	0.4	1.1	0.9	0.2	0.0	2.8	1.2
Seattle City Light	—	0.2	0.1	0.2	0.0	0.0	0.2	0.0	0.1	—	—	—	—	0.1	0.9
Tacoma Power	0.0	0.0	0.2	0.0	—	—	—	0.0	0.1	0.1	—	0.1	—	—	0.1
Tucson Elec. Pow.	—	—	0.1	—	—	—	—	0.1	0.0	—	—	—	—	0.3	—
Turlock Irrig. Dist.	0.1	—	—	—	—	—	0.2	—	—	—	0.0	—	—	0.1	—
WAPA DSW											2.3	0.8	0.7	1.1	0.6
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
	2022							2023							

Failures of capacity and flexibility tests have remained low in summer 2023

Flexibility test failures (in percent of 15-minute intervals)

Arizona Publ. Serv.	—	0.0	0.1	—	—	0.1	0.4	0.9	1.8	2.5	1.1	0.2	0.1	—	0.0
Avangrid											1.0	0.7	0.1	0.2	0.0
Avista	1.0	0.5	0.1	—	0.1	—	0.1	—	0.0	0.0	0.2	0.2	0.0	—	—
BANC	—	—	—	0.3	—	—	—	—	—	—	—	0.1	—	—	—
BPA	3.1	3.3	1.0	1.1	0.2	0.1	0.4	—	0.1	0.6	0.2	1.2	0.3	1.3	0.2
California ISO															
El Paso Electric											0.8	0.7	0.3	2.1	0.5
Idaho Power	—	0.2	0.2	0.5	—	0.1	—	0.0	0.1	0.3	0.3	0.5	0.1	—	—
LADWP	—	—	—	0.1	0.1	—	—	—	0.3	—	0.1	0.0	0.1	0.0	0.2
NorthWestern En.	0.1	0.3	1.0	0.2	—	0.5	0.8	0.3	0.1	0.2	0.8	0.3	0.2	1.0	0.4
NV Energy	0.2	—	0.1	0.1	0.1	0.2	0.0	0.1	0.3	0.0	0.1	0.1	0.0	0.1	0.2
PacifiCorp East	0.1	0.2	0.1	—	0.1	—	0.0	0.1	—	0.0	0.1	—	0.0	0.2	—
PacifiCorp West	0.0	—	0.1	0.1	—	0.1	—	0.1	0.1	—	0.1	0.6	0.0	0.2	—
Portland Gen. Elec.	0.0	0.4	0.1	0.1	0.2	1.0	0.1	0.0	0.1	0.0	0.1	1.5	0.7	0.1	—
Powerex	—	—	0.3	0.1	—	—	—	—	0.2	—	—	—	—	—	—
PSC of New Mexico	—	0.4	—	0.0	0.2	0.1	0.8	0.2	—	1.2	5.1	0.9	0.6	0.7	0.5
Puget Sound En.	0.1	0.4	0.2	0.3	—	0.0	—	—	0.1	0.8	0.2	1.0	0.6	2.6	1.3
Salt River Proj.	0.5	0.6	1.1	0.6	0.6	0.5	0.8	3.5	1.2	1.7	2.0	0.6	0.2	3.7	1.1
Seattle City Light	—	0.2	0.0	0.2	—	0.1	0.0	—	0.1	—	—	—	—	—	0.5
Tacoma Power	0.1	0.0	0.1	0.1	—	0.2	—	0.2	0.1	0.2	—	0.1	—	—	—
Tucson Elec. Pow.	—	—	—	0.4	0.0	—	0.2	0.3	0.3	0.3	0.1	0.1	—	0.2	0.3
Turlock Irrig. Dist.	—	—	—	0.1	—	—	1.2	—	—	—	0.0	—	—	0.1	—
WAPA DSW											2.7	0.7	0.8	0.3	0.6
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	2022							2023							

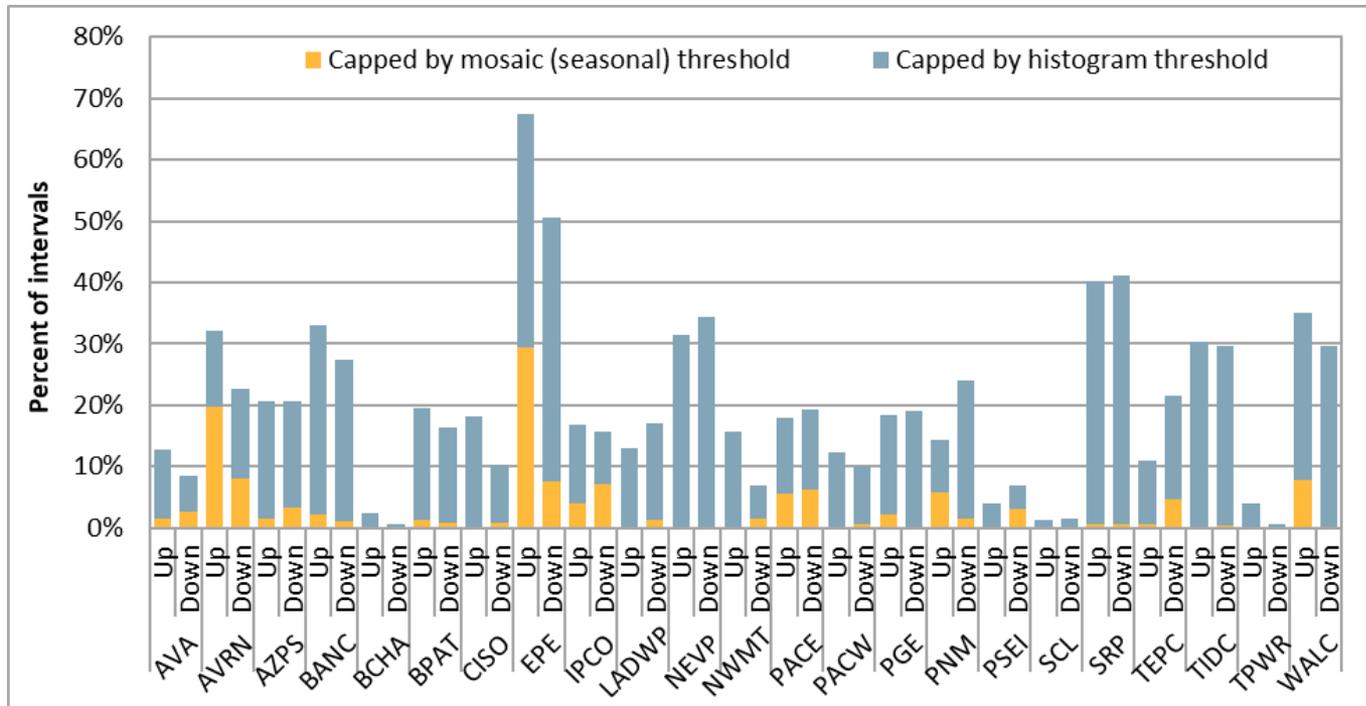
New quantile regression for calculating net load uncertainty

- New method for calculating uncertainty used in flexibility test called *quantile regression*
- Regression-based estimate of uncertainty based on:
 - Historical load, solar, and wind information (previous 180 days for same hour)
 - Net load based on difference between binding 5-minute market forecasts and advisory 15-minute market forecasts
 - Model estimates 95 percent confidence interval of net load
- Resulting regression coefficients are combined with current load/solar/wind forecast information to forecast the extreme range of net load uncertainty that might materialize (95% confidence)

Two thresholds in place to cap regression-based estimate of uncertainty

- **Histogram threshold:** 1st and 99th percentile of net load error using observations from the previous 180 days for the same hour (updated each day).
- **Mosaic (seasonal) threshold:** 1st and 99th percentiles using quantile regression method using observations from the previous 90 days (updated each quarter)

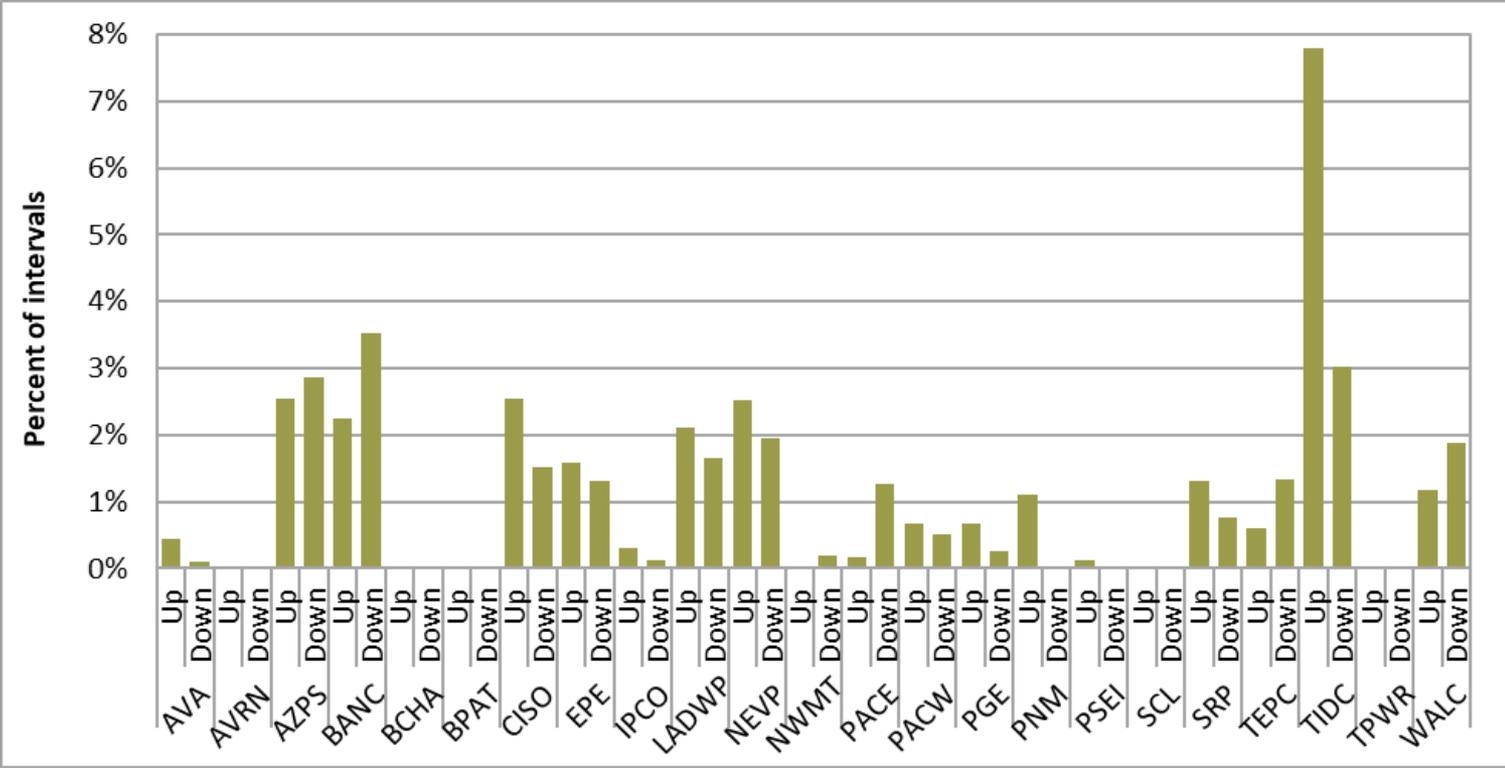
Percent of time uncertainty capped by mosaic or histogram thresholds (July 2023)



A floor of 0 MW is also applied to regression-based estimate of uncertainty

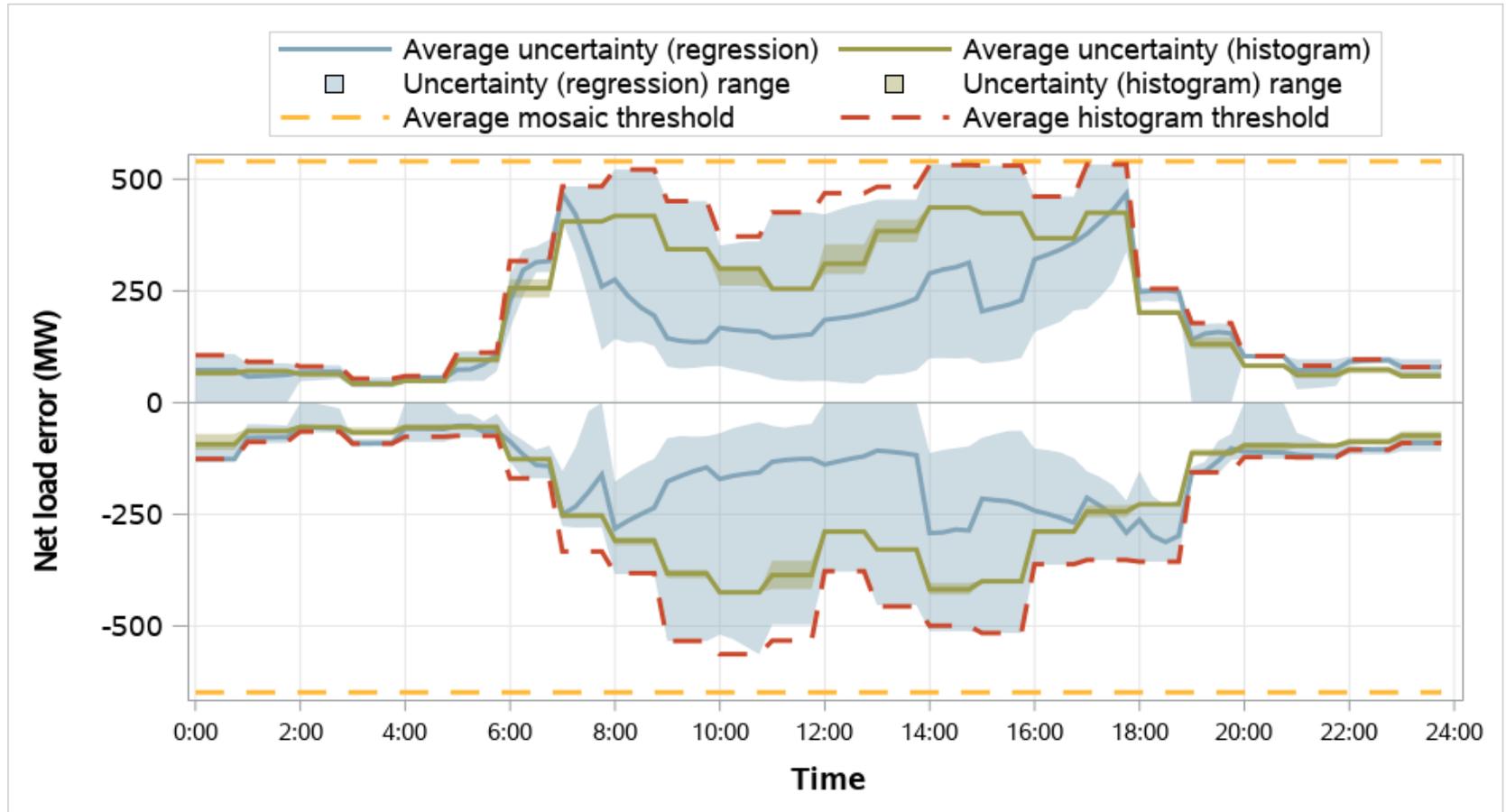
Upward and downward uncertainty is set at ~0 MW when the uncertainty calculated from quantile regression would be negative

Percent of time uncertainty set at 0 MW (July 2023)



Regression approach tends to result in lower requirements during mid-day in some areas, but are much more variable

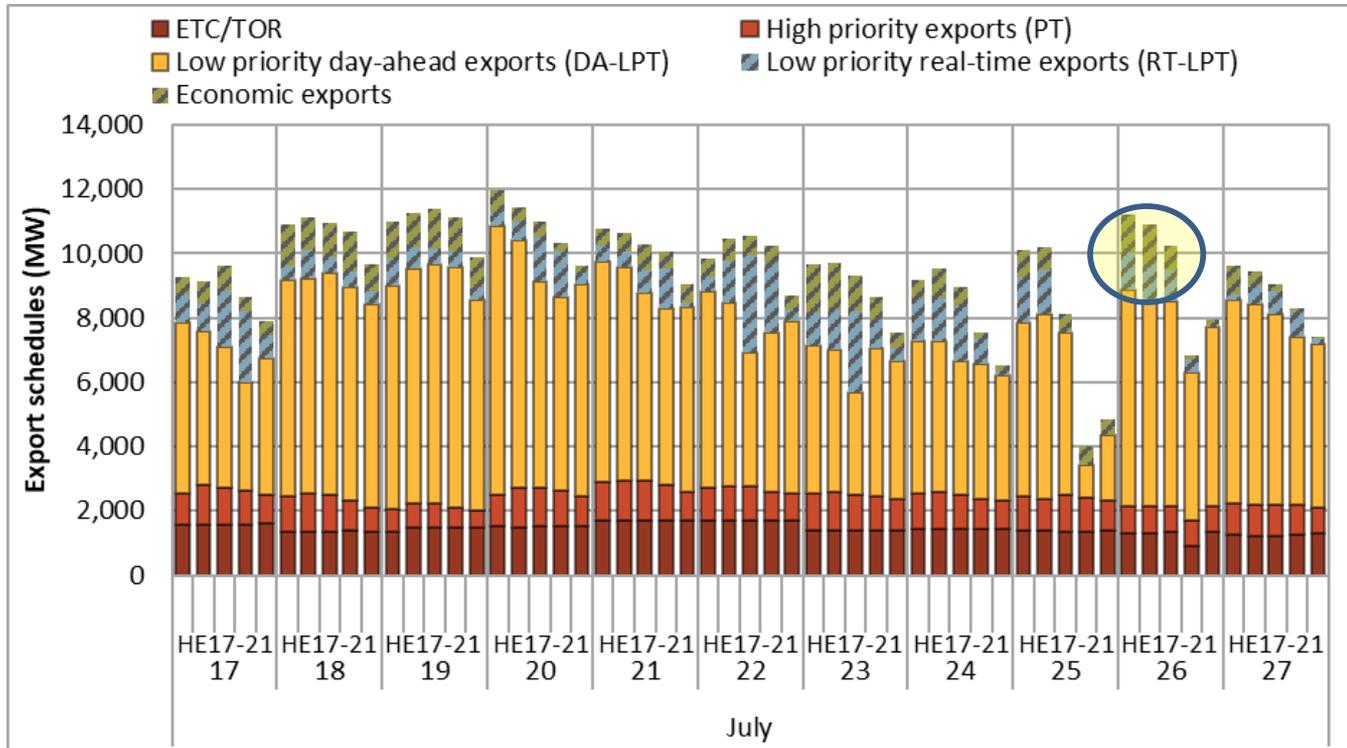
NV Energy net load uncertainty (Weekdays, July 2023)



Change in treatment of low priority exports from ISO implemented on July 1, 2023

- Real-time low priority (RT LPT) and economic exports are no longer counted as part of ISO area's demand obligation.
- This sometimes reduces ISO area requirements significantly.
- However, this change has not had much impact on preventing ISO from failing tests:
 - No impact on capacity test
 - Change prevented ISO from failing flexibility test during only four 15-minute intervals (or 1 hour) in August

Real-time low priority and economic exports schedules now have not net effect on ISO's capacity test requirement

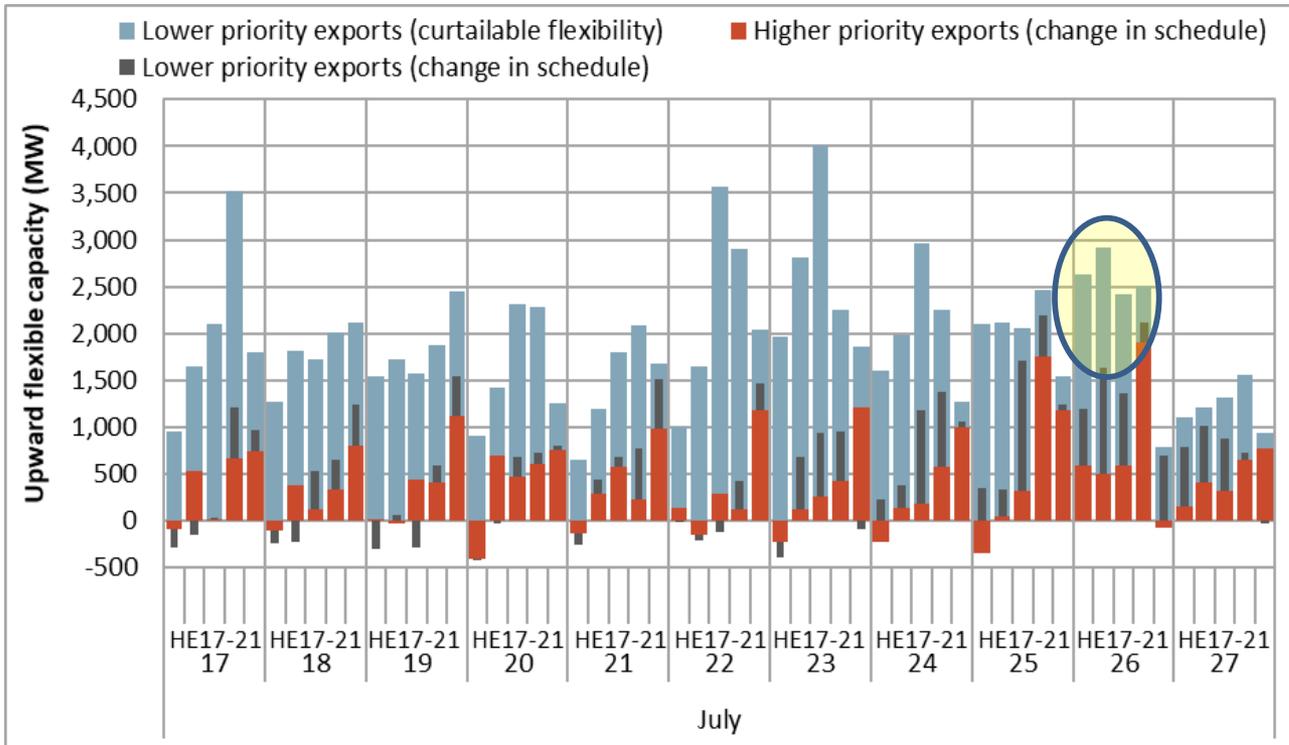


Real-time low priority (RT LPT) and economic exports are now counted as upward available capacity when calculating supply in the capacity test.

This cancels out additional demand that these exports add to capacity test requirement.

(Peak hours, July 17 – July 27, 2023)

Upward flexible ramp capacity from exports in ISO's flexibility test



(Peak hours, July 17 – July 27, 2023)

Higher priority exports

- ETC/TOR, high-priority, and DA-LPT.
- Still counted as demand in the flexibility test based on their *change* in schedule.

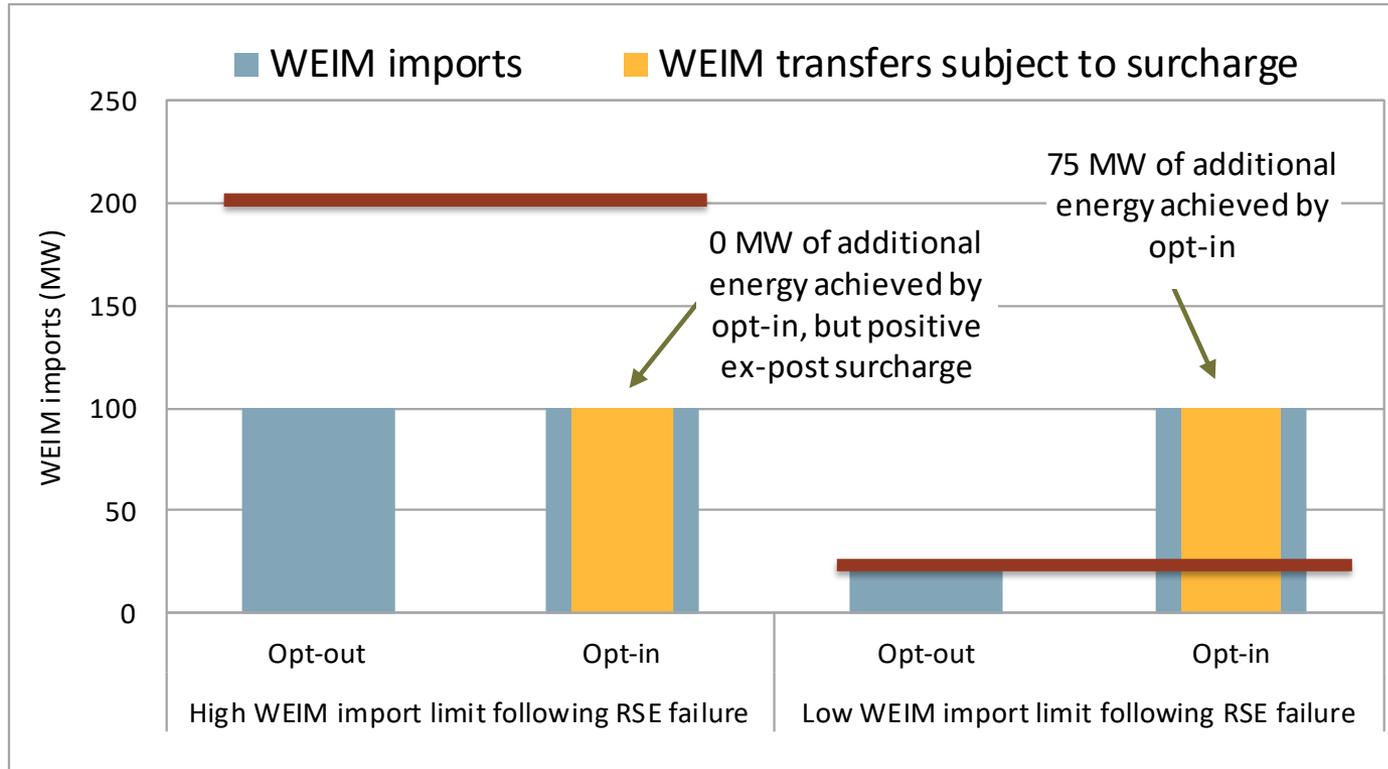
Lower priority exports

- RT-LPT and economic exports. (light blue bars)
- Now assumed to be curtailable and counted as upward flexible capacity

Assistance Energy Transfers (AET) implemented July 1

- Decision to participate is optional for all BAAs
 - BAAs can opt-in with (with several days advance notice)
 - Information on WEIM BAAs opting in not currently made public by ISO
 - ISO's status is posted publically by ISO
- BAAs that opt-in can access to excess WEIM supply that may not have been available otherwise following a resource sufficiency evaluation failure
 - Opting in prevents WEIM imports from being limited during a test failure, but WEIM imports are subject to an ex-post surcharge
 - Surcharge price = \$1,000 or \$2,000/MW bid cap
 - Surcharge applied to minimum of (1) WEIM imports or (2) MW by which area failed the test

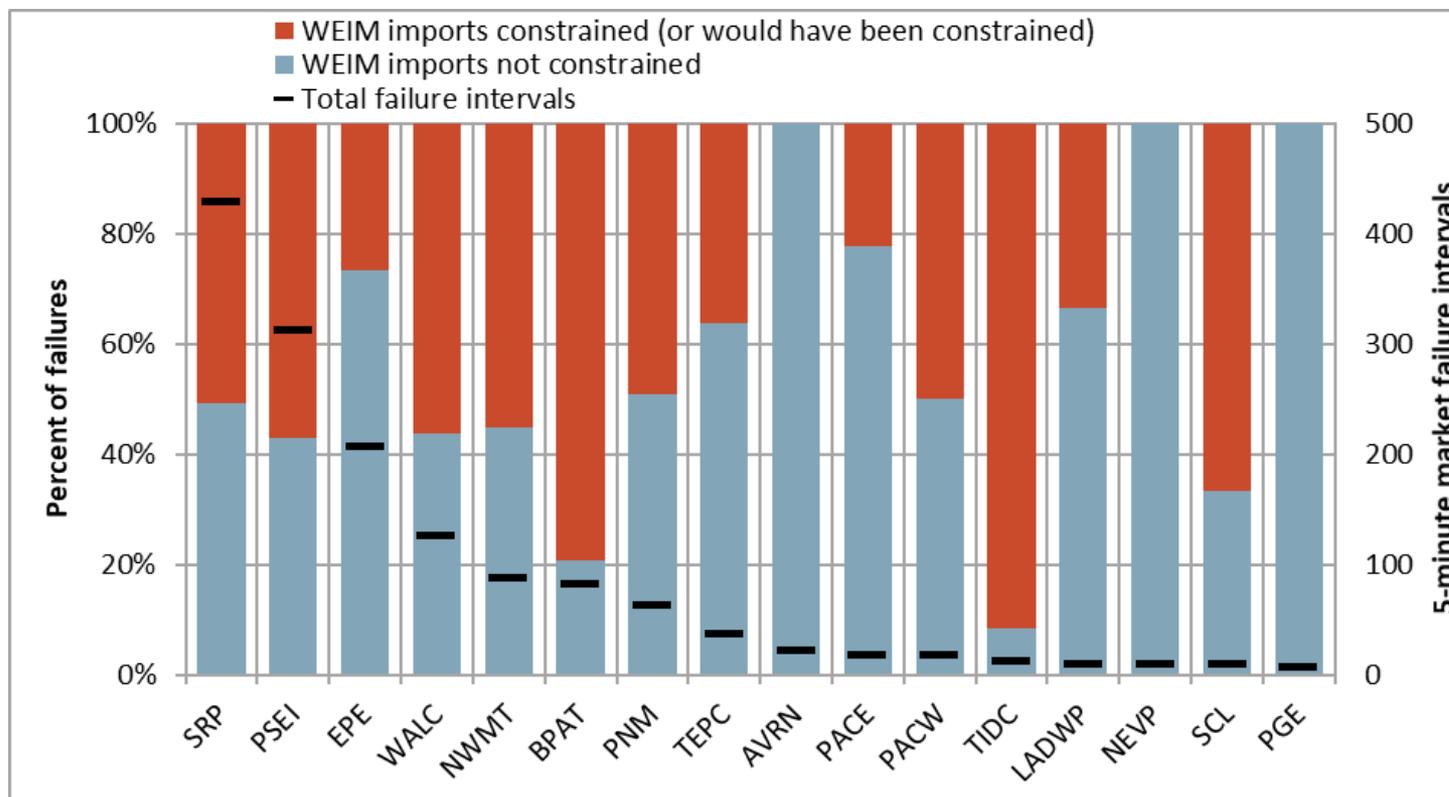
Example of Assistance Energy Transfers (AET)



- Optimal WEIM import without any limits is 100 MW
- BAA failed resource sufficiency evaluation by 150 MW
- Scenario 1 (left): High WEIM import limit following failure (200 MW)
- Scenario 2 (right): Low WEIM import limit following failure (25 MW)

Intervals in which WEIM imports were constrained (or would have been constrained) by test failure

5-minute intervals, July 2023



For balancing areas that opted-in to AET, this metric summarizes import limits that would have been in place following RSE failure without opt-in.