DOE Solar Forecasting Workshop- Forecasting Renewable Resources

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Agenda

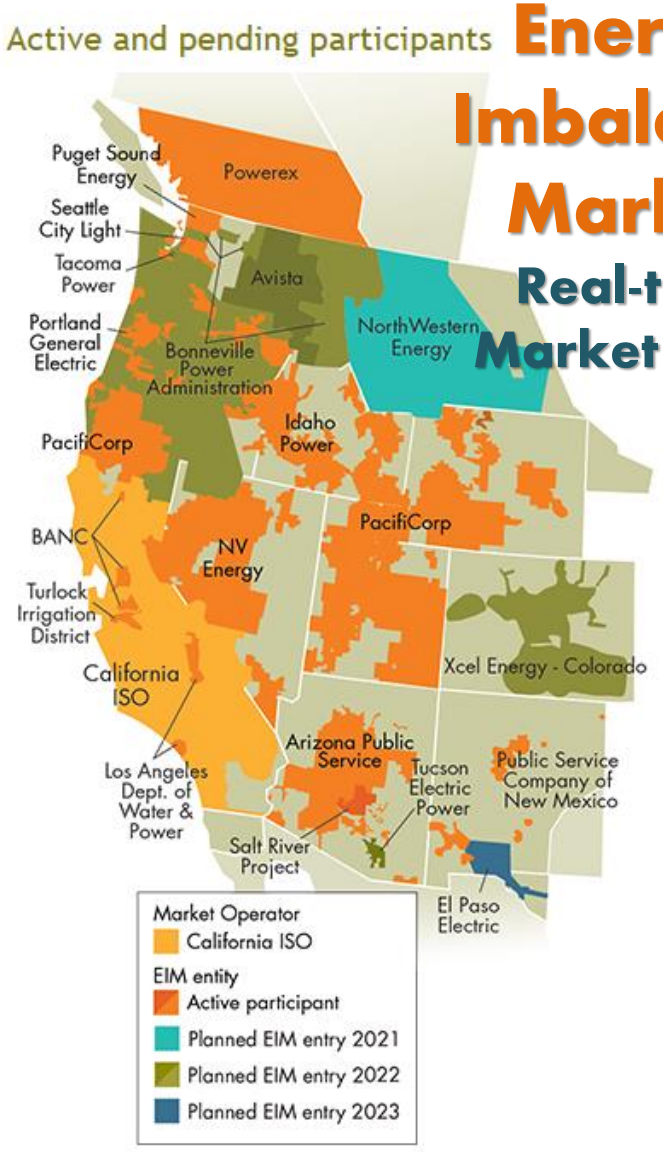
- CAISO background
- Solar and wind forecasting
- Behind-the-Meter Impact to Demand and Operations
- CAISO Advancements

California ISO's market footprints

https://www.westerneim.com/pages/default.aspx

ISO Balancing Authority Area

Day-ahead & Real-time Market

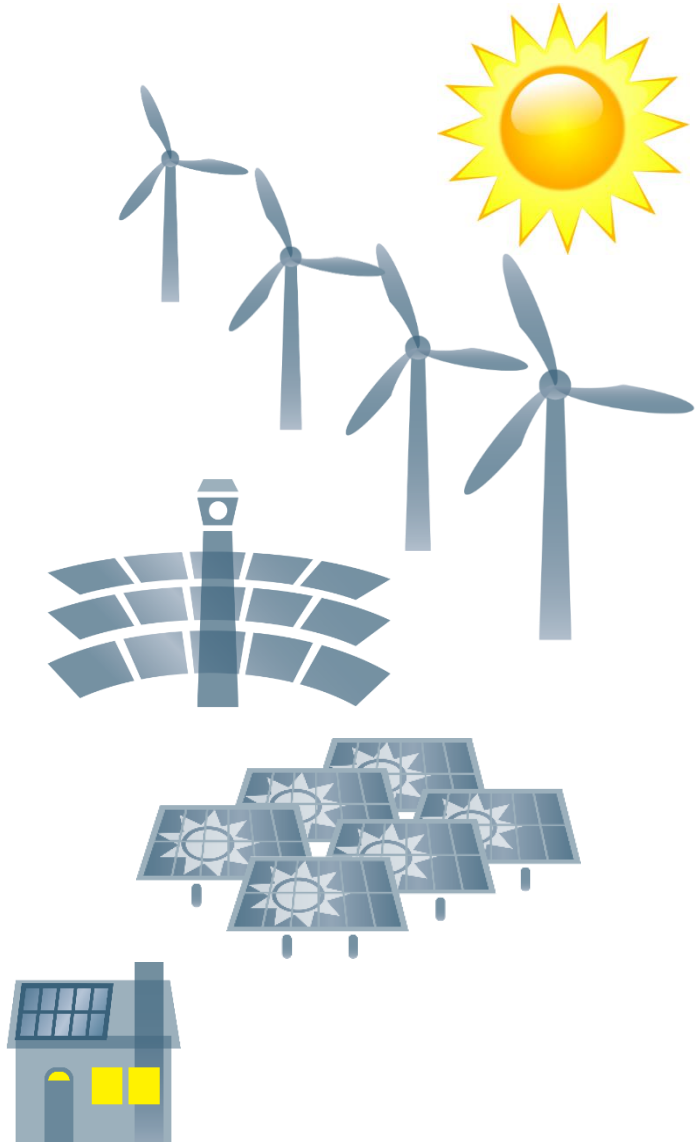


Energy Imbalance Market

Real-time Market Only

Major progress on meeting CA's renewable goals

- Currently Installed:
  - 21,000 MW of utility-scale renewables
  - ~11,000 MW of consumer rooftop solar
- Additional renewables:
  - 4,000+ MW additional utility-scale renewables by 2026
  - ~16,750 MW of consumer rooftop solar by 2026



WIND, SOLAR AND LOAD FORECASTING

Wind & Solar Forecasting at CAISO


Tehachapi Pass

Eligible Intermittent Resources (EIR) Provide

- Asset Registration Information
- Outage/De-Rate Schedules
- Real-Time Generation Telemetry (MW)
- Real-Time Telemetry for Meteorological Information


Topaz Solar Farm, San Luis Obispo County, California

Wind & Solar Forecast Service

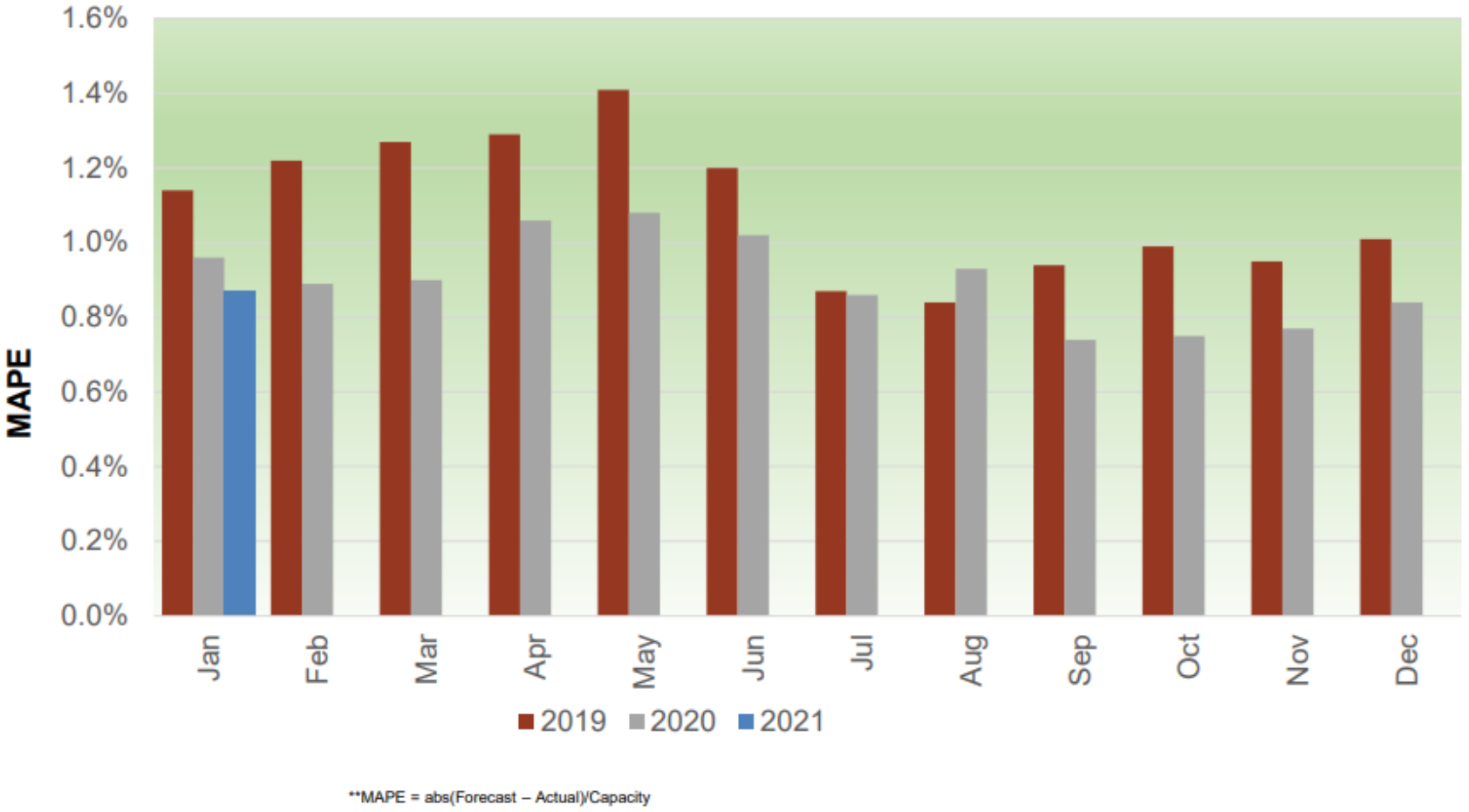
Two Forecast Service Providers each provide:

- **Hourly Day-Ahead Forecasts for each EIR** out 4 Days; updated at 5:30 am and 8:45am Day Previous
- **Real-Time Forecasts** for rolling 9 hours at a 5 minute granularity. Updated every 5 minutes
- One Provider Provides Probabilistic Forecasts used for risk assessment

CAISO Systems

- Forecasting Team can select "active" Forecast Provider for DA, RT, and Blend Configurations
- **Hourly Forecast** used in all reliability studies (RUC, Outage Coordination, Next Day Study)
- **Real-Time Forecast** used in real time dispatch to set DOT for EIR Resources
- **Internal Persistence Forecast** used in RTD to improve accuracy 40% from FSP providers.

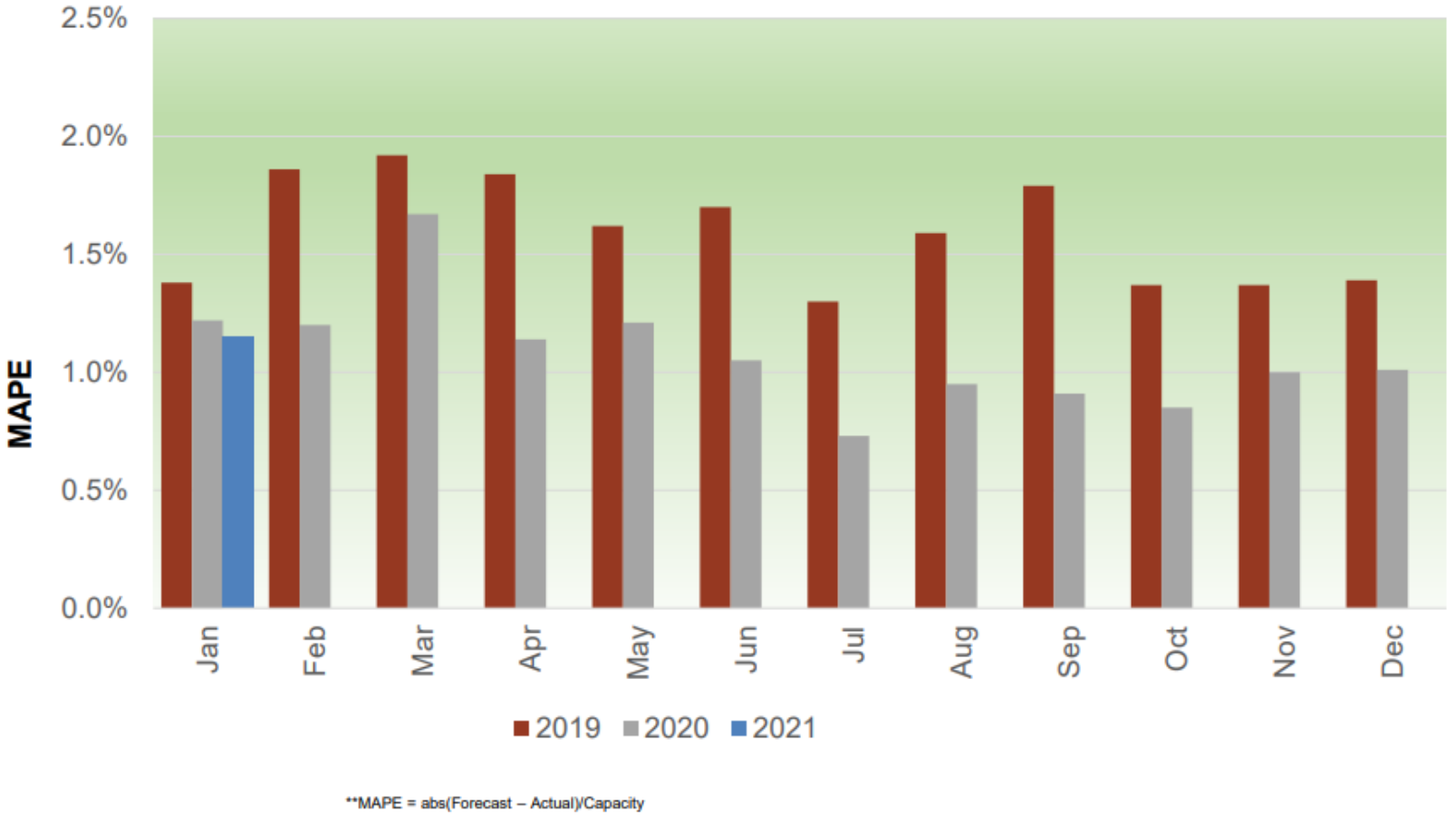
Achieving significant accuracy improvement with the real-time wind forecast



**MAPE = abs(Forecast – Actual)/Capacity

33% improvement in real-time (RTD) forecast since April 2018 when Persistence Method was implemented

Achieving significant accuracy improvement with the real-time solar forecast

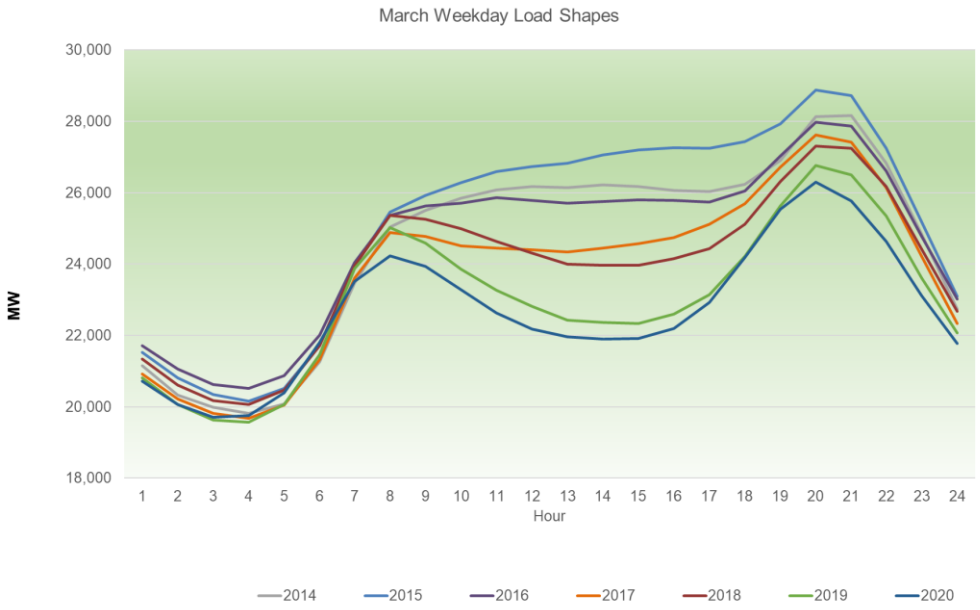


**MAPE = abs(Forecast – Actual)/Capacity

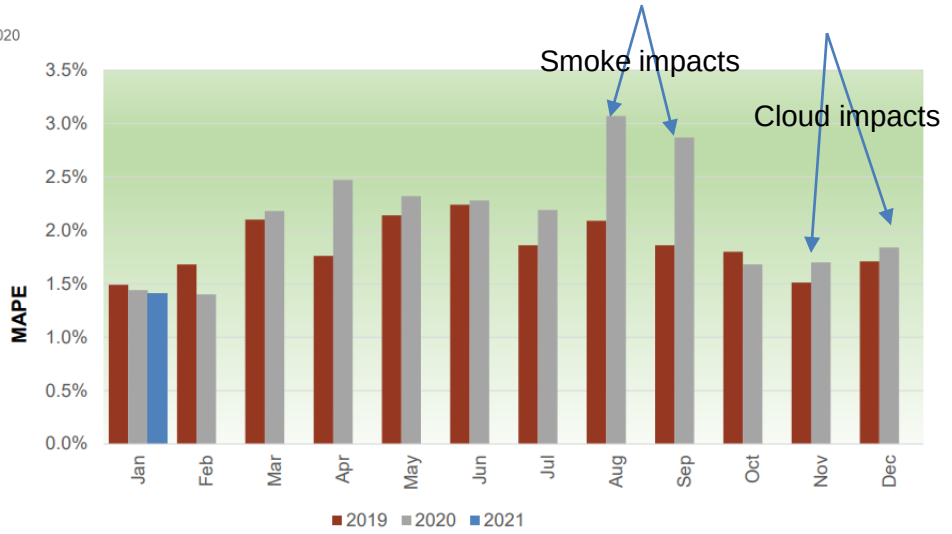
40% improvement in real-time (RTD) forecast since April 2018 when Persistence Method was implemented

BEHIND THE METER SOLAR IMPACT TO DEMAND AND OPERATIONS

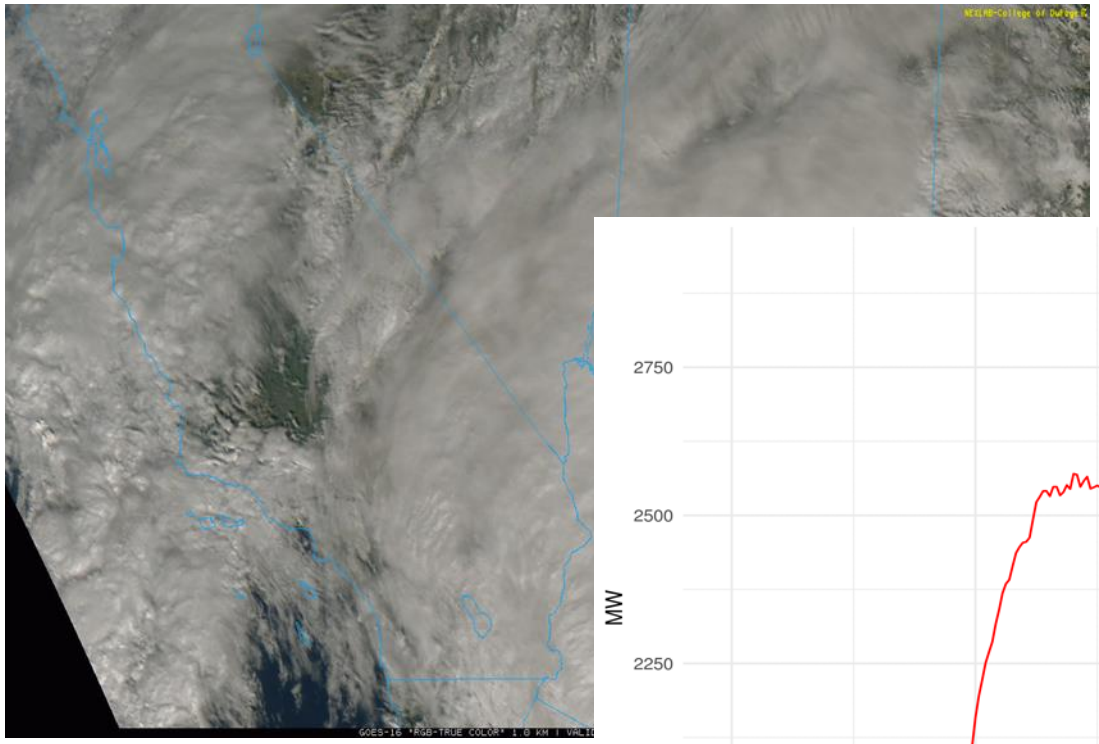
Load shape is reflecting behind-the-meter solar penetration

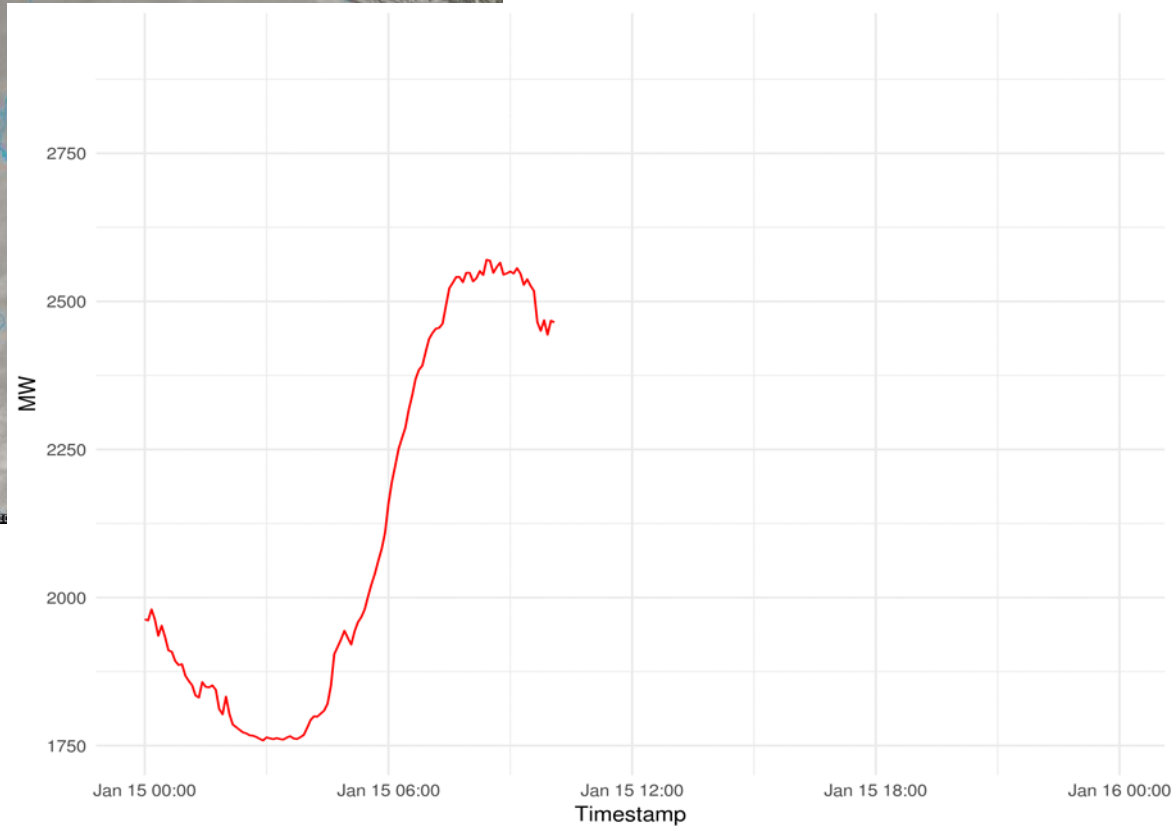


Day-Ahead load forecast error reflects environmental effects

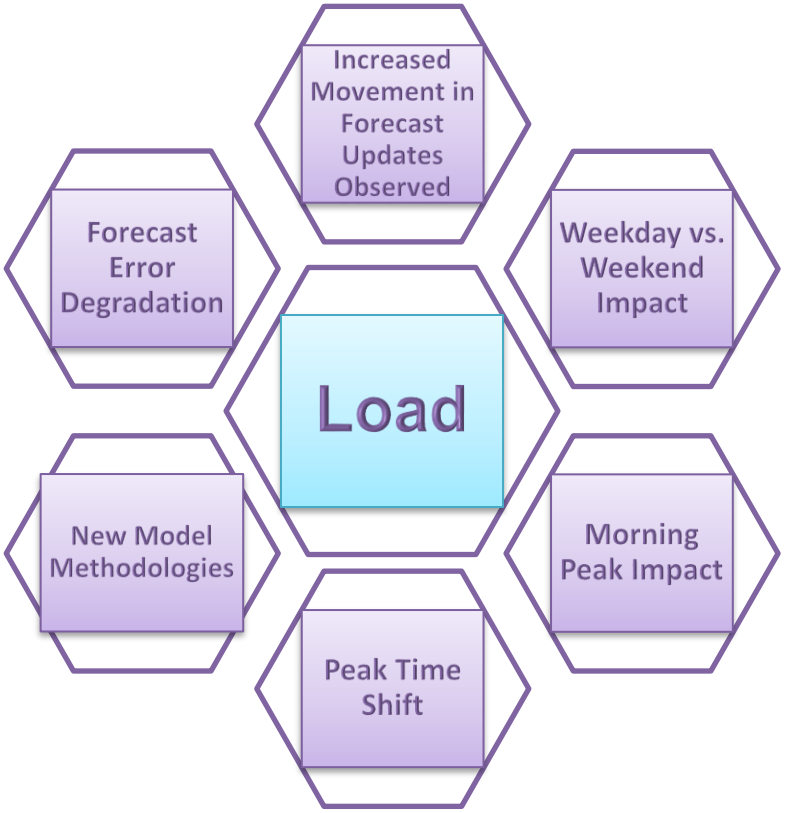


Cloud cover can severely effect the load shape due to Behind-the-Meter solar penetration





Demand Forecasting with Increased Behind-the-Meter Solar



- Importance of Behind the Meter Solar Forecasting as Input

CAISO Forecasting Advancements in Support of High Penetrations of Renewable Resources