

# High Risk Wind Forecasting Challenges in Southwest Power Pool

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# SPP Wind and Solar

- **Wind**

- Installed: **18,500 MW**
- Wind Turbines: **10,000**
- Wind Peak: **15,690MW** 12/15/2017
- GI Queue: **54GW** 6/13/2018
- Wind Penetration Record: **63.96%** 4/30/2018

- **Solar**

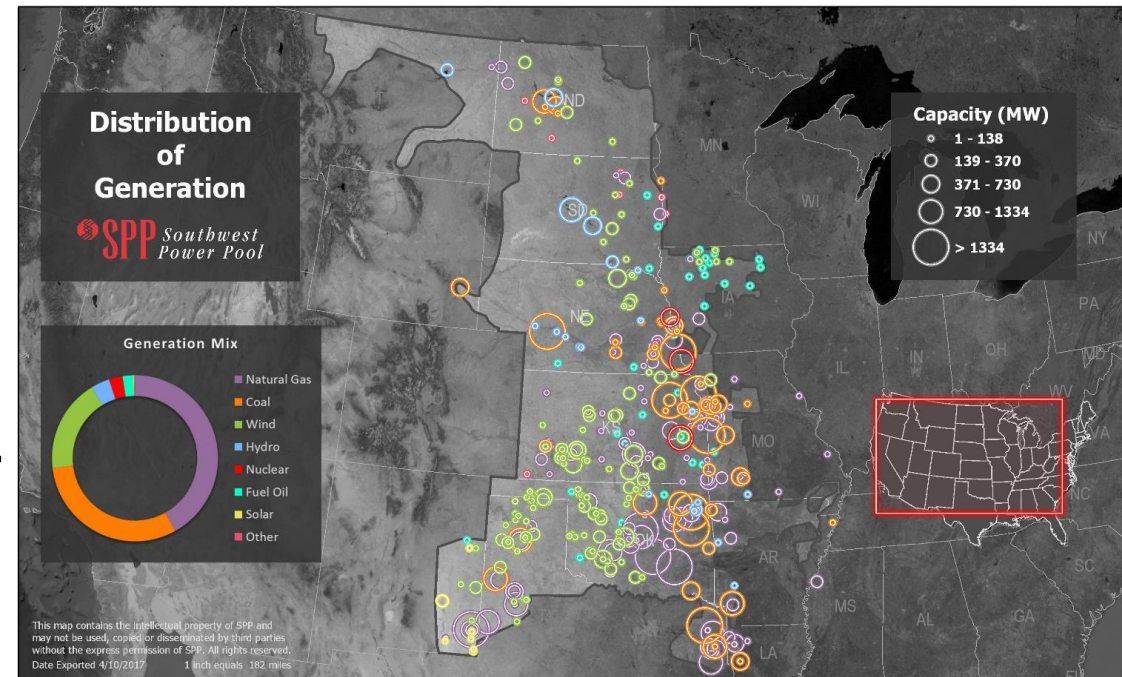
- SPP Market: **215MW**
- GI Queue: **18,000MW** 6/13/2018

- **Energy Storage**

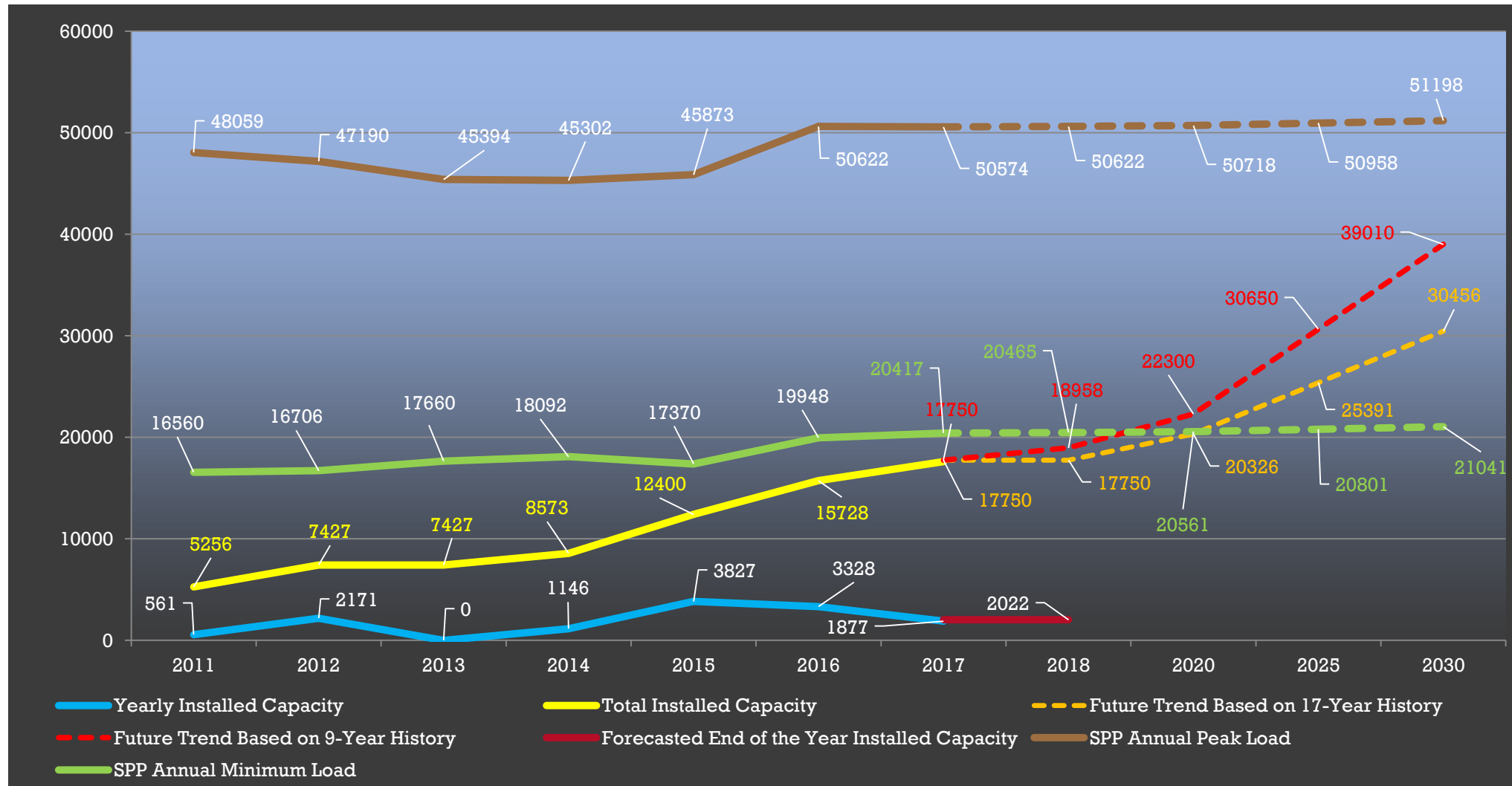
- GI Queue: **2,800MW**

- **Total Renewable Energy Penetration**

- **69.44%** 4/29/2018

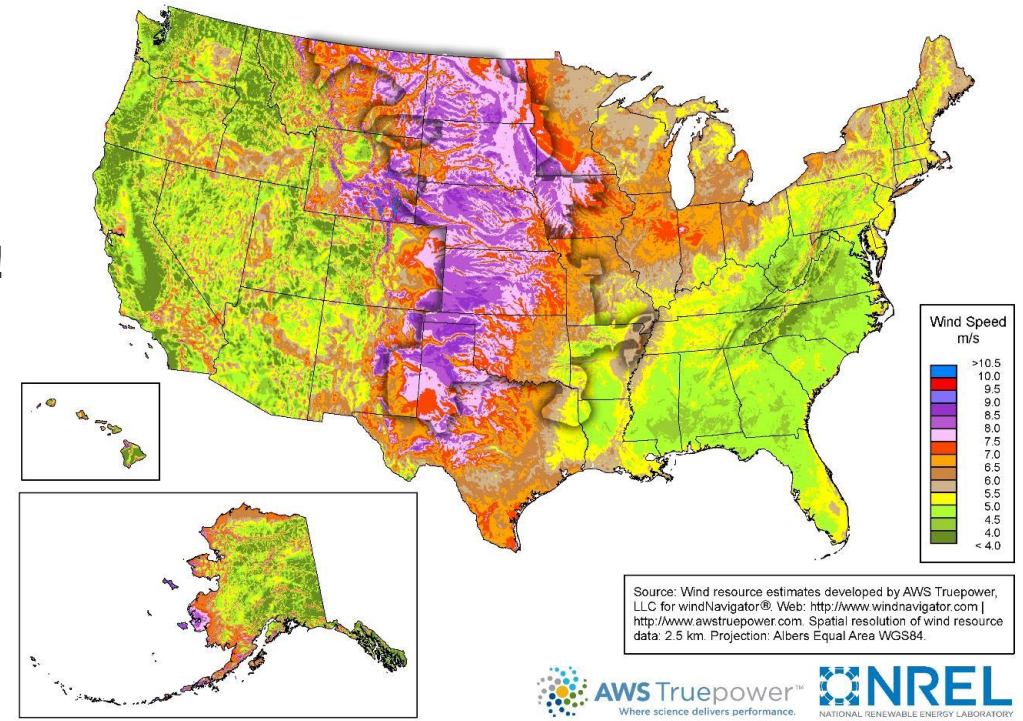


# Wind Capacity Installed by Year

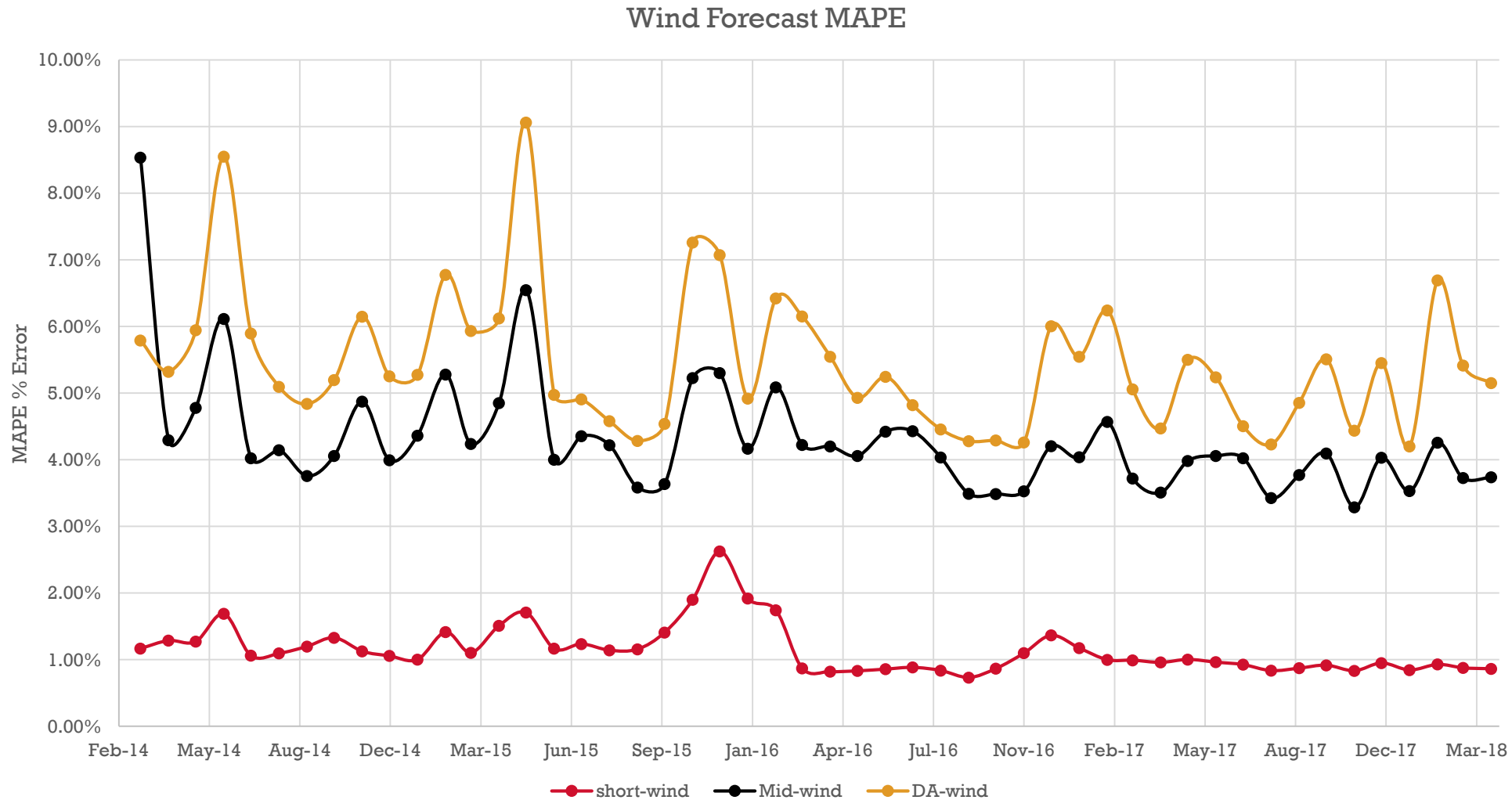


# High Risk Wind Forecasting in SPP

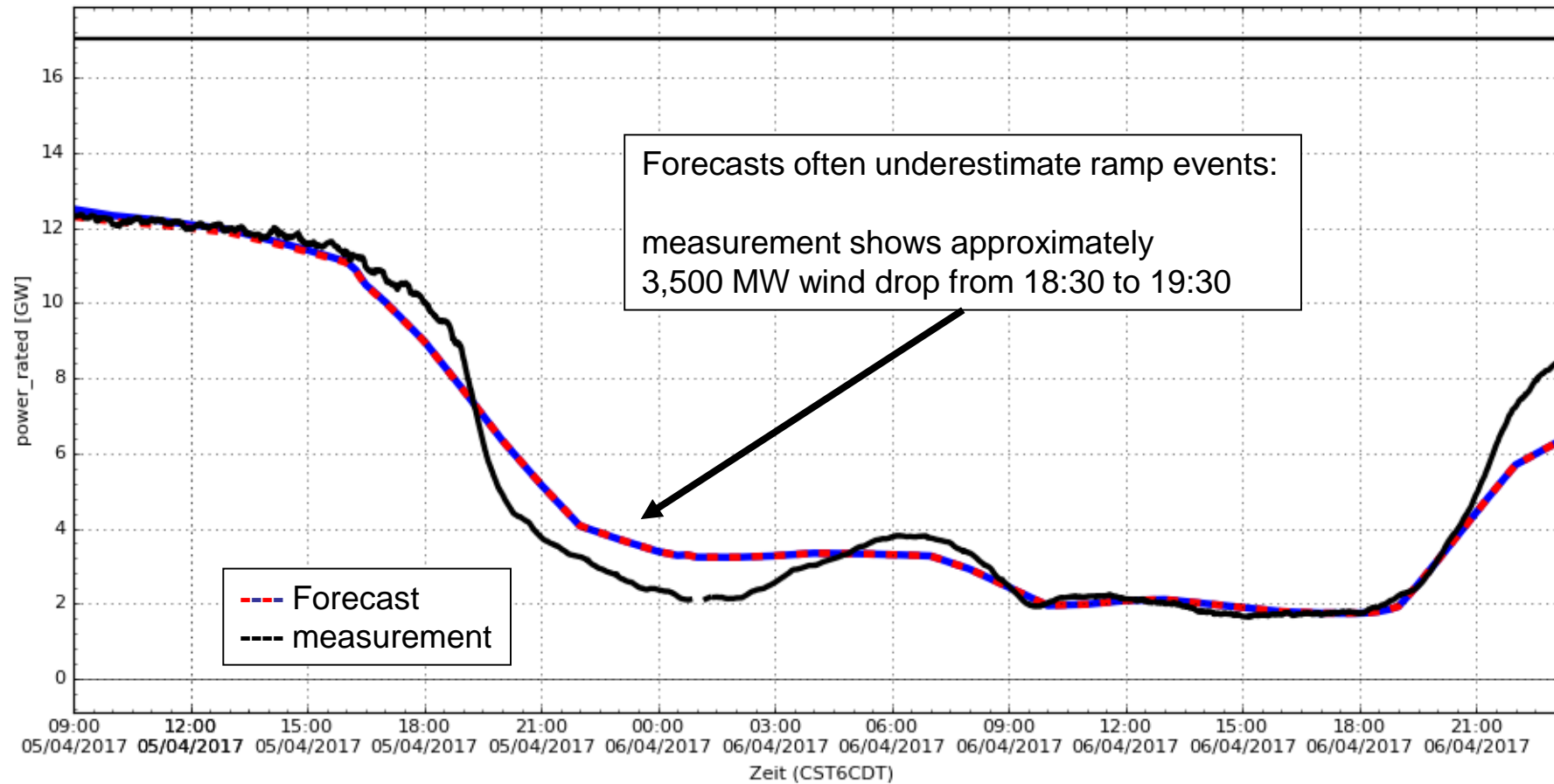
- Wind Ramping Challenges
  - Low Level Jet prediction (LLJ)
  - Wind under forecasted less of problem
    - Less Reliability Costs
    - More Economic Costs
  - Wind over forecasted can be a very big issue!
    - Reliability Issue
    - Economic Issue
- Icing
  - Conditions for icing
  - Timing of the icing
  - Duration of icing events



# Monthly Wind Forecast Accuracy - MAPE

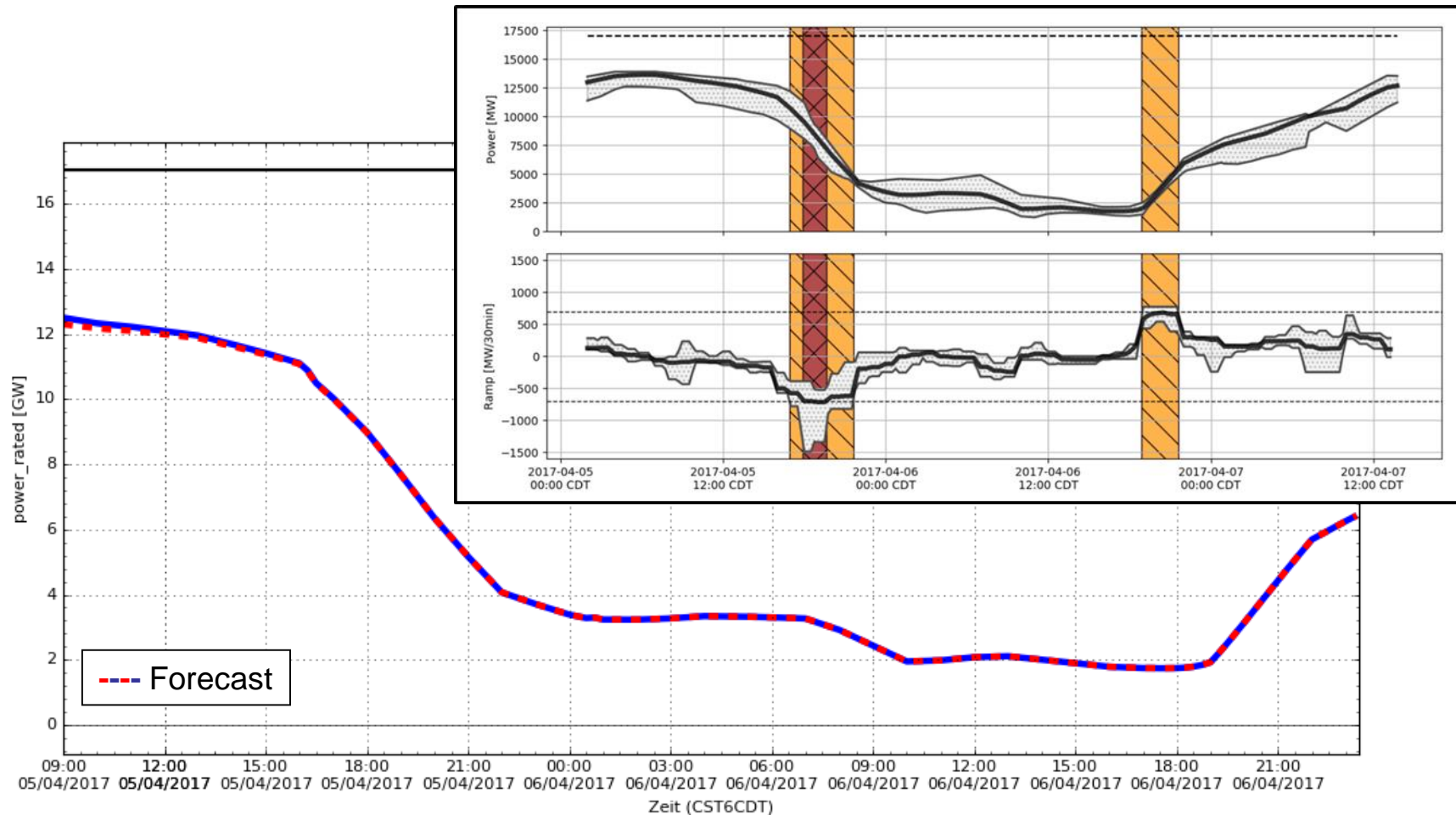


## Ramp Event - 04/05/2017



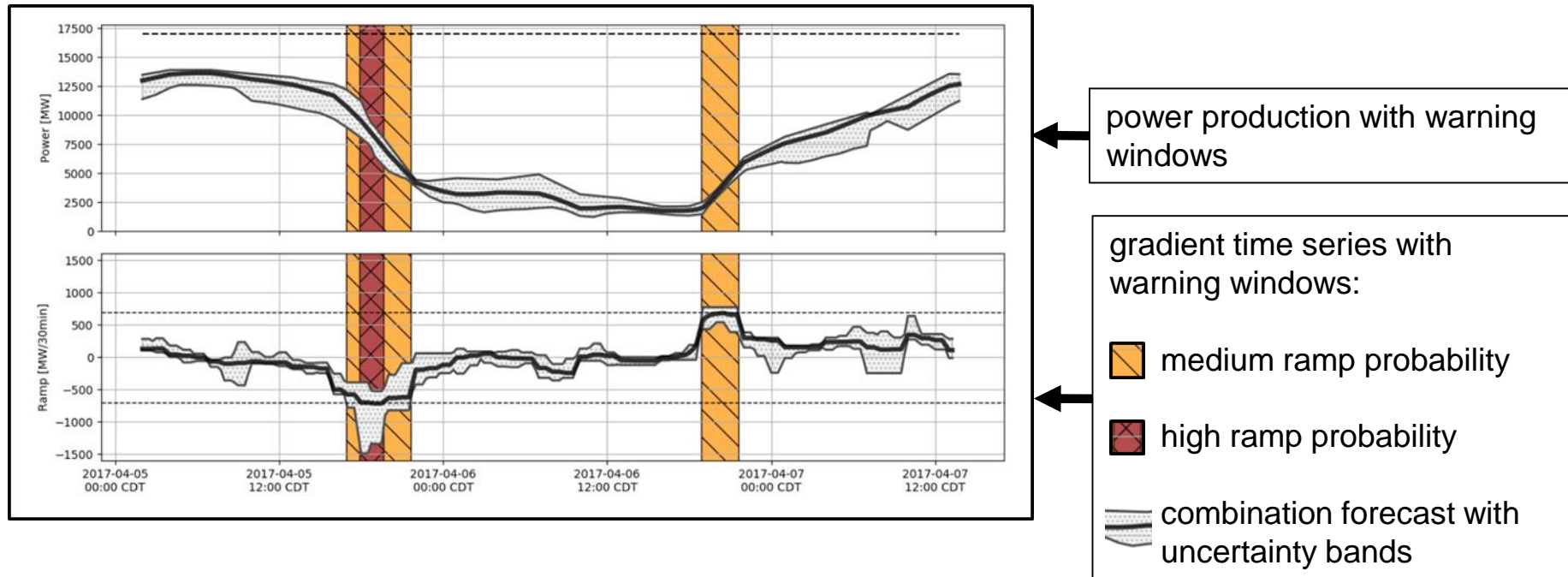
## Ramp Event - 04/05/2017

Ramp Forecast Report to raise awareness!

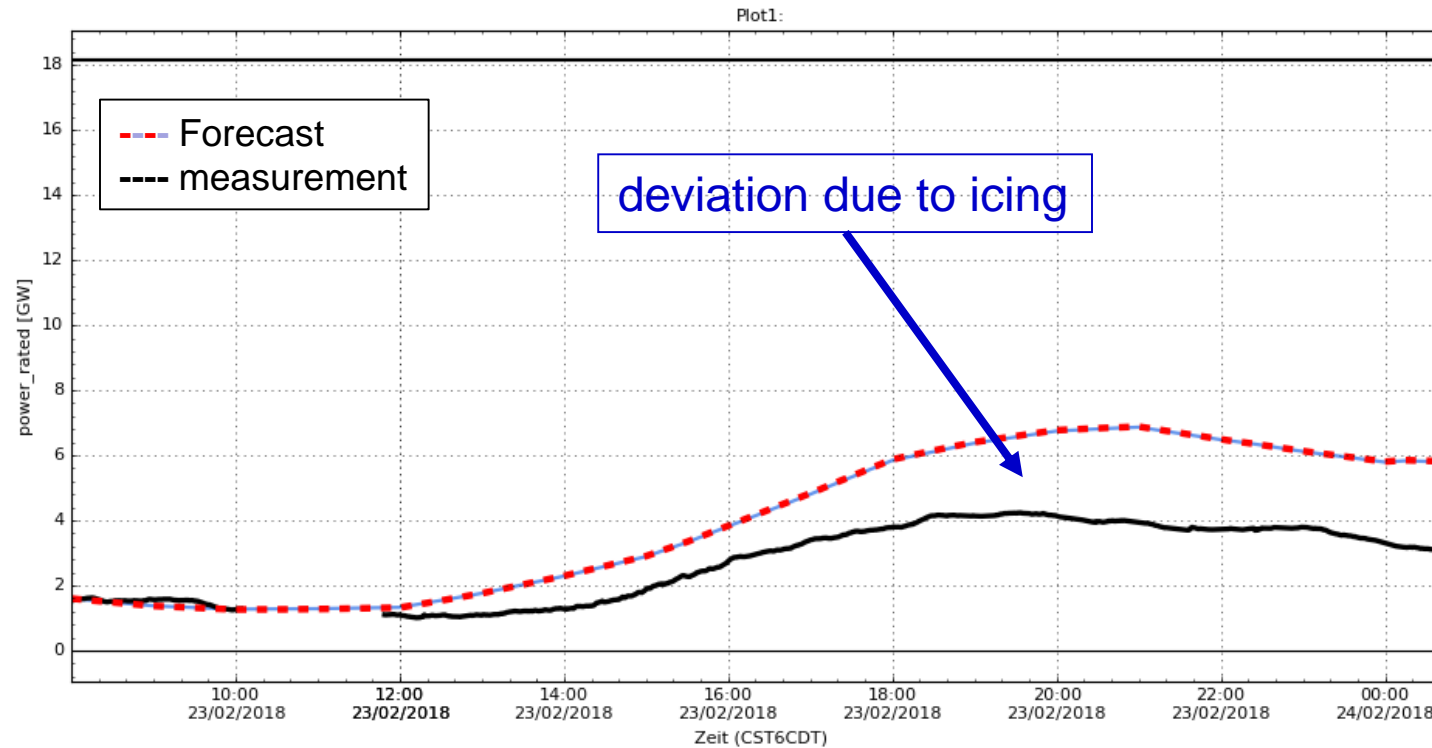


## Ramp Event - 04/05/2017

### Ramp Forecast Report





## Icing event - 2/23/2018

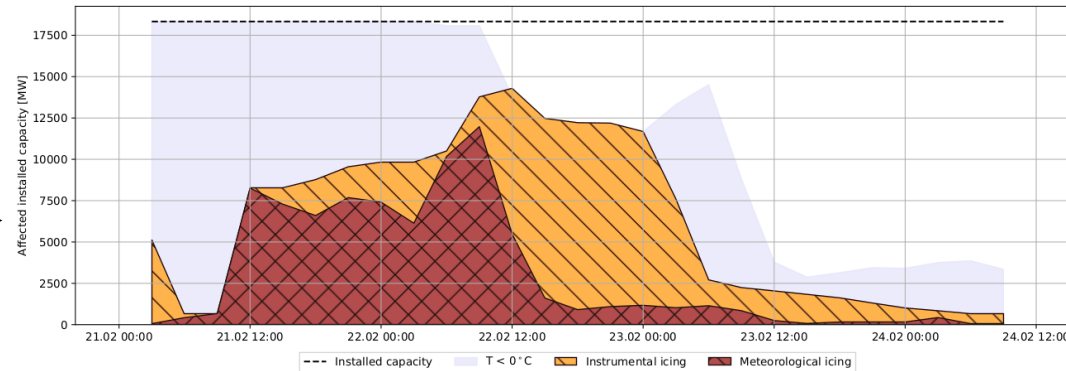


## Icing event - 2/23/2018

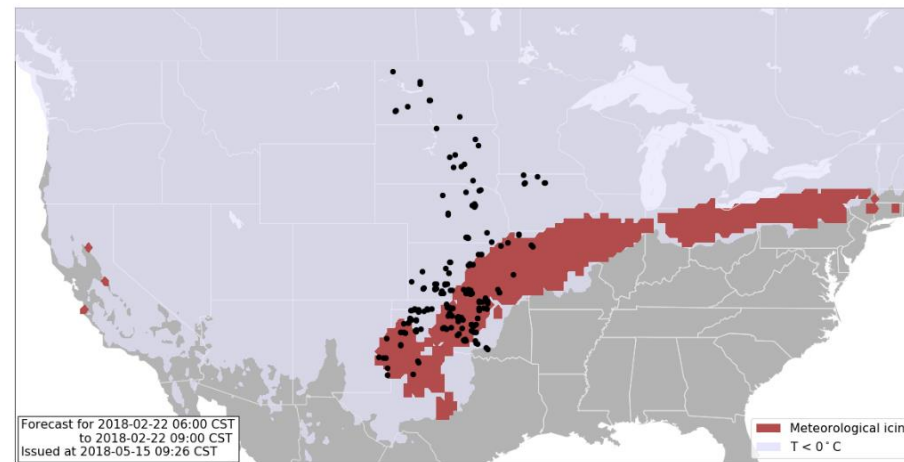
Icing forecast report raises awareness!

Time series of installed capacity,  
that might be affected by icing:

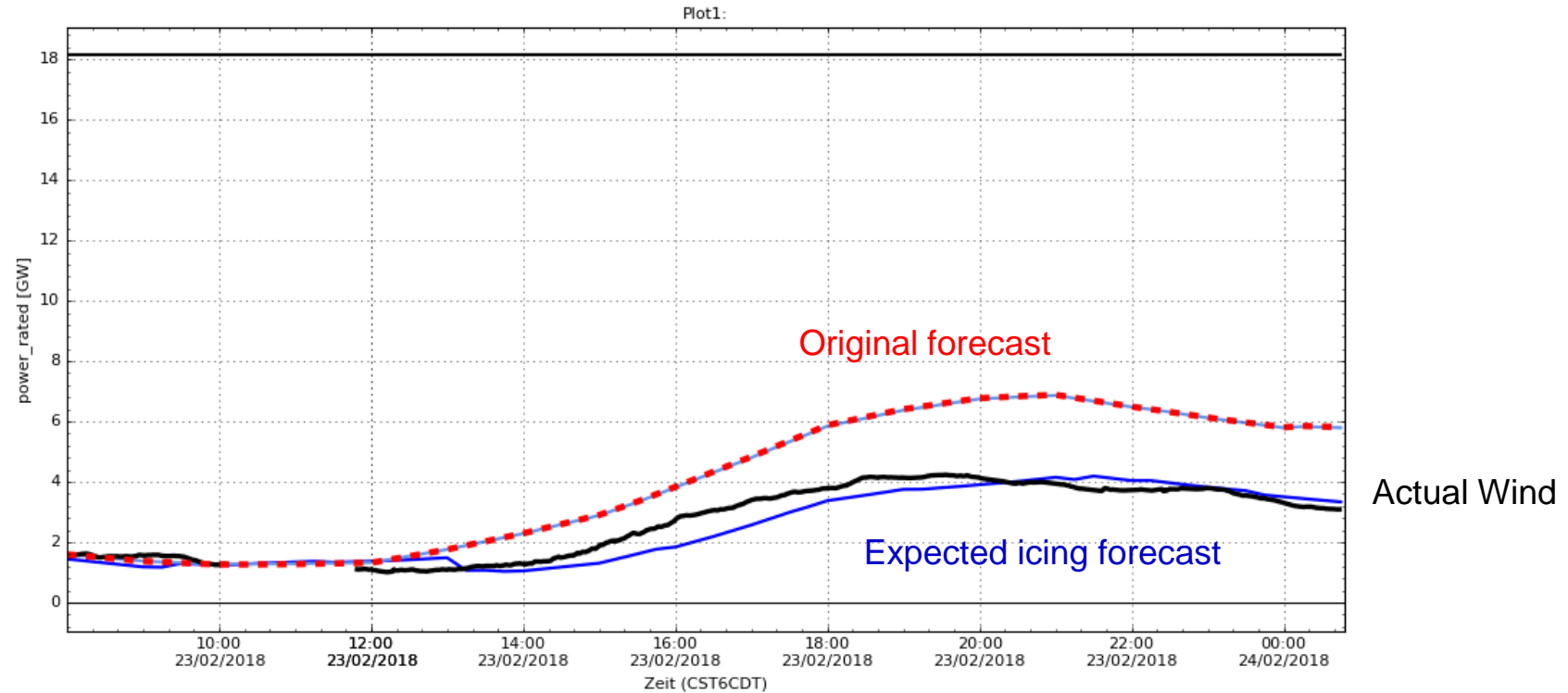
-  Meteorological event that leads to icing
-  Instrumental icing (or technical icing), indicates remaining icing conditions of anemometers or blades



Visualization of meteorological  
event via map



## Icing event - 2/23/2018



Forecast of icing events is still challenging!

Main Goal:

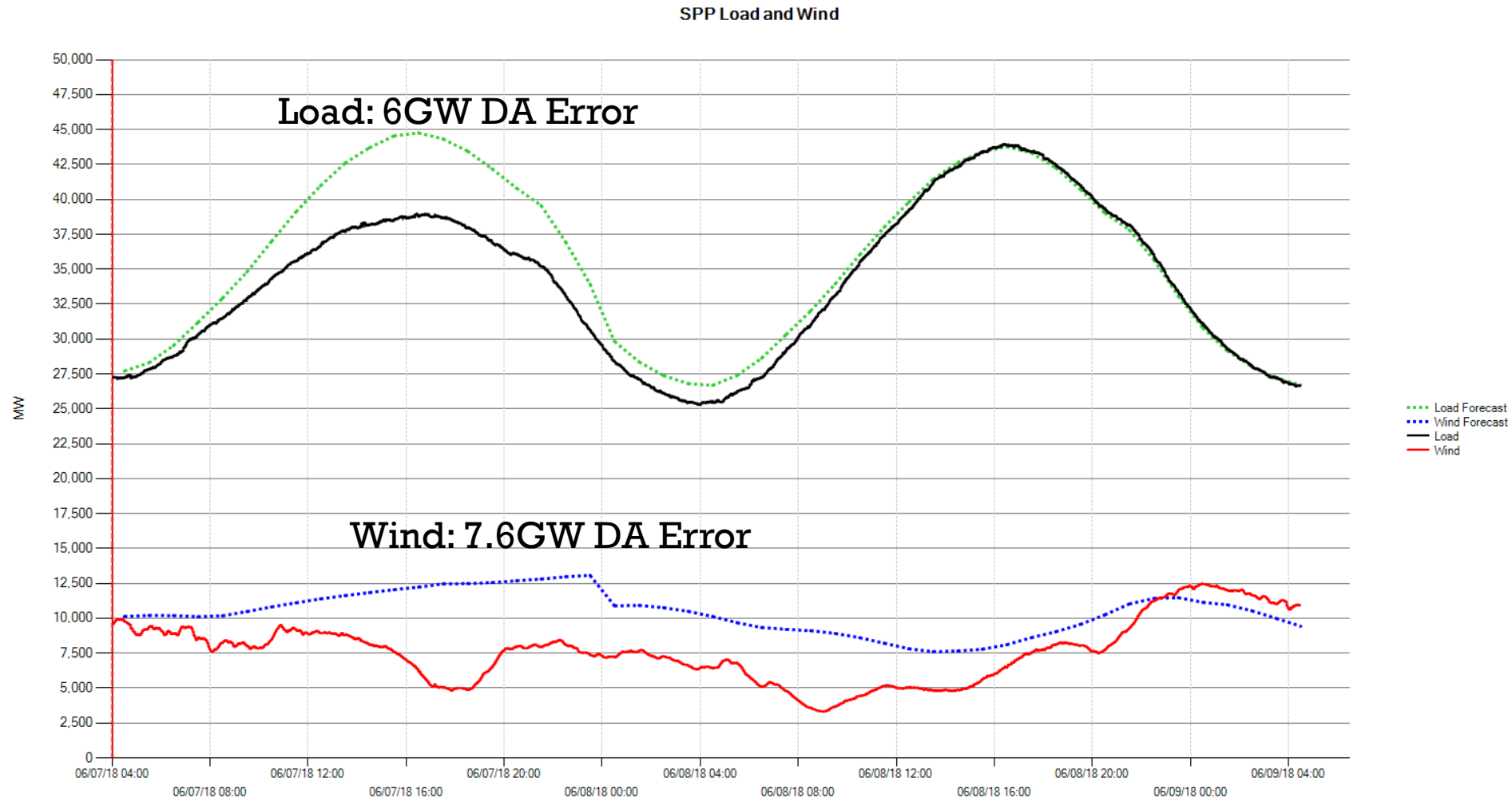
- Situational Awareness
- Estimation of power loss due to icing



Further work needs to be done

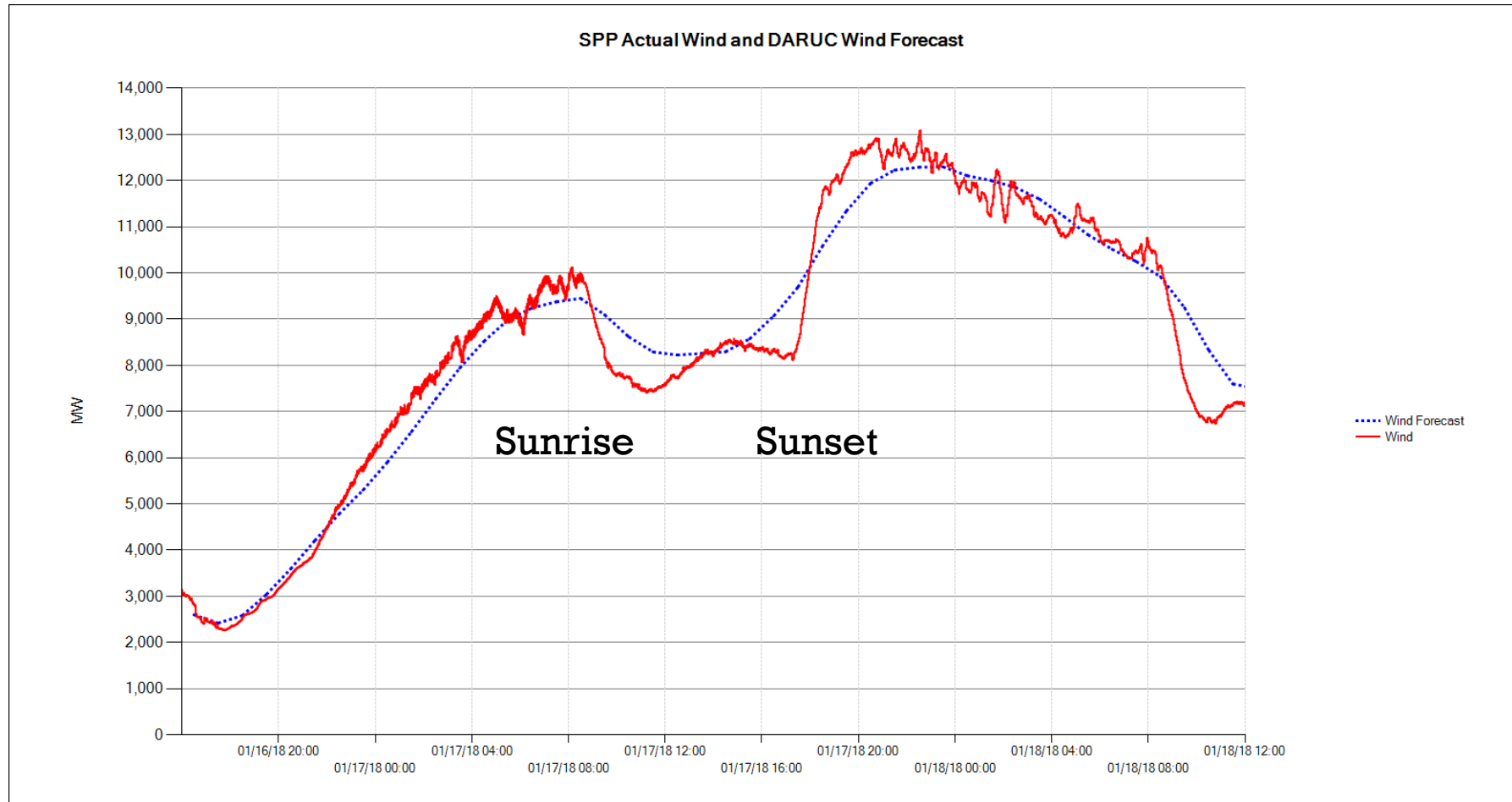
# Weather Forecast Error Impacting Load and Wind

• 6/7-8/2018



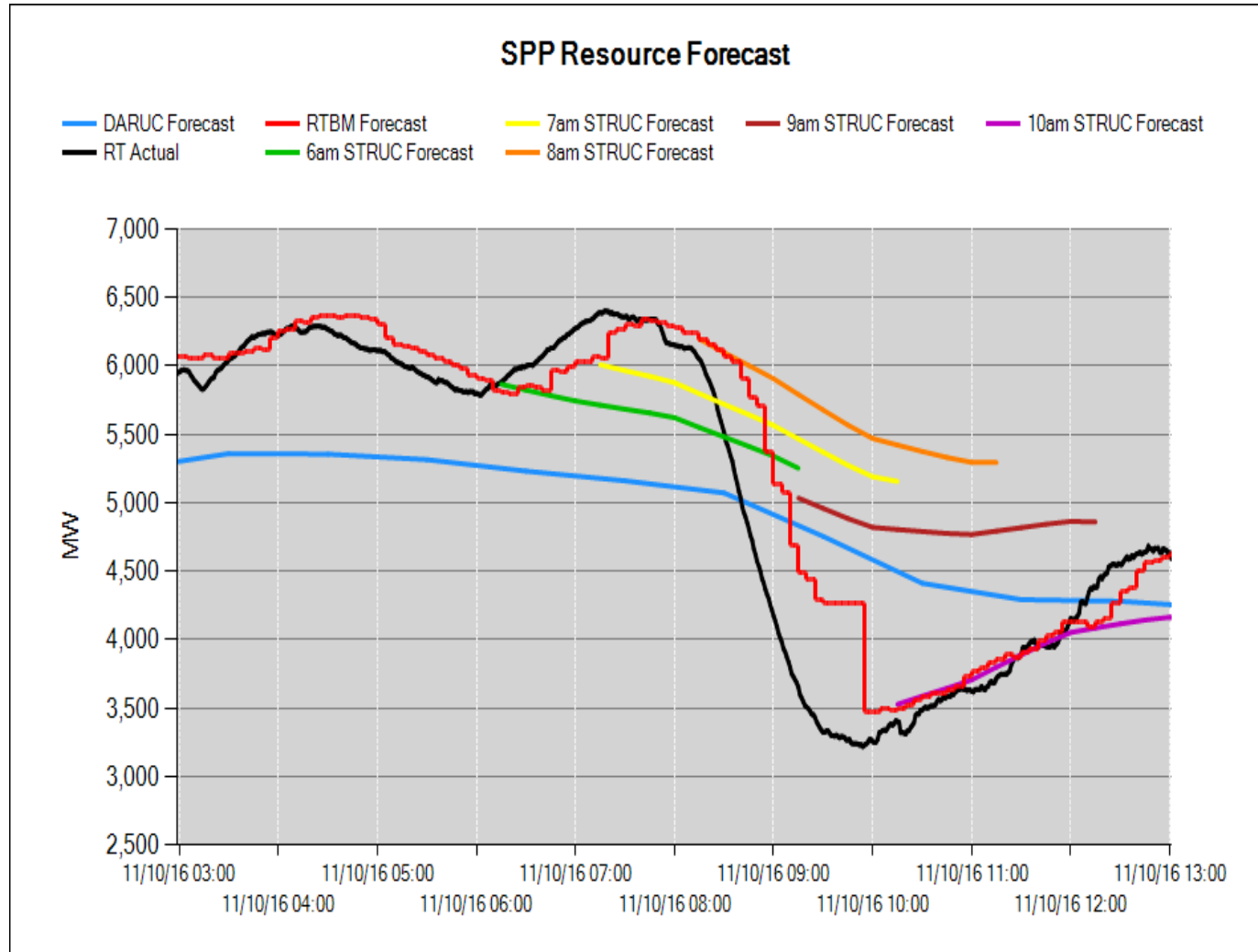
# Sunrise/Sunset SPP Wind Scenario

- Jan. 17<sup>th</sup> 2018, SPP wind varied significantly in line with the sunrise/sunset

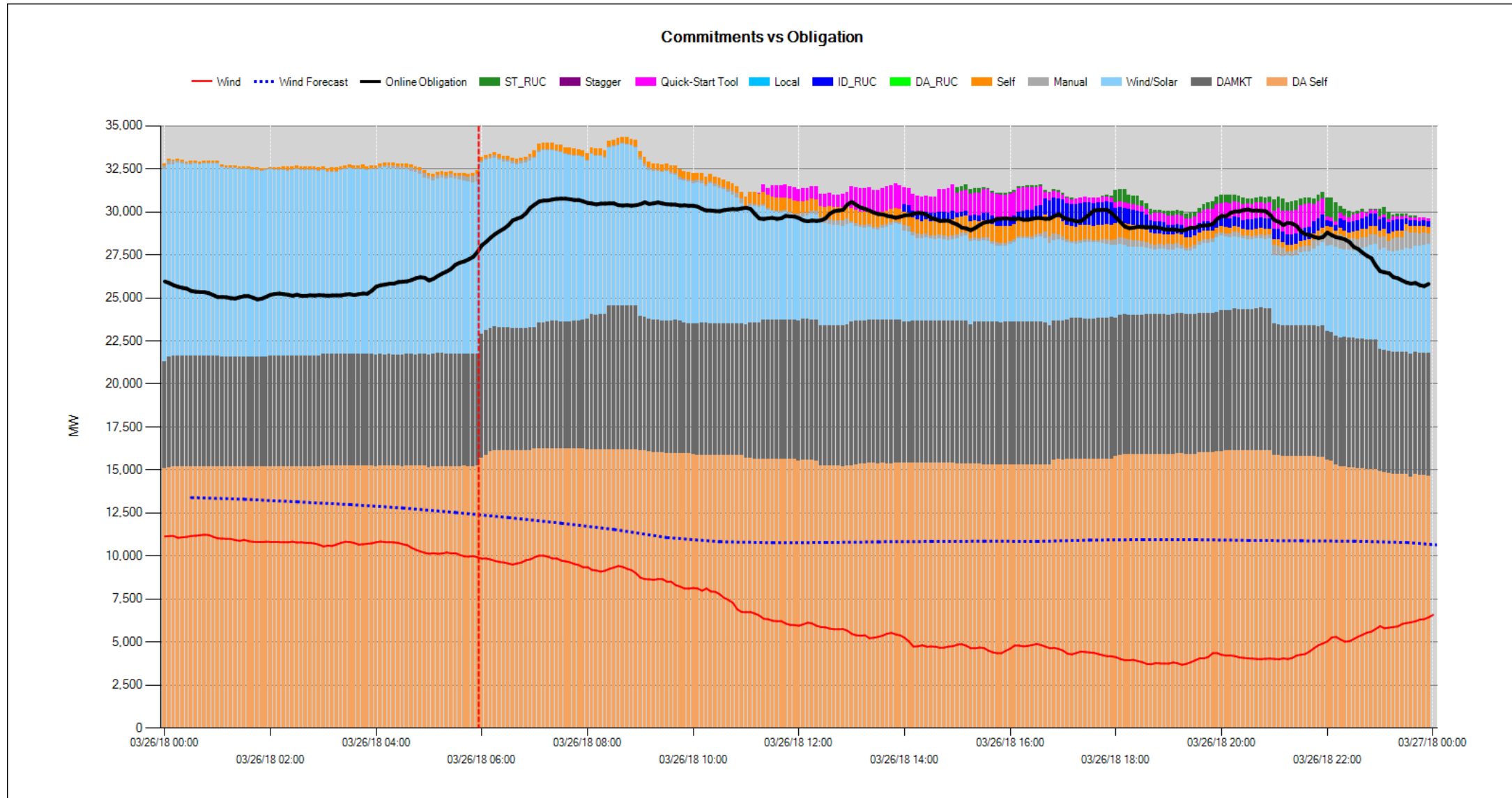


# SPP Wind Forecast and STRUC Studies

- Unexpected wind drop of 3GW



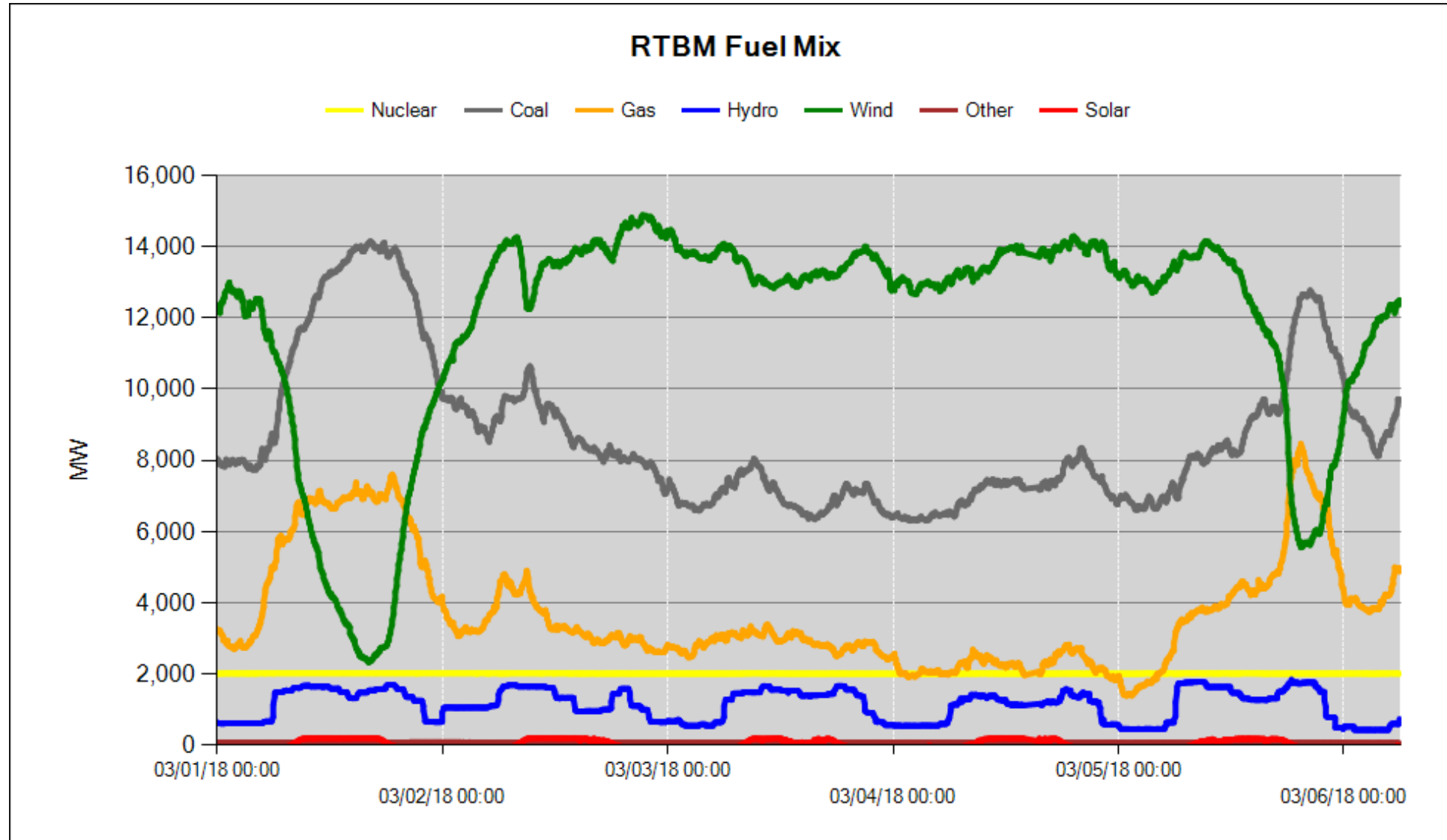
# Unit Commitments vs Obligation with Wind Forecast Error



# Forecast Impacts on RTO/ISO...

- Staff workload
- Real Time Operations
- Price accuracy between DA-Mkt and Real Time
- Head Room Excess Capacity Issues
- Large Make Whole Payments
- Inaccurate preparation for transmission constraint control
- Inaccurately project constraint flows (local level)
- Wrong Unit Commitments
- Quick-Starts and STRUC Constraints

# Variability + Reliability requires fuel diversity



# Questions?

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