

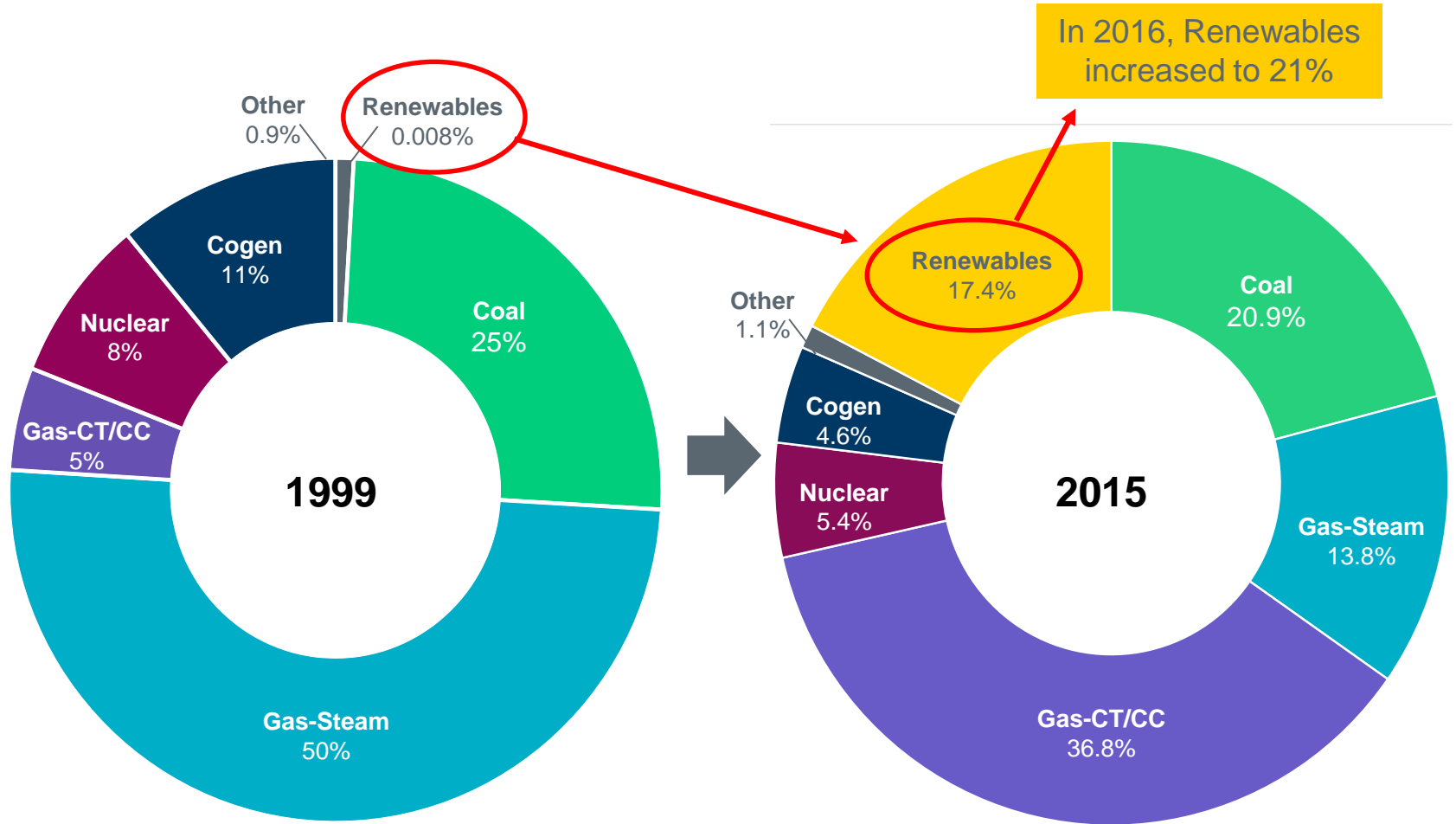


# Renewable Integration in ERCOT

Paul Wattles  
Senior Analyst, Market Design & Development

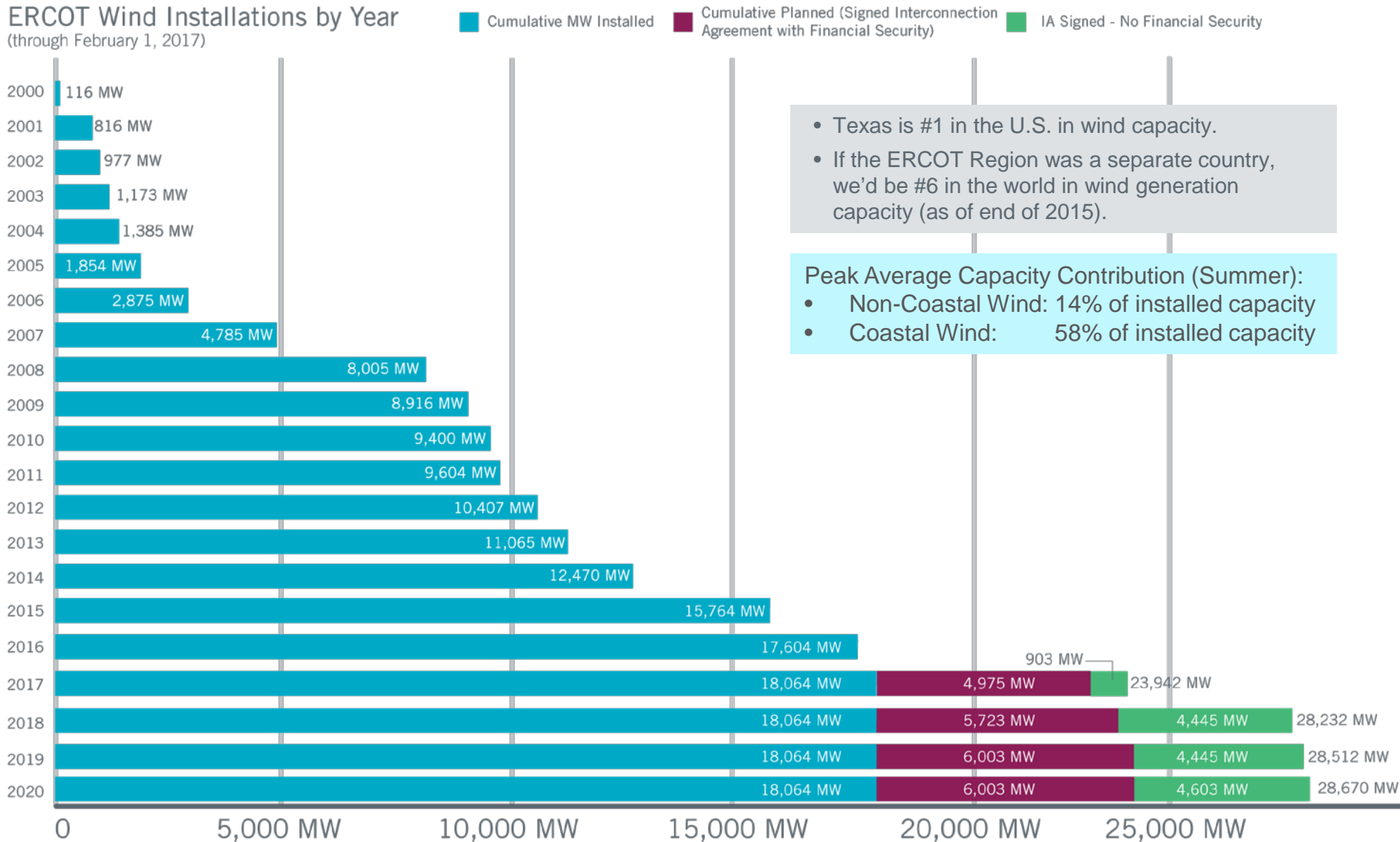
**UT Energy Week**  
February 8, 2017

# Changing Resource Capacity Mix



# Wind Generation Queue

ERCOT Wind Installations by Year  
(through February 1, 2017)



- Texas is #1 in the U.S. in wind capacity.
- If the ERCOT Region was a separate country, we'd be #6 in the world in wind generation capacity (as of end of 2015).

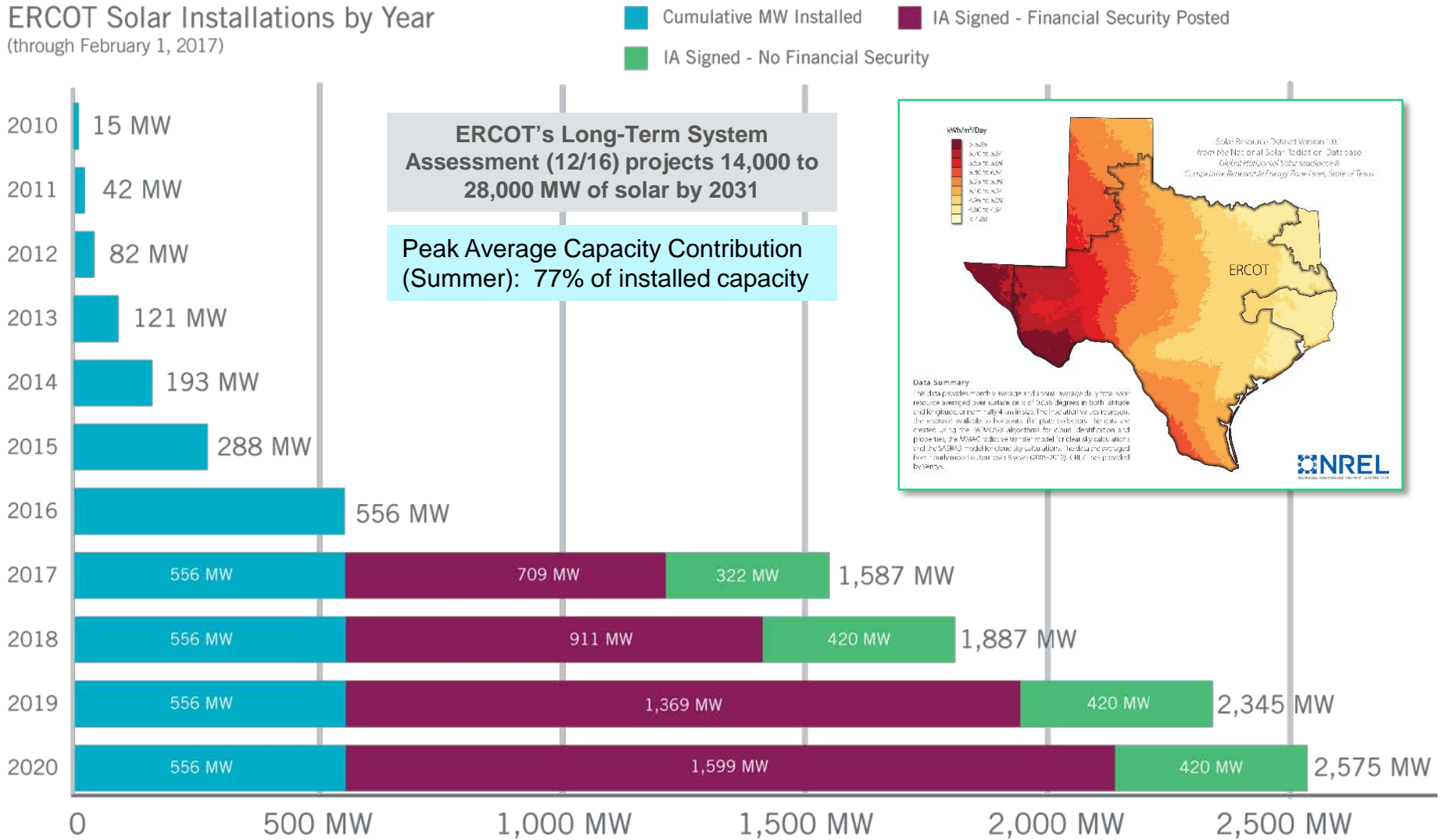
Peak Average Capacity Contribution (Summer):

- Non-Coastal Wind: 14% of installed capacity
- Coastal Wind: 58% of installed capacity



# Utility Scale Solar Generation Queue

ERCOT Solar Installations by Year  
(through February 1, 2017)

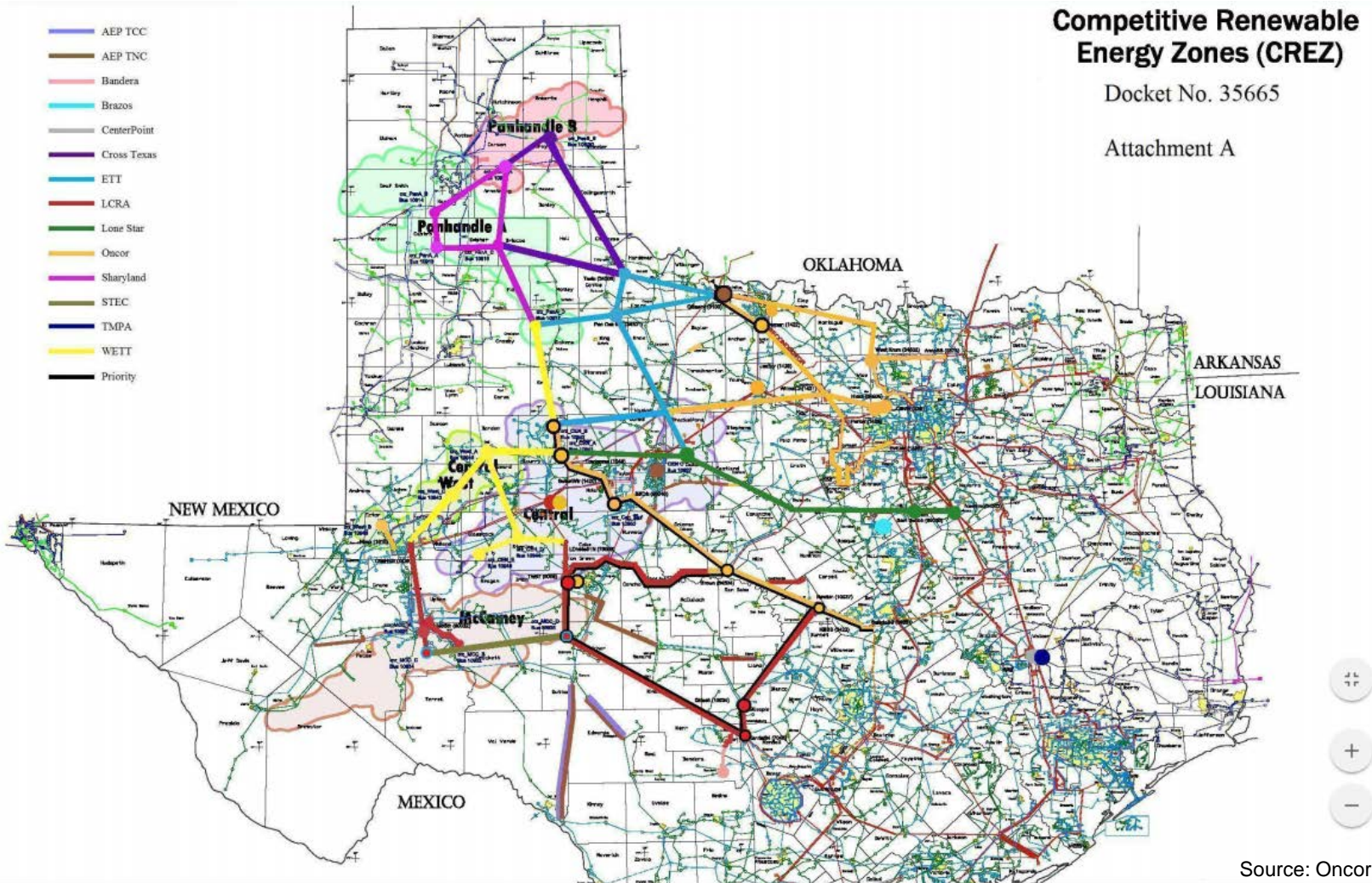


# CREZ Transmission

## Competitive Renewable Energy Zones (CREZ)

Docket No. 35665

Attachment A

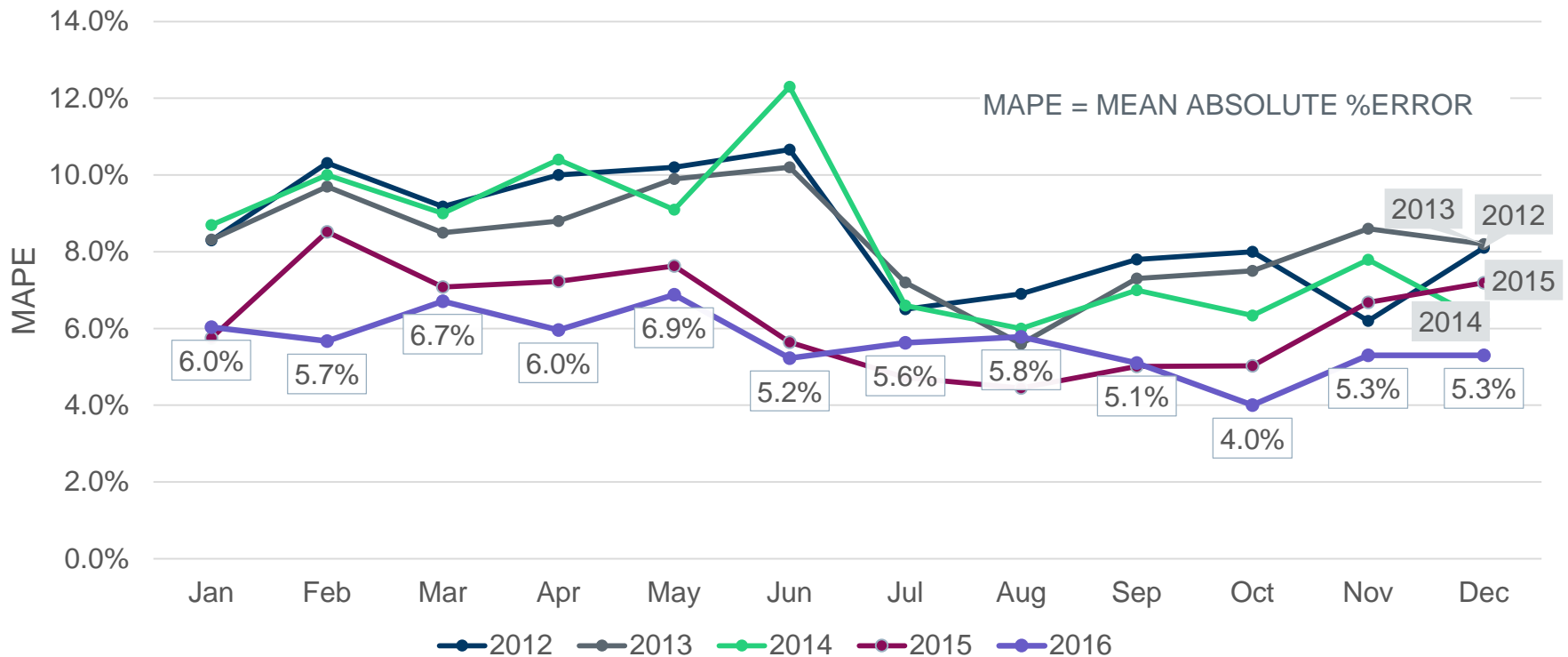


Source: Oncor

# Integrating and Managing Renewables

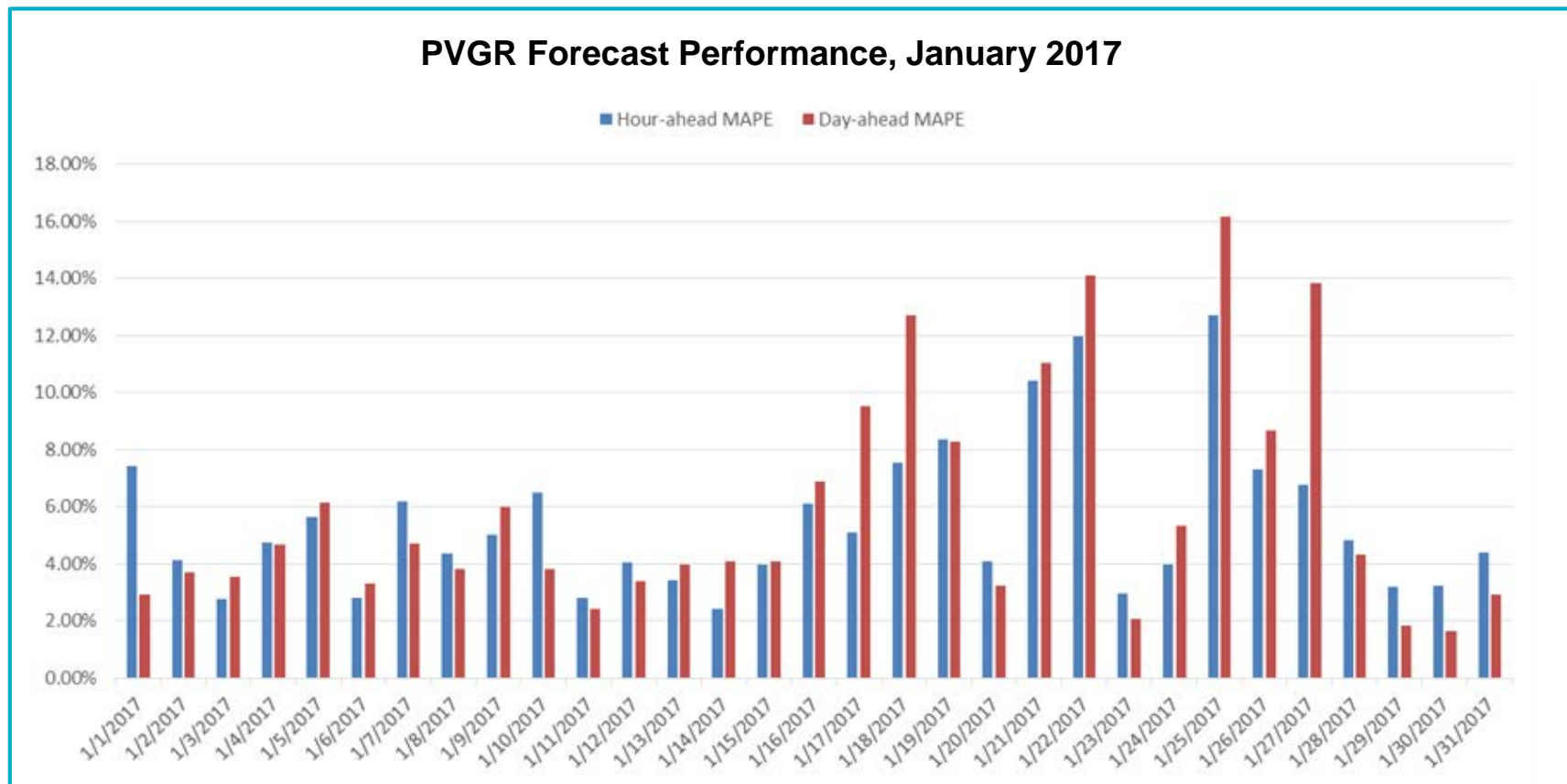
- ERCOT's 7-day wind forecast overall performance has steadily improved
  - Inclement weather preparation, including capability to manually overwrite wind forecast for icing events

### Day Ahead Wind Forecast Performance



# Integrating and Managing Renewables

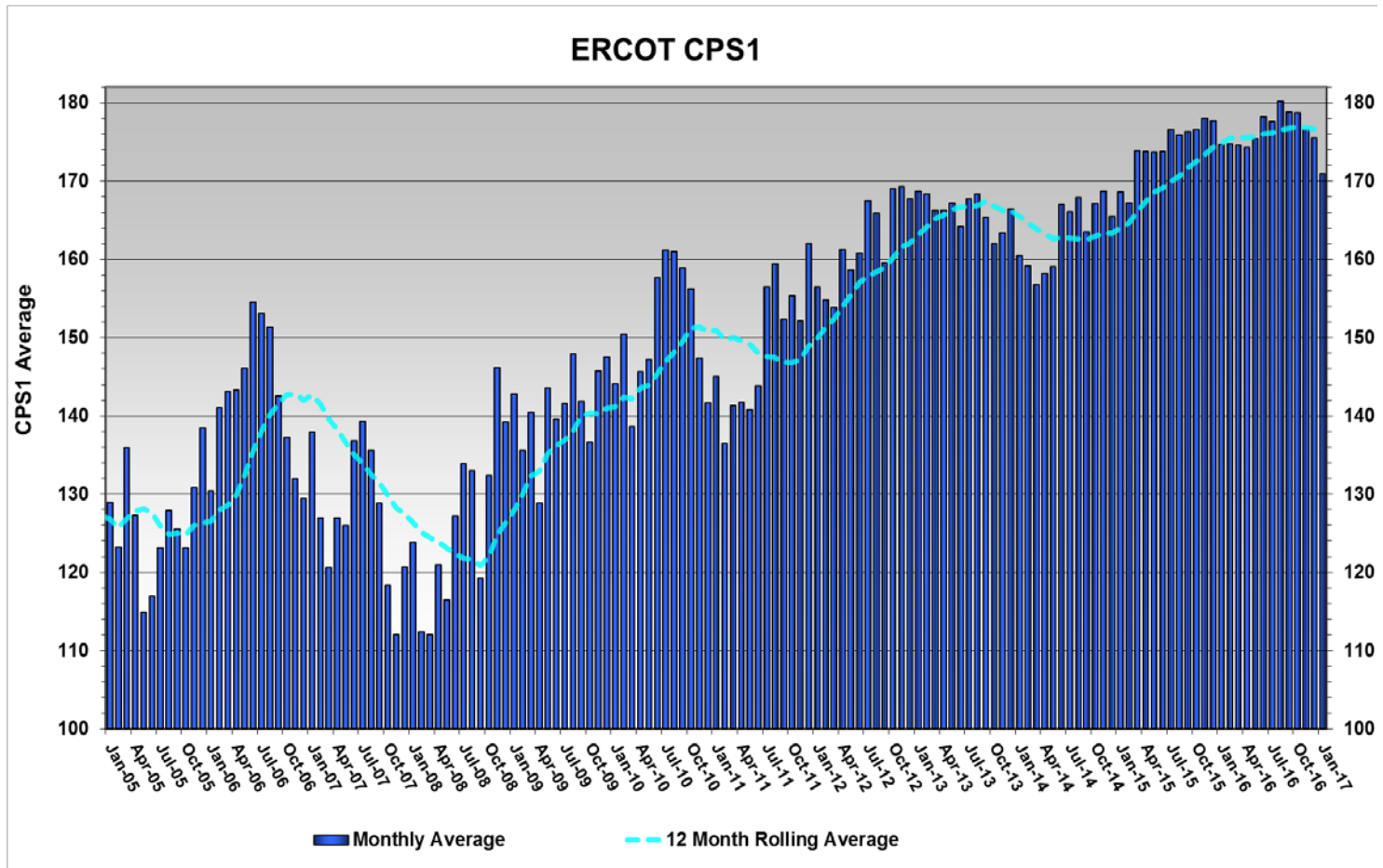
- Grid-scale solar PV forecasting tool moved into production April 2016
- Performance has steadily improved





# Grid Performance: CPS1 Scores 2005-2016

Control Performance Standard 1 is a measurement of how well a Balancing Authority (ERCOT) maintains grid frequency within acceptable parameters. It is a metric of the North American Electric Reliability Corporation (NERC).



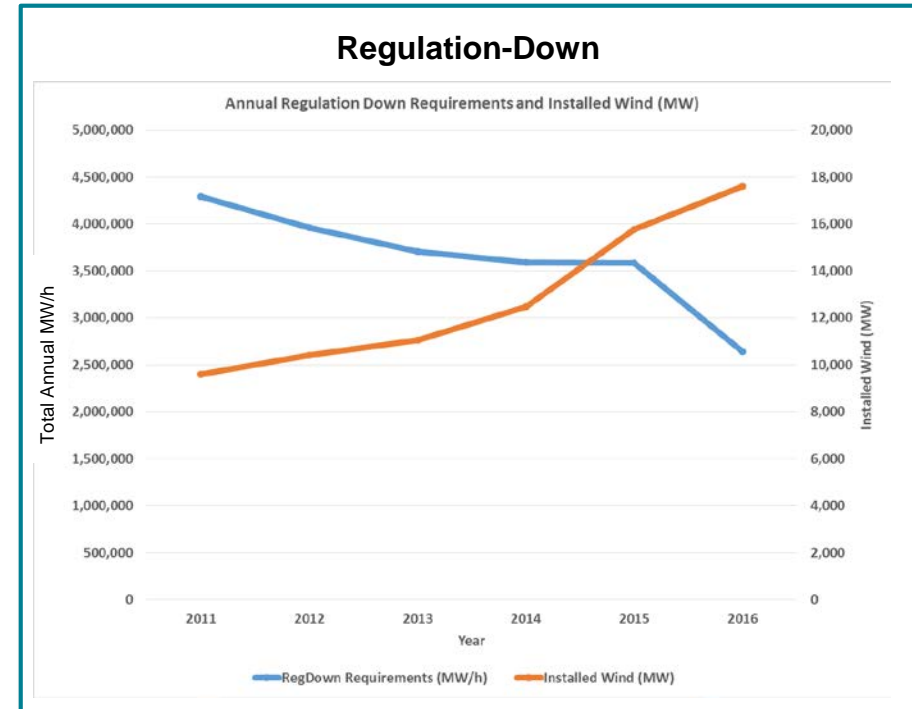
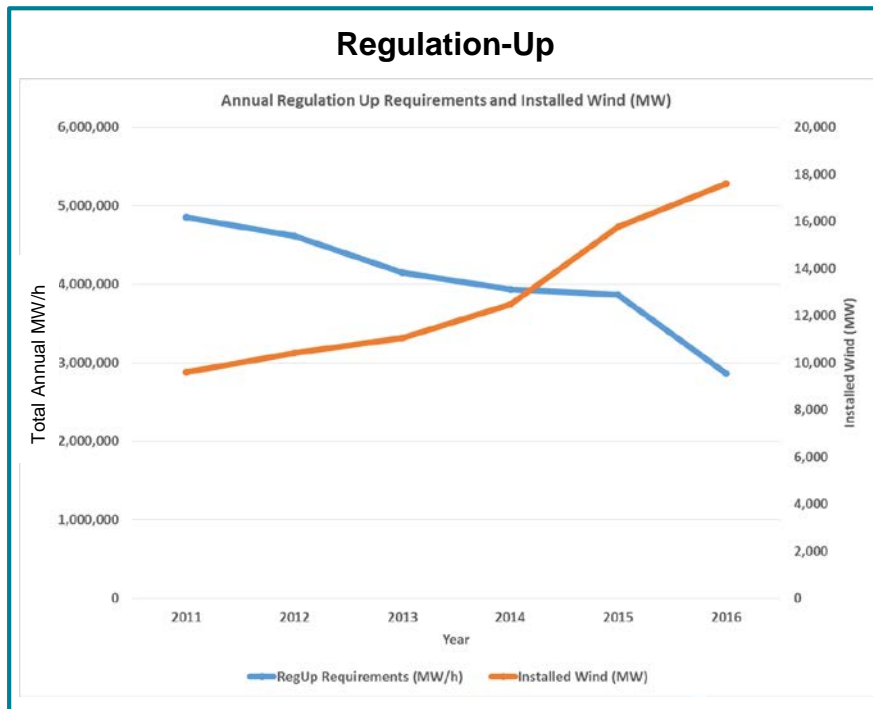
CPS1 12 Month Rolling Average = 176.31%  
 ('Perfect' score is 200%)





# Regulation Service Requirements 2011-2016

- Annual procurements of Regulation Service (MW/h) and year-end Installed Wind Capacity (MW)
  - Reg. requirements have decreased even as wind integration has increased





# Questions?