



# The ERCOT Nodal Market

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IPPSA 18<sup>th</sup> Annual Conference

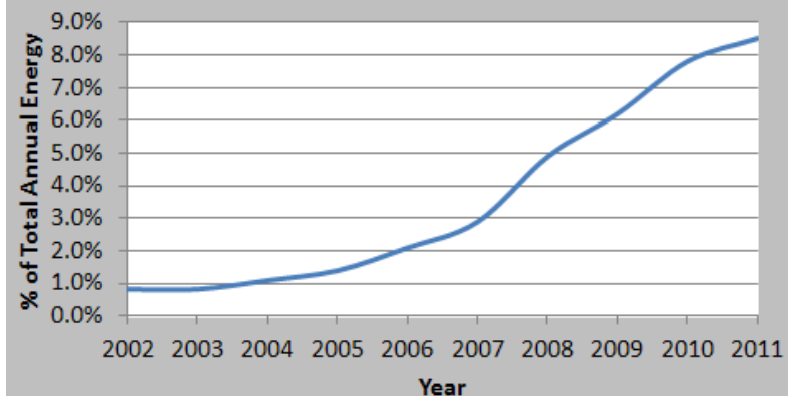
**March 13, 2012**

## Quick Overview of ERCOT

- **The ERCOT Market covers ~85% of Texas' overall power usage (~75% of the land area)**
- **Approximately 4500+ buses**
- **Approximately 550+ Settlement points**
- **Record peak demand of 68,379 MW (occurred on 8/3/11)**
- **Total installed wind capacity of 9,600 MW**
  - 19,400 MW of new wind capacity generation requests under review
- **Record peak WGR net MW power output of 7,400 MW (occurred on 10/7/11)**

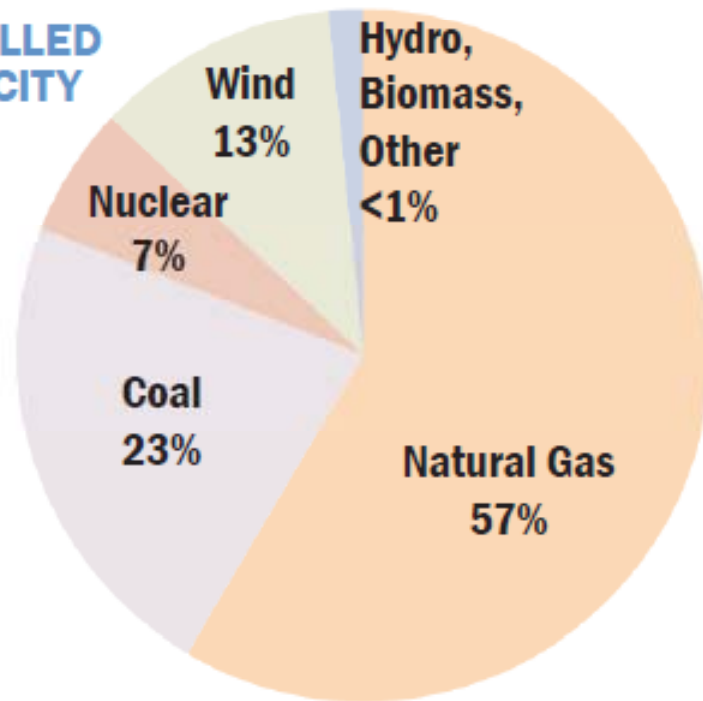


**Percent of Total Energy Coming from Wind Resources**

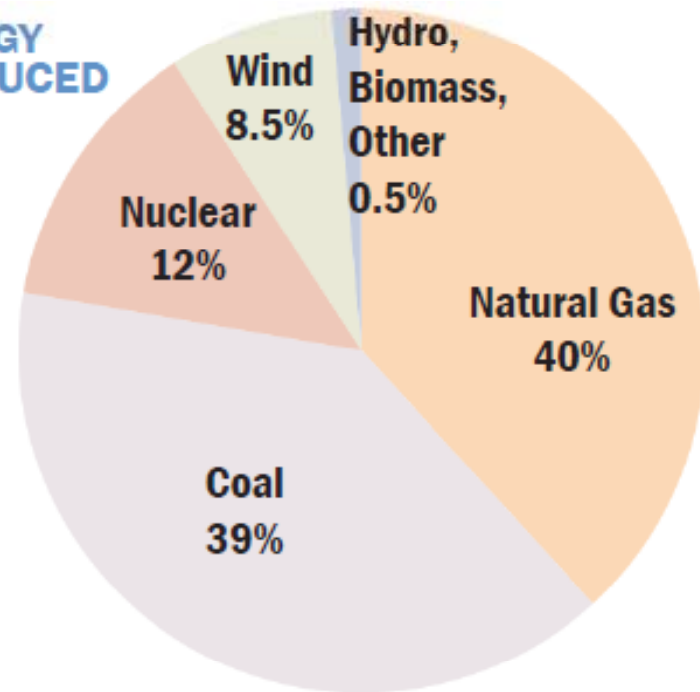


# Percent of Capacity and Energy by Fuel Type

**INSTALLED  
CAPACITY  
2011**



**ENERGY  
PRODUCED  
2011**



# Overview of the ERCOT Market

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- **Key Features**

- Energy Only (System Wide Offer Cap = \$3000)
- Ancillary Services (Unit Specific)
- Congestion Revenue Rights (Annual & Monthly Auctions)
- Day-Ahead Market (Co-optimization of energy & ancillary services)
- Real-Time Security Constrained Economic Dispatch

- **Metrics Related to Resource Adequacy**

- Reserve Margins
- Peaker Net Margin
- Energy Prices

- **Wind Management**

- Forecasting
- Real Time Wind Generation Dispatch in a Nodal Market
- Predicting Large Wind Ramps

- **Recent Design Changes**

# Key Features of ERCOT Energy Only Market

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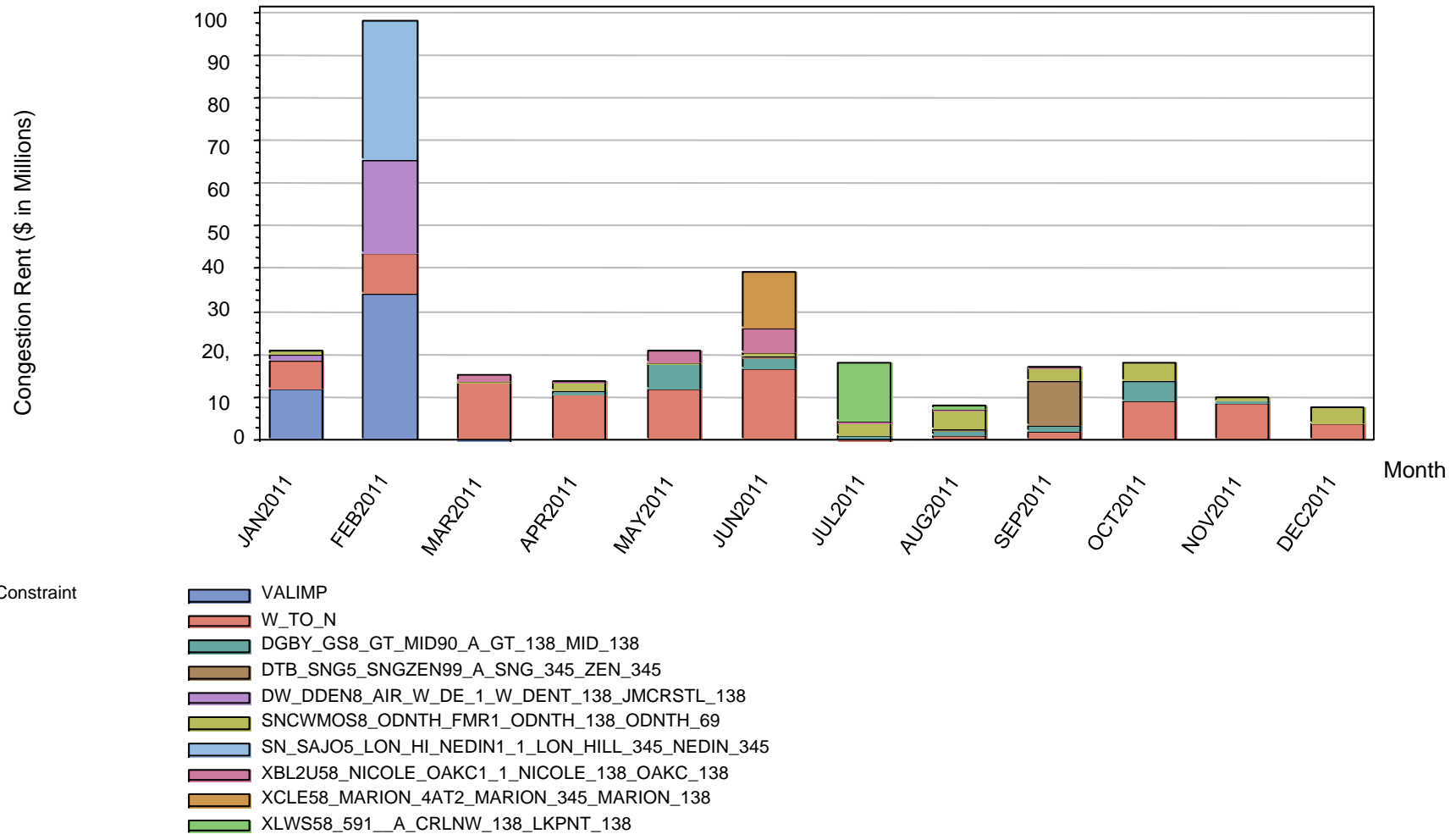
- **System Wide Offer Cap**
  - Energy offers are limited to \$3000/MWh per PUC rule
  - Administratively set the price of energy to \$3000/MWh when ERCOT is out of competitive energy offers (scarcity price in ERCOT)
  - Offer Cap is reduced to \$500/MWh when and if Peaker Net Margin reaches an accumulation \$175,000 in a year (has not occurred thus far)
- **Ancillary Services**
  - Regulation Reserve (reserves deployed to maintain frequency)
  - Non-Spinning Reserve (30 minute reserves)
    - Considers Load Forecast Risk and Wind Forecast Risk
  - Responsive Reserve (10 minute reserves)
    - 2300 MW now going to 2800 MW in April
    - Contingency reserves supplied by generation & up to 50% from load resources
- **Emergency Interruptible Load Service**

## Key Feature - Security-Constrained Economic Dispatch (SCED)

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- **Determines the optimal Generation Dispatch in order to meet demand and manage congestion**
- **Utilizes Resource Specific Energy Offer Curves**
- **Determines the Base Points for all generation units in the system including wind generation**
- **Assures the maximum use of wind generation delivered to the ERCOT Load centers**

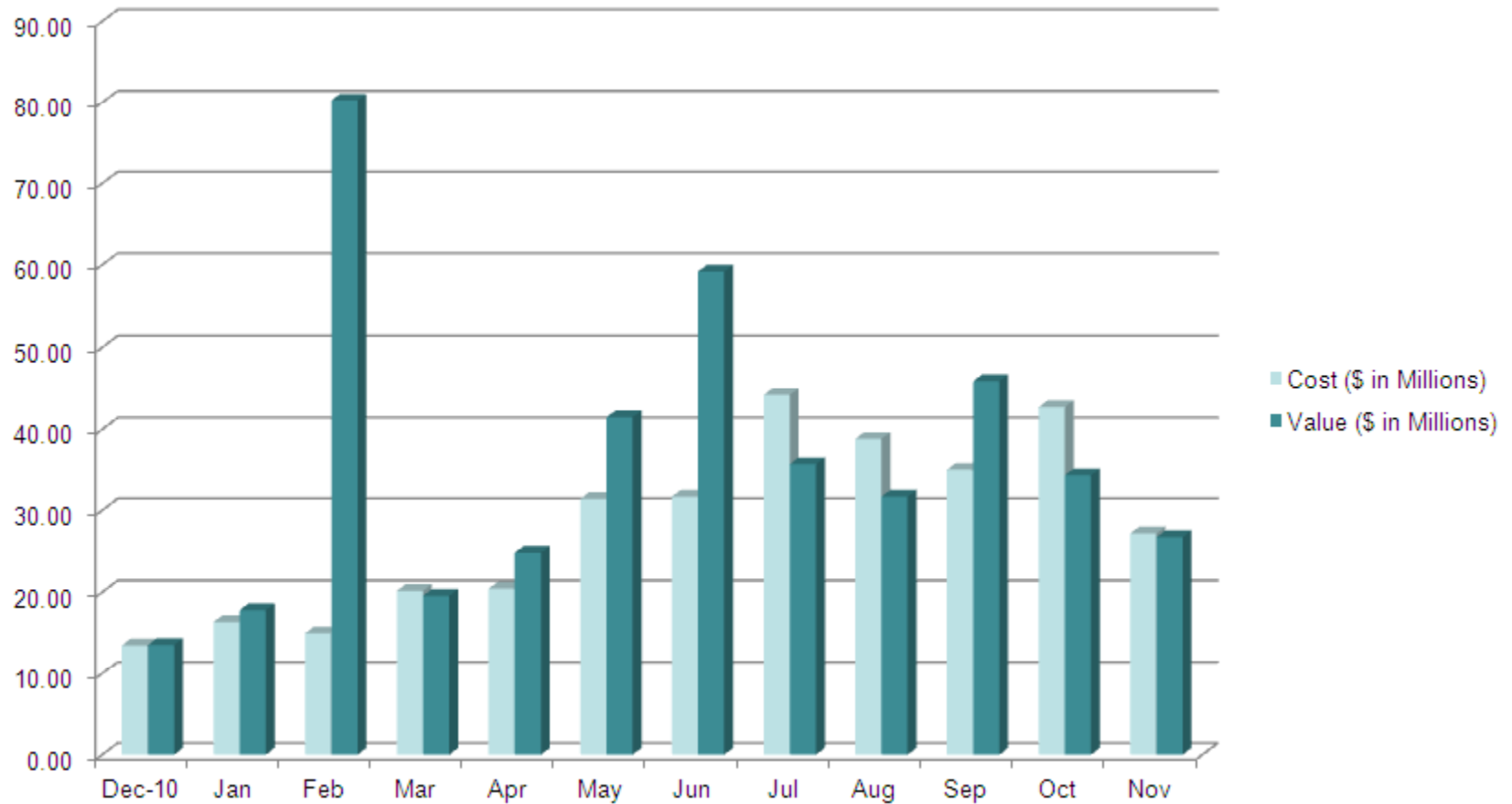
# Congestion Rent of Top 10 Real-Time Constraints Managed by SCED



Congestion Rent of Top 10 Real-Time Constraints

JAN2011-DEC2011

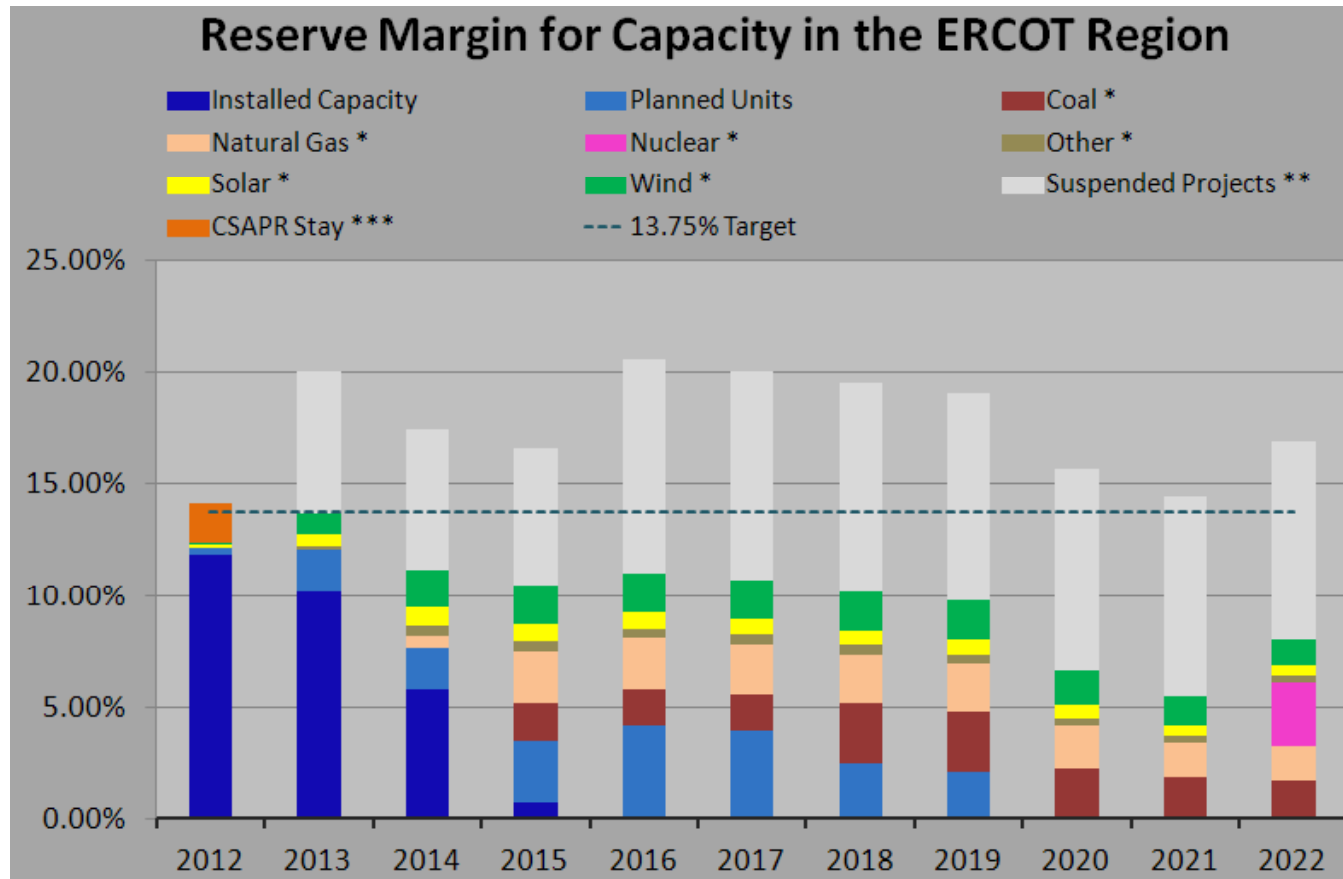
# Key Feature- Congestion Revenue Rights Cleared in the Day Ahead Market



Graphic to compare purchase cost of CRRs in auctions to CRR revenue collected and paid out to CRR Account Holders

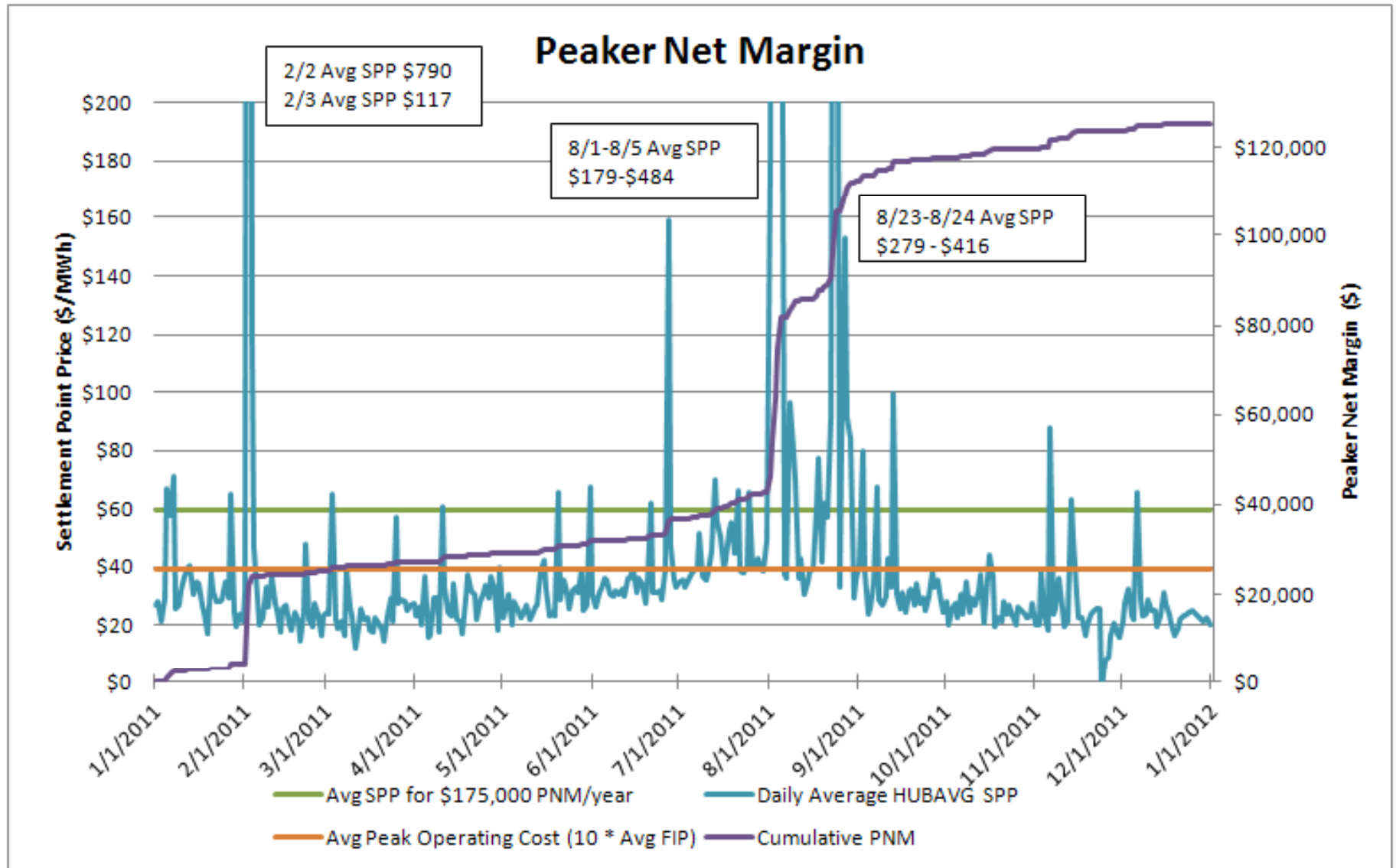


# Metrics Related to Resource Adequacy



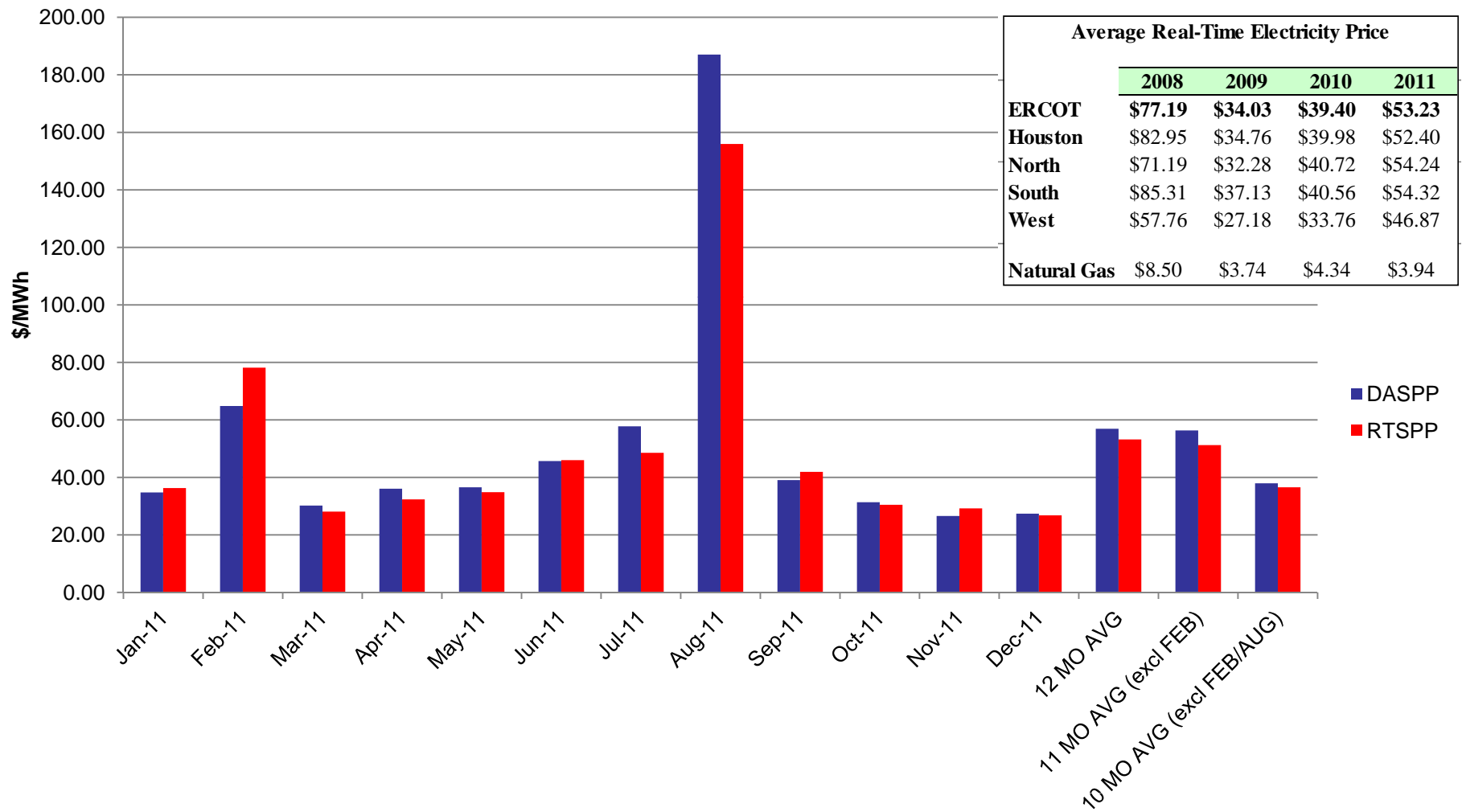
- Fuel Composition of Projects Undergoing Full Interconnection Studies - these projects may be cancelled or delayed beyond the indicated commercial dates shown
- \*\*\* Monticello 1&2 – 1130MW (as a result of a federal court’s order to stay EPA’s CSAPR)

# Metrics Related to Resource Adequacy

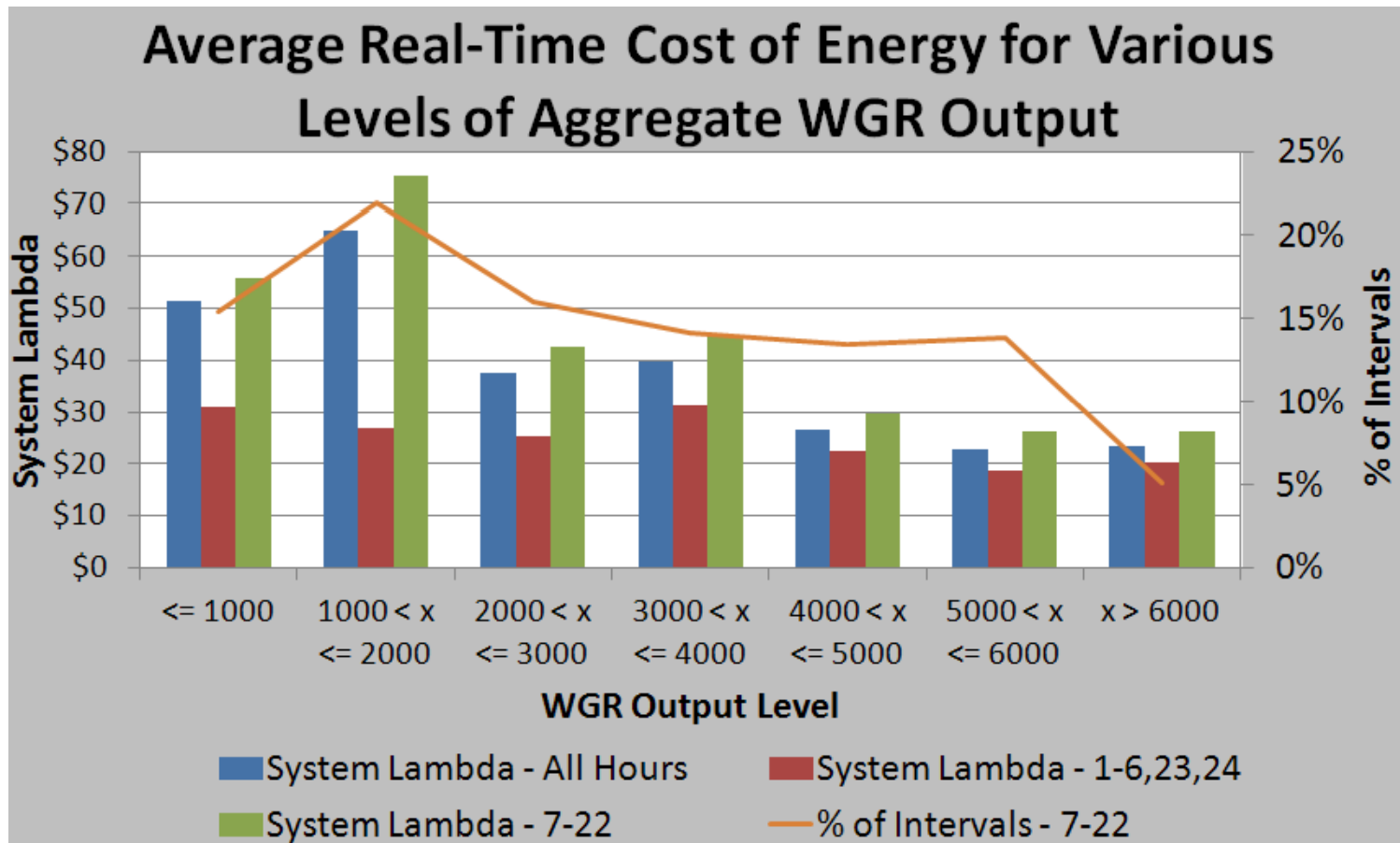


# Metrics Related to Resource Adequacy- Day-Ahead Settlement Points (DASPP) & Real-Time (RTSPP)

## Nodal 2011 Average Energy Price

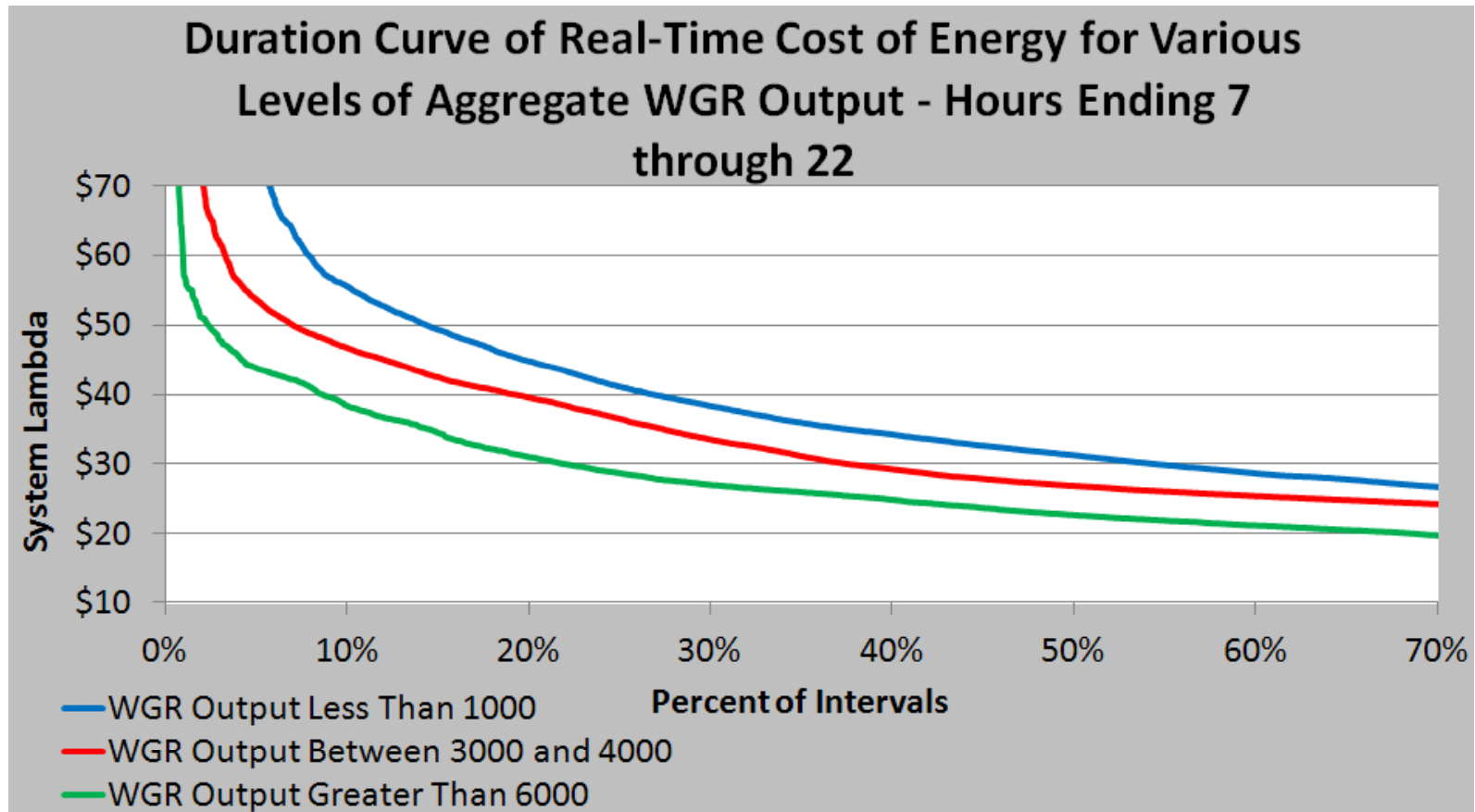


# Real-Time Cost of Energy vs. Wind Output



Note: Orange line indicates that wind output was less than 1000 MW for 16% of all on-peak SCED intervals observed

# Real-Time Cost of Energy vs. Wind Output

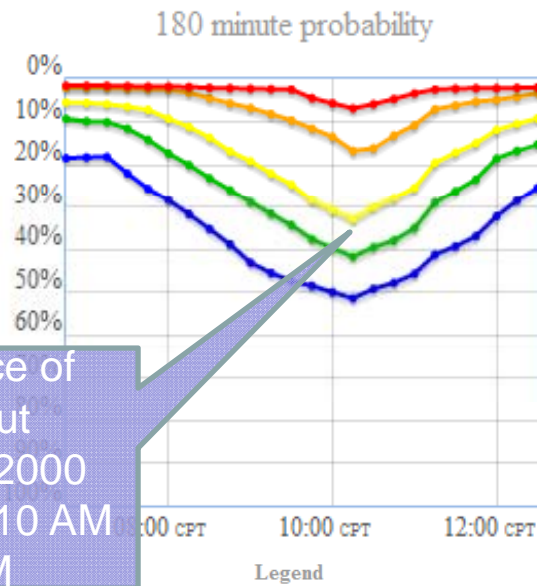


Note: blue line indicates that the energy price was approximately \$30 in 50% of all on-peak SCED intervals in which wind output was less than 1000 MW

- **ERCOT Large Ramp Alert System (ELRAS)**
  - Utilizes the same data that is being provided by ERCOT for the wind power forecasts
  - An estimation of the probability of a defined ramp event (i.e. 1000 MW up ramp in a hour) beginning in a particular interval
  - Information regarding the weather event which is most likely to cause the ramping event (i.e. a cold front)
  - Looks from the current time to 6 hours into the future
- **ERCOT Wind Power Forecast**
  - The Wind Generation Resource Production Potential (WGRPP) is an 80% probability of exceedence forecast
  - The Short-Term Wind Power Forecast (STWPF) is the most likely or 50% probability of exceedence forecast
  - Each hour a new forecast is created for each Resource for the next 48 hours

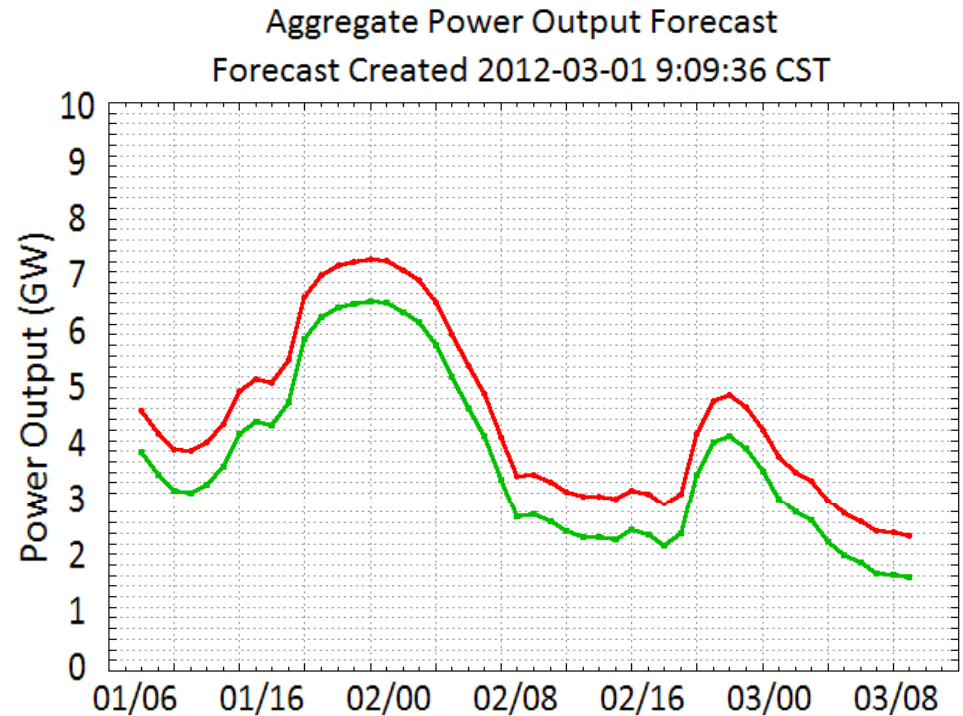
# ERCOT Wind Power Forecasting

- **ERCOT Large Ramp Alert System (ELRAS)**



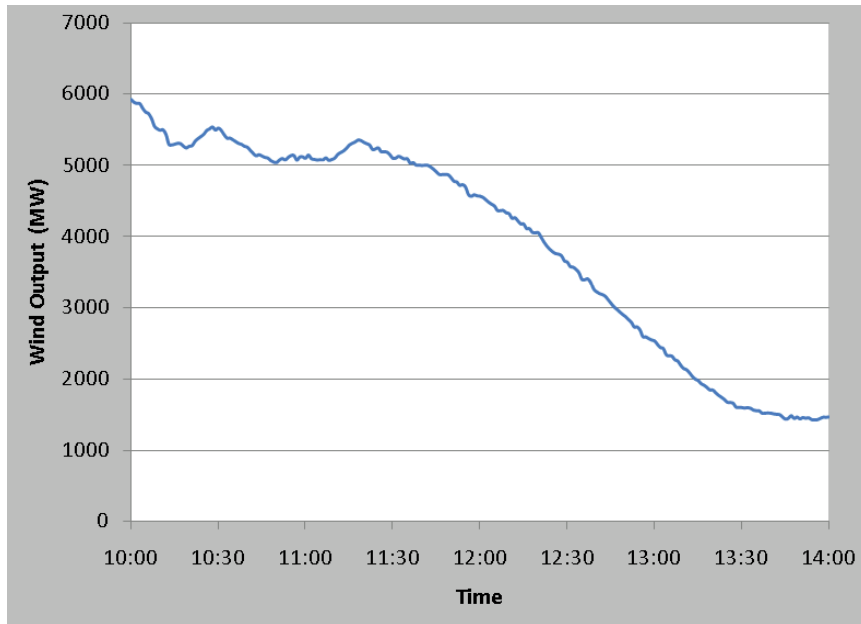
~35% chance of wind output dropping by 2000 MW between 10 AM and 1 PM

- Wind Power Forecast
  - STWPF – Red line
  - WGRPP – Green Line

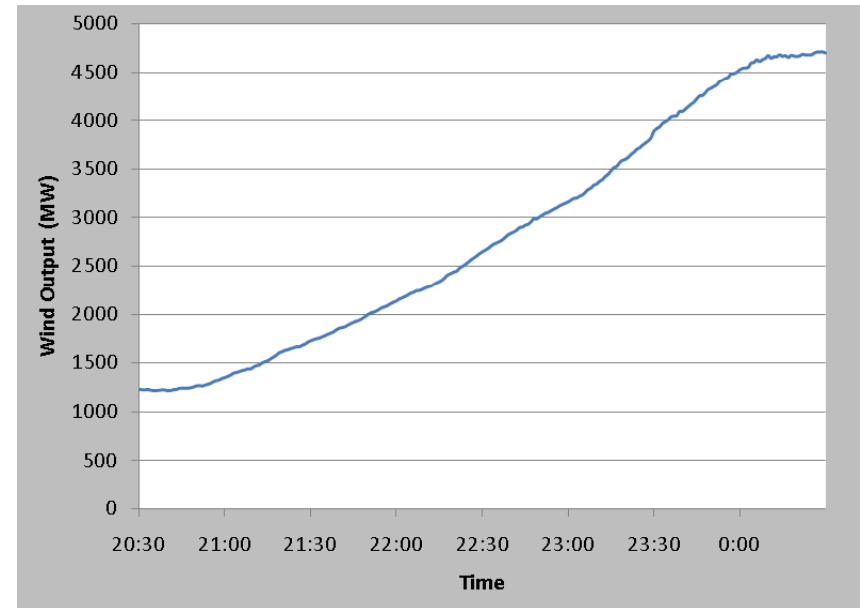


# Observed Ramps in ERCOT

- **Ramp down on June 27<sup>th</sup>, 2011**
  - Ramp of ~3500 MW in 2 hours



- **Ramp up on July 5<sup>th</sup>, 2011**
  - Ramp of ~3500 MW in 3 hours





# Recent Design Changes

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- **Ancillary Service methodology change to move 500MW of Non-Spinning Reserve Service to Responsive Reserve Service**
- **Implemented offer floors for Non-Spinning Reserve Resources**
  - No less than \$120 for Online Resources always available for dispatch
  - No less than \$180 for Offline Resources available when deployed by system operator
- **Implemented offer floors for Responsive Reserve & Reliability Unit Commitment Resources**
  - Offer placed at the system wide offer Cap of \$3000 for these Resources
- **Evaluating feasibility of implementing Pilots for**
  - Fast response regulation service
  - 30 min Emergency Interruptible Load Service (EILS)
  - Active deployment of Load Resources participating in Non-Spinning Reserve based on forecasted price
- **Demand Response**
  - Emergency Interruptible Load Service Proposed PUC Rule Enhancements
    - Allow Distributed Generation participation
    - Remove the 10 minute deployment limitation from the rule

## ERCOT Resource Adequacy Focus

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- **ERCOT has contracted with the Brattle Group to Evaluate Resource Adequacy Incentives in ERCOT**
- **The study will focus on the following:**
  - Identify and examine the factors that influence investment decisions related to the financing and development of projects to meet ERCOT's resource adequacy goals.
  - Provide suggestions for ways to enhance favorable investment outcomes for long-term resource adequacy in ERCOT