APS Load & VER Forecast in the Western EIM:
Challenges and Improvements

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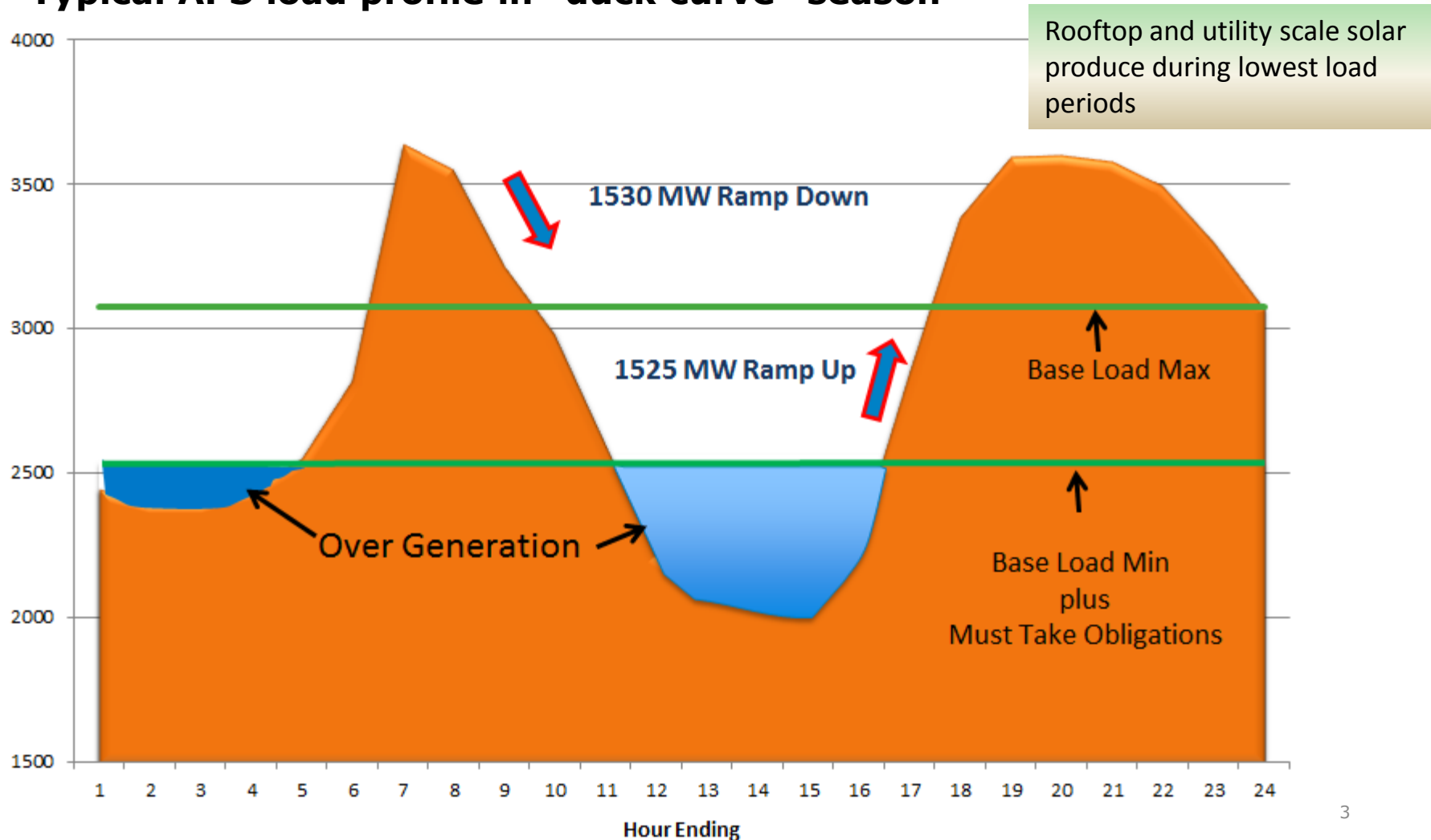**June 6, 2018**

Overview

- Forecasting Challenges
  - The Duck Curve
  - Monsoon Season and Cloudy days
  - VER Forecasting Latency
  - APS 3 Sub Region Load Pocket
  - Intraday Extended Forecasting
  - Improvements in Next Hour Forecasting
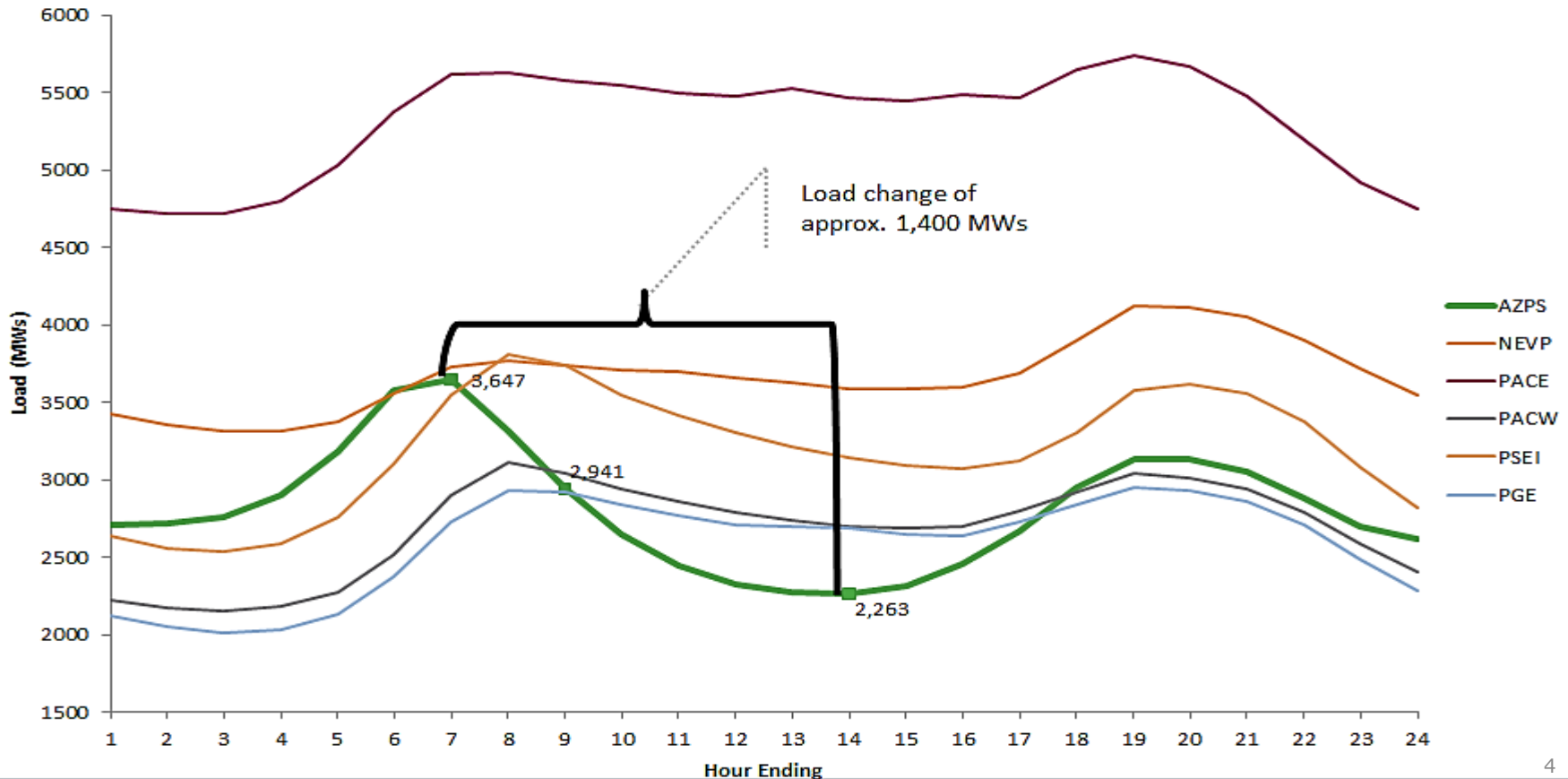
APS Load Challenges: Duck Curve

Typical APS load profile in "duck curve" season

Rooftop and utility scale solar produce during lowest load periods

1530 MW Ramp Down

1525 MW Ramp Up

Base Load Max

Base Load Min
plus
Must Take Obligations

Over Generation

Hour Ending

Duck Curve in the Western EIM

Amongst EIM entities APS is most impacted by the duck curve

March 1st, 2018 EIM Load Shape

Load change of approx. 1,400 MWs

Legend:
- AZPS
- NEVP
- PACE
- PACW
- PSEI
- PGE

Data labels: 3,647 · 2,941 · 2,263

Y-axis: Load (MWs)
X-axis: Hour Ending

APS Load Challenges: Monsoon and Cloud Cover Impacts on Intraday Load Forecast

- Monsoon season weather is unpredictable and erratic
  - Delay in forecast models to recognize intraday weather changes has ripple effects
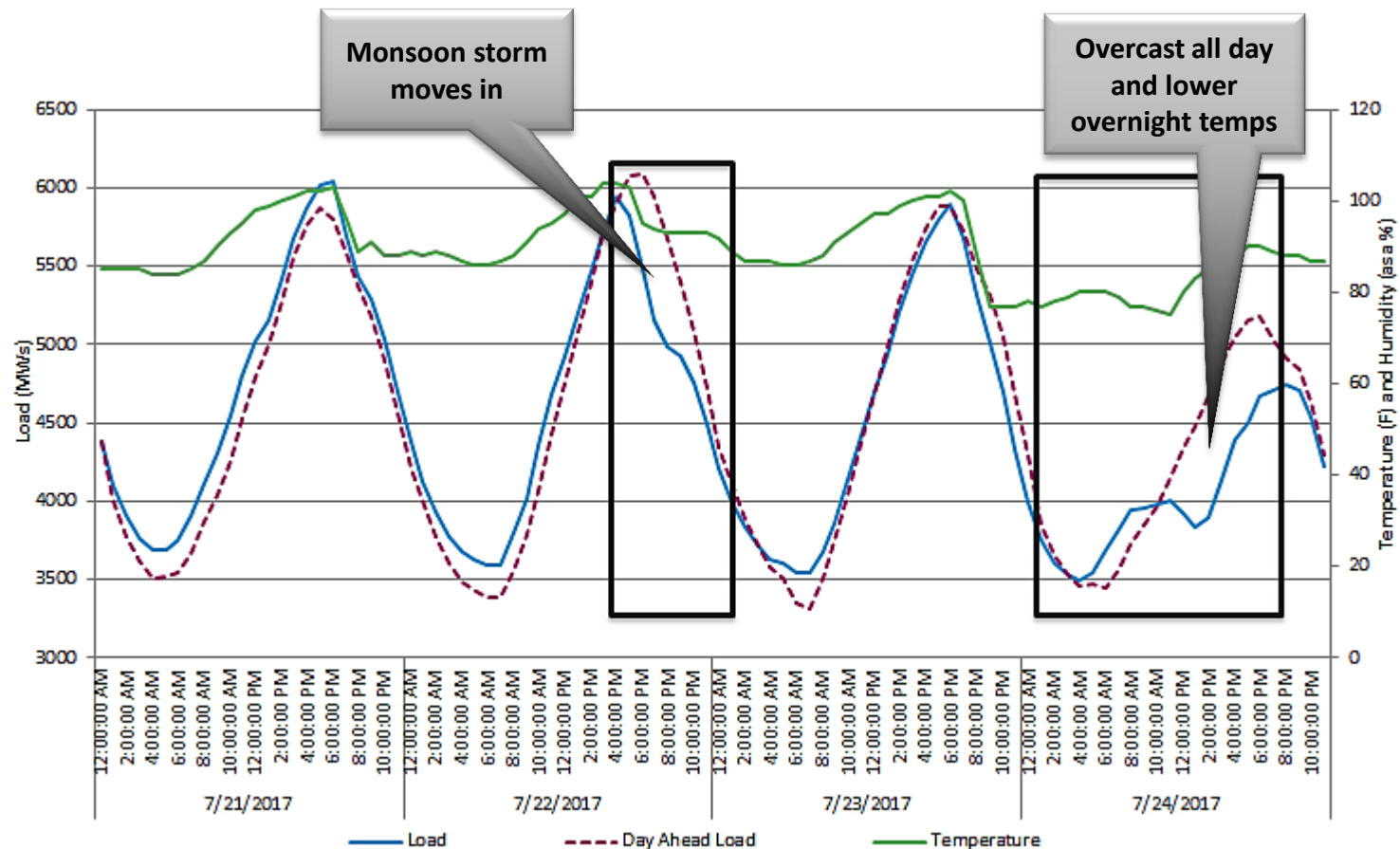
VER Forecast Latency

Challenges:

- Latency in APS VER forecasts sent to CAISO and receipt of forecast by CAISO system
  - APS sends VER forecasts every 5 minutes (APS improvements on latency from 15min to 5min)
  - CAISO VER data to market ~11minutes, after receipt and process of VER data
- Cloud cover exacerbates latency issues between APS and CAISO systems

Weather Reporting → Actuals sent from APS to UofA → UofA Forecasting Model runs & send to APS → 5min Forecast pulled by PCI → APS export task to CAISO every 5 min

Potential Solutions:

- CAISO VER Enhancements Implementation
- CAISO persistence forecast model
  - Would be beneficial to the ramping on and off of solar, especially when due to weather
  - Persistence forecast not offered on thermal solar
- APS continuously working with UofA on forecast improvements and accuracy

APS Load Challenges: 3 Sub Region Load Pocket

- **APS Serves 3 Distinct Load Regions**:
  - Phoenix Metropolitan Area
  - Northern Arizona
  - Yuma
- **Each region has distinctly differing temperature forecasts**
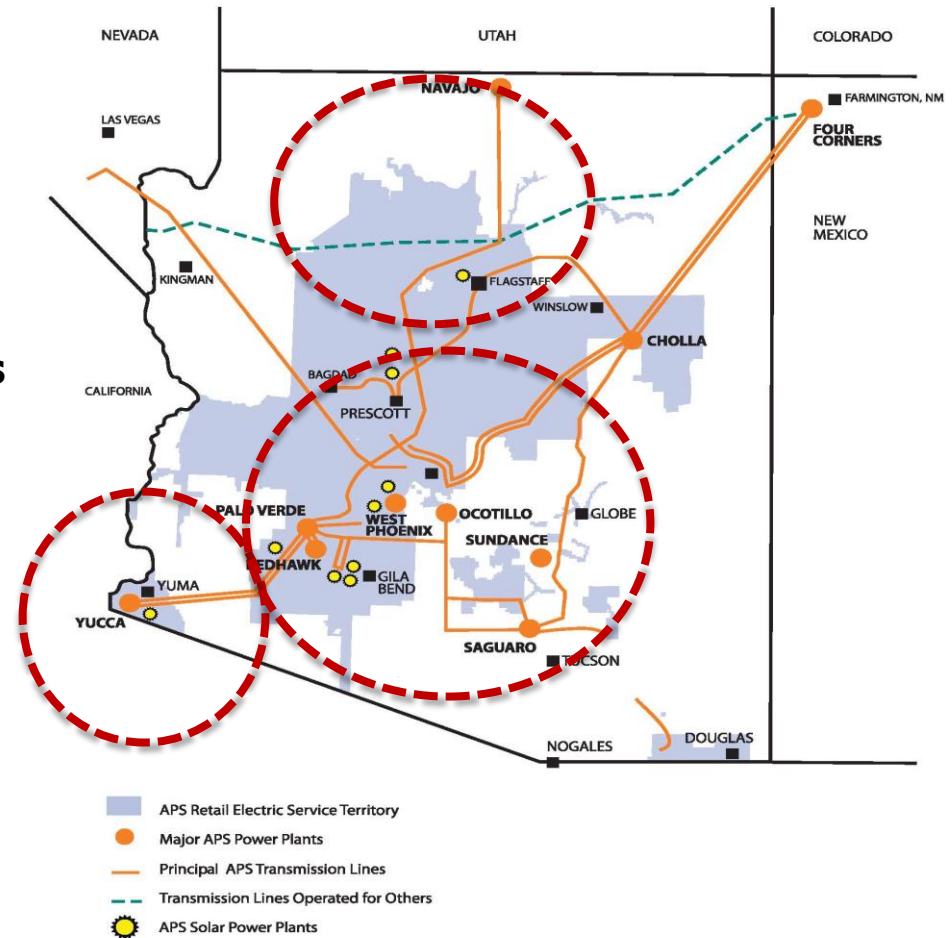
Extended Load Forecasting

- Large variances on future hour forecasting between APS Load forecast model and CAISO
  - The further out the forecast the larger the variance of CAISO model
  - Affects intraday gas and generation planning

CAISO vs. APS Load Forecast Model
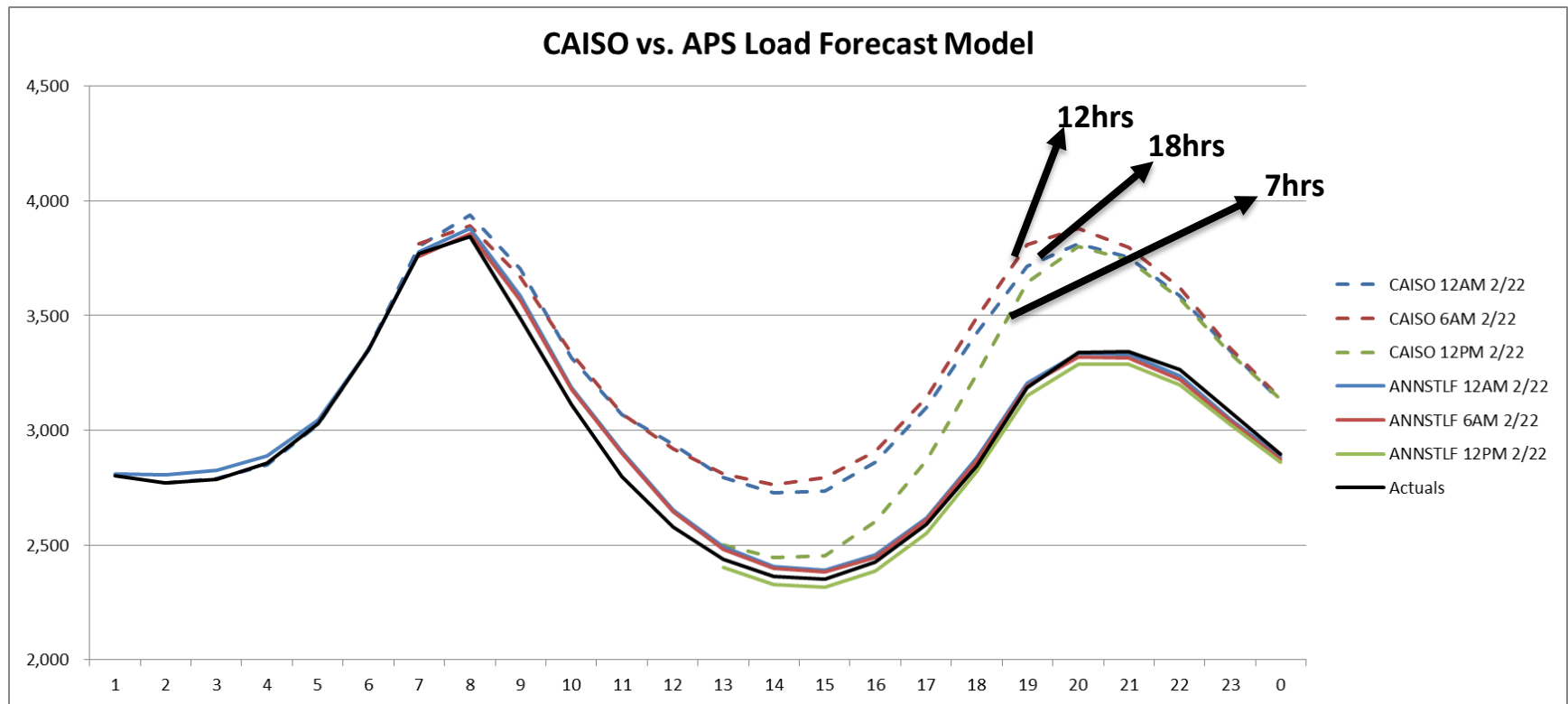
Improvements in Load Forecasting for APS

CAISO forecasting accuracy for APS BAA on next hour has improved and continue to see improvements
- Continually working with CAISO on accuracy
- Extended forecasting accuracy still a concern, partnering with CAISO on improvement strategies

CAISO vs APS Next Hour Load Accuracy

CAISO 2017 - 1.51%
APS 2017 - 1.30%