TEXAS RE
Ensuring electric reliability for Texans

# Introduction and Welcome

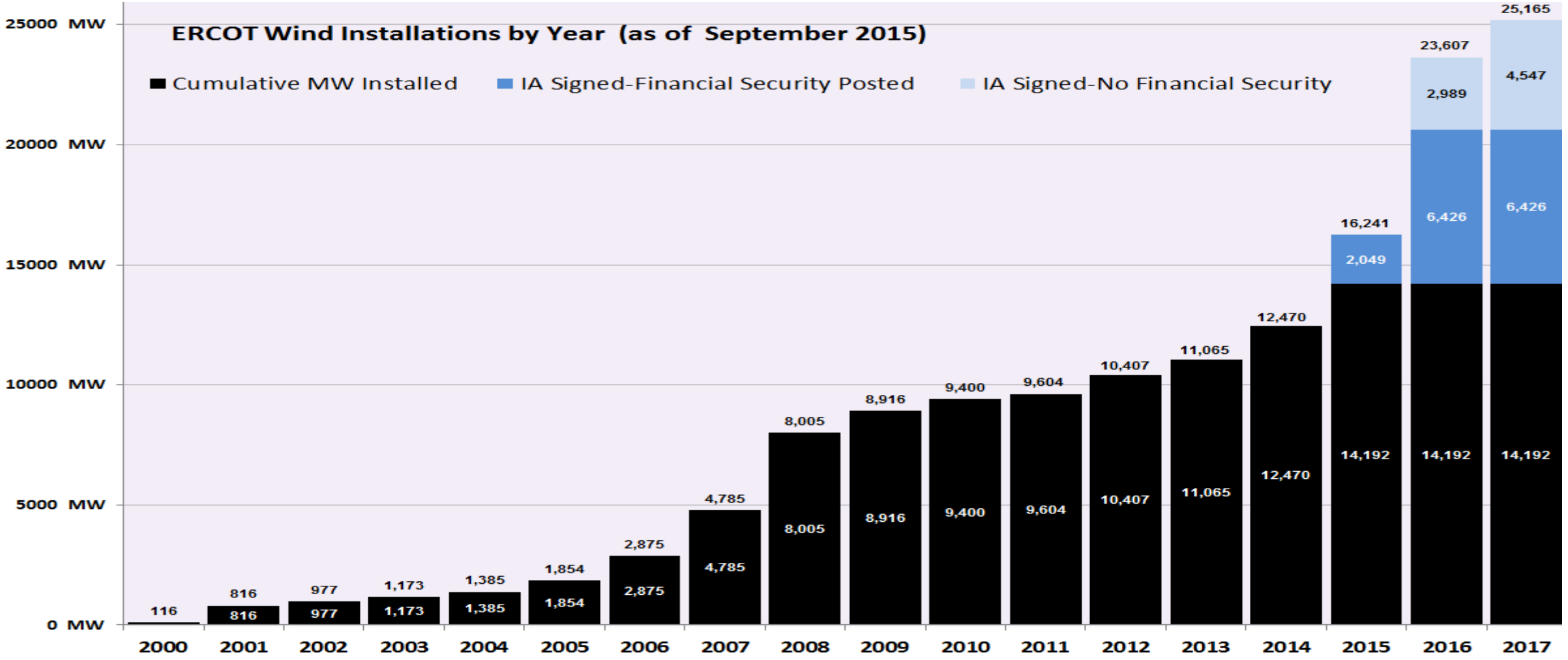
**Mark Henry**
**Director, Reliability Services**

**Winter Wind Webinar**
**November 11, 2015**

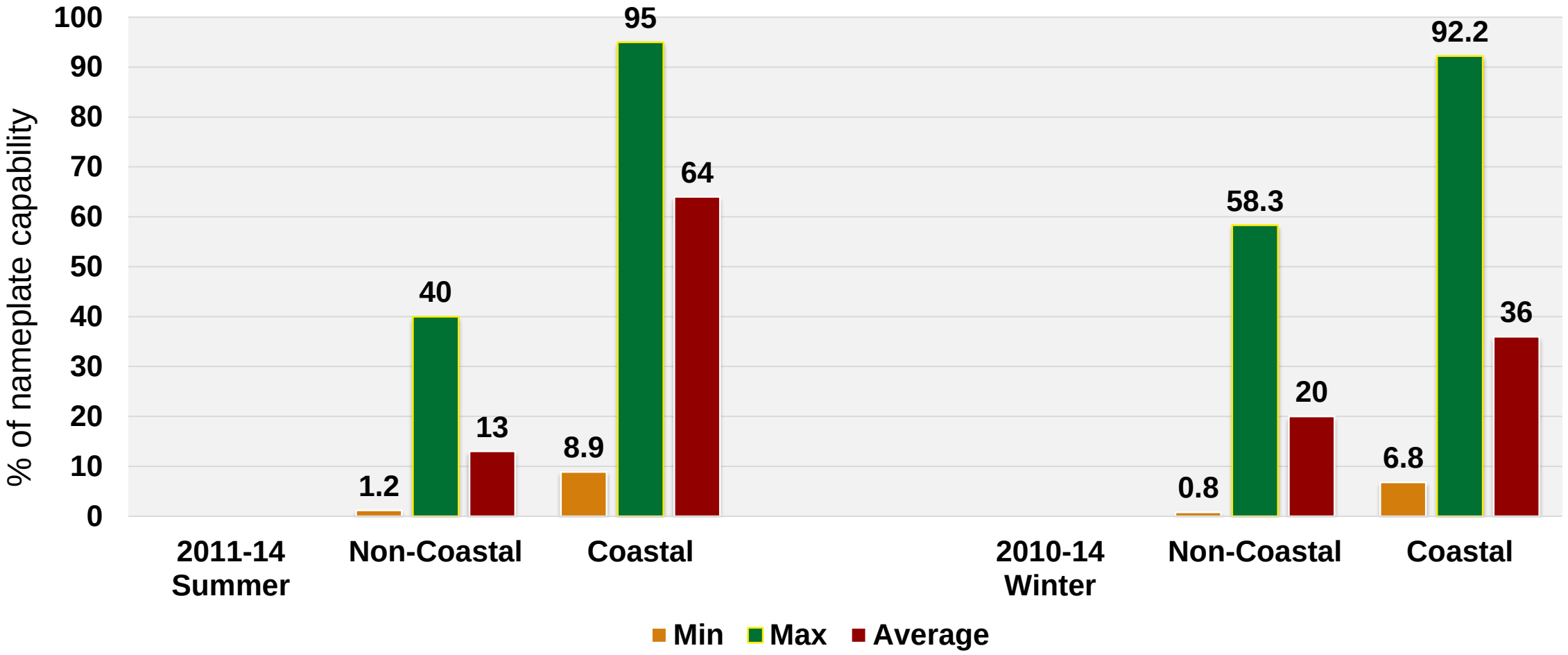
# Agenda

| Topic | Speakers |
|---|---|
| Introduction and Objectives | Mark Henry, Texas RE |
| Overview, Forecast, and Extreme Winter Operations, from ERCOT and Wind Generator Perspectives | Bill Blevins, ERCOT |
| Wind Generator Winter Preparation in the ERCOT Region | Allen Schriver, NextEra |
| Keechi Plant Experiences and Practices for Winter Operations | Mitch Kerley, Enbridge |
| Observations from WGR Spot Checks | Alan Allgower, ERCOT |

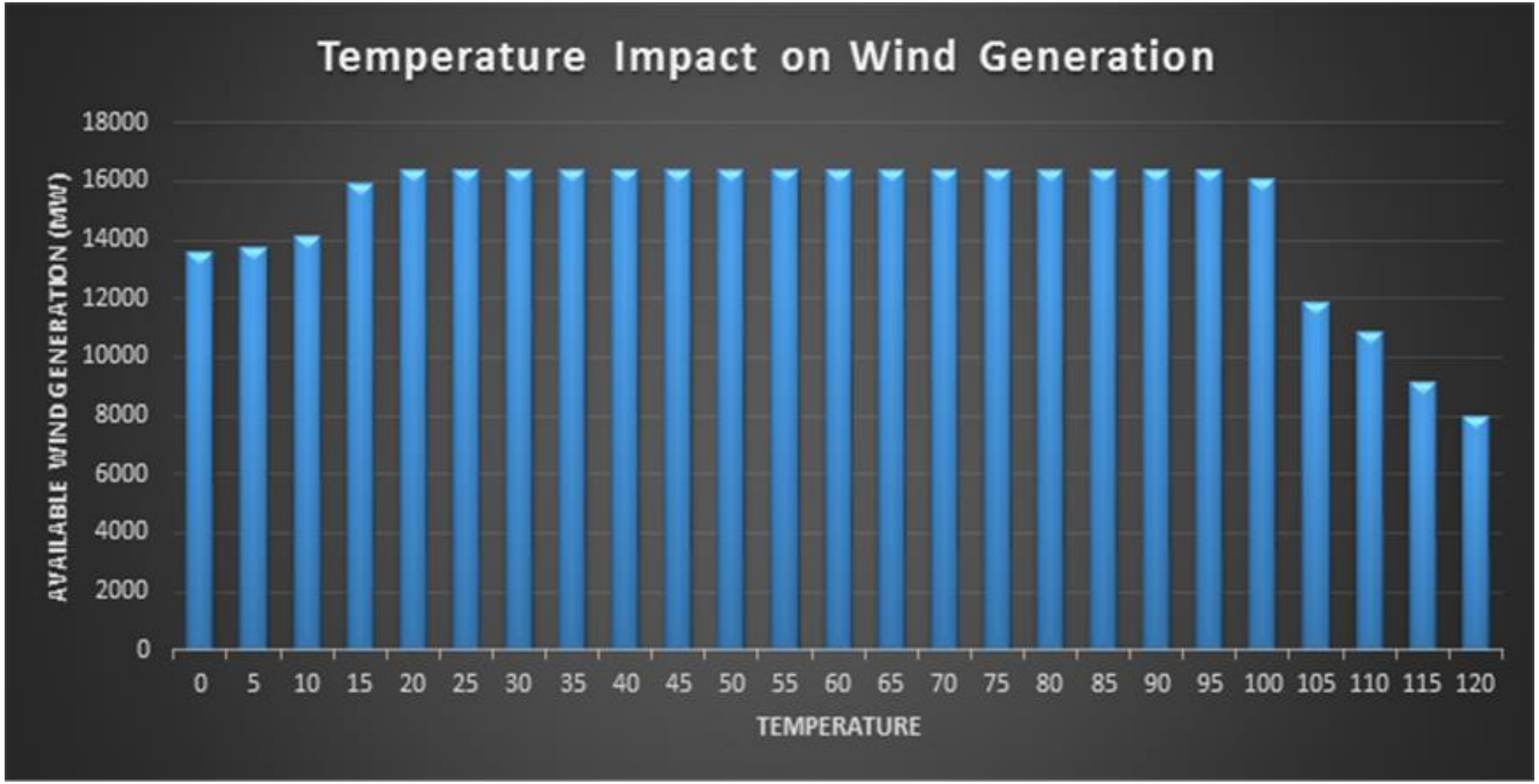
# ERCOT Wind Installations by Year



# % Summer and Winter Peak Capacity (TOP 20 hours)



# Temperature Impact on Wind Generation



# Polar Vortex January 6th-8th, 2014

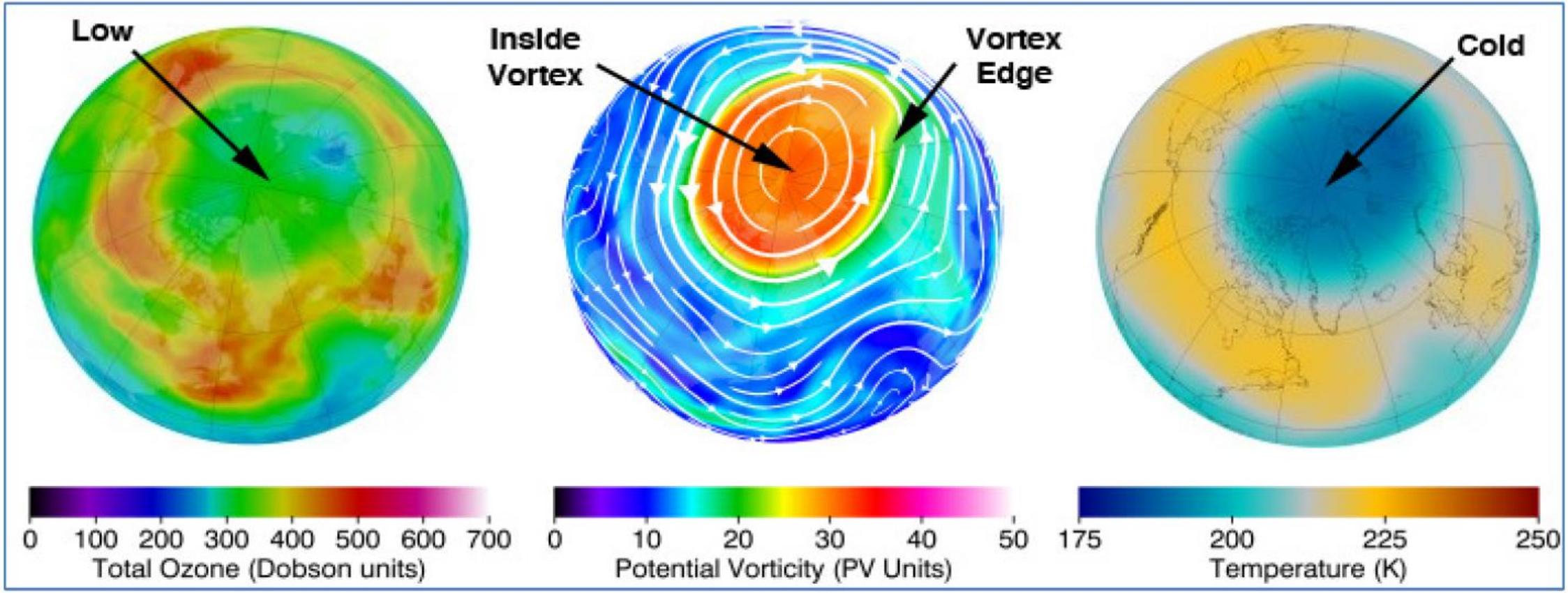
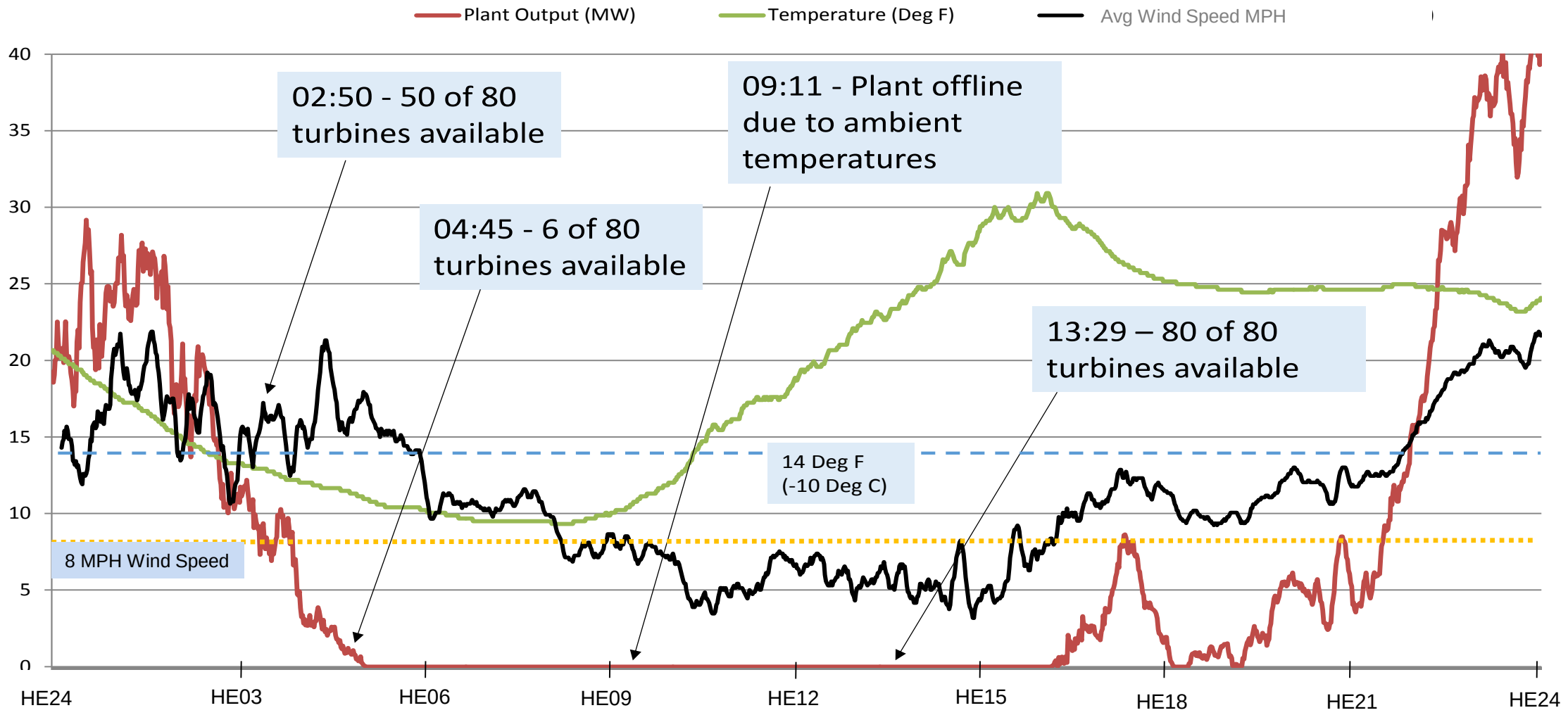



**Figure 4: How a Polar Vortex Forms**

Source: NASA - http://ozonewatch.gsfc.nasa.gov/facts/vortex_NH.html

# Example Texas Wind Plant Output January 14, 2014



# Wind Preparation Requirements

**ERCOT Protocol § 3.21:**

- **Entities submit weatherization plans to ERCOT**
- **Twice attest to ERCOT that each Generation Resource under the Resource Entity's control has completed or will complete all weatherization preparations required by the plan**
  - Between May 1 and June 1
  - Between Nov. 1 and Dec. 1
- **Form: Protocol § 22 Attachment K**

# Questions?

Mark Henry
mark.henry@texasre.org

# 2015 Texas RE and ERCOT Wind Generation and Winter Preparation Webinar

Bill Blevins
ERCOT Operations Planning

# Table of Contents

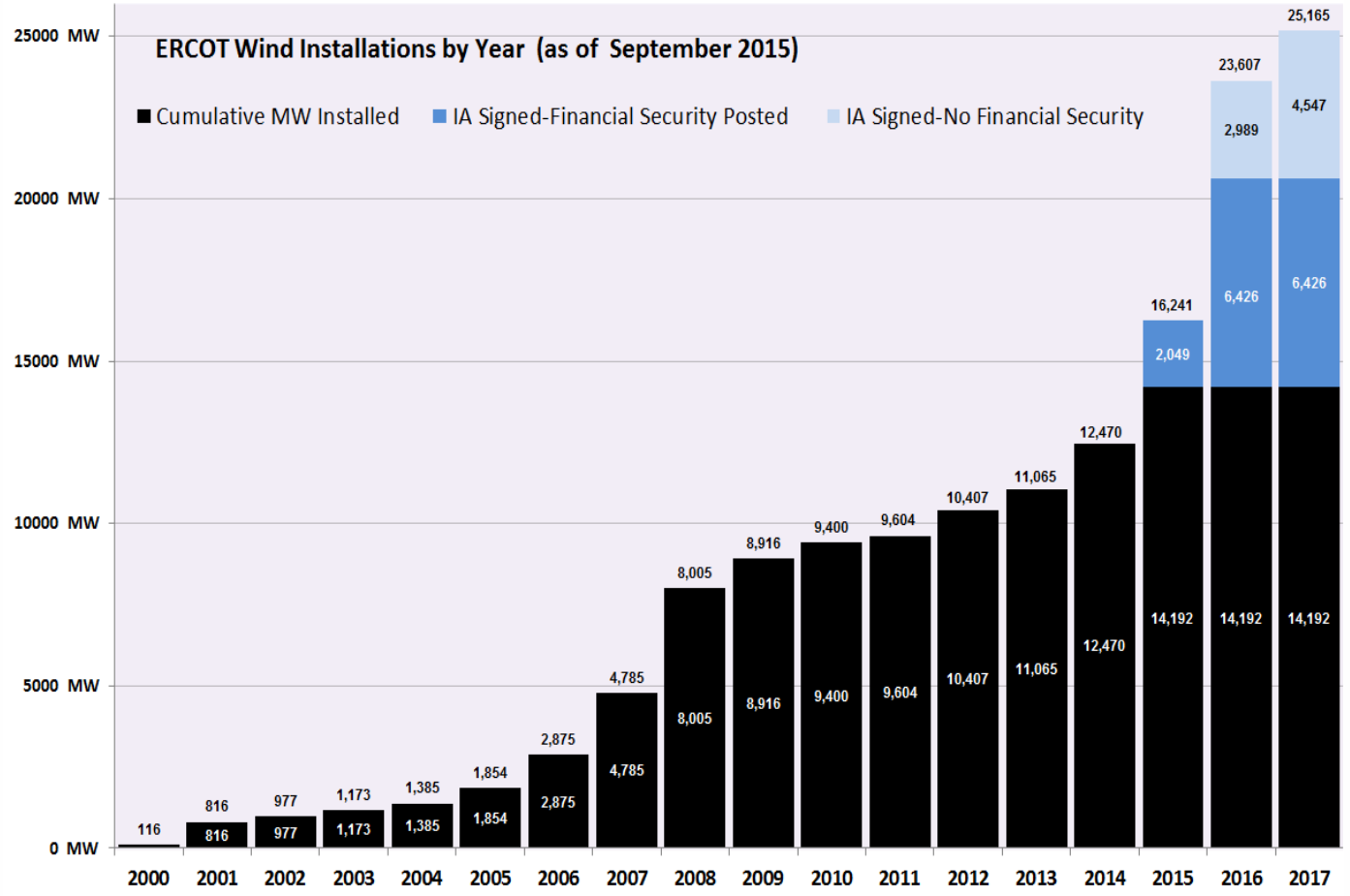

- Overview
- Wind Forecast @ ERCOT
- Wind Forecast and Extreme Weather: ERCOT Perspective
- Preparation for Cold Weather: Wind Units Perspective


Acronyms for this presentation:

- WGR: Wind-powered Generation Resource
- STWPF: Short-term Wind Power Forecast
- COP: Current Operating Plan

# Overview

# Installed Wind Generation in ERCOT

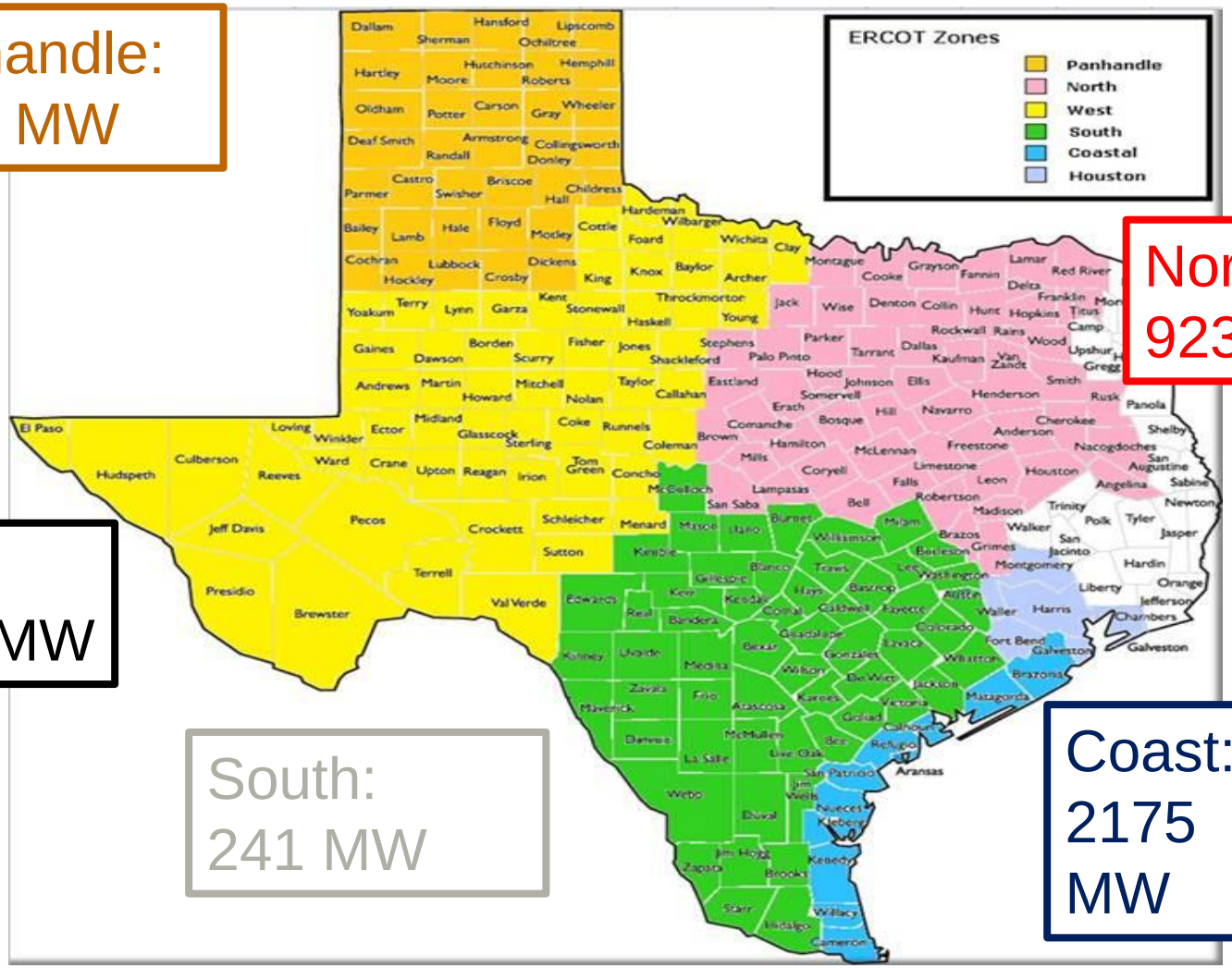



The data presented here is based upon the latest registration data provided to ERCOT by the resource owners and can change without notice. Any capacity changes will be reflected in current and subsequent years' totals. Scheduling delays will also be reflected in the planned projects as that information is received. This chart reflects planned units in the calendar year of submission rather than installations by peak of year shown.

Financial security posted for funding interconnection facilities does not include CREZ security deposits, which are refunded to the Interconnecting Entity when an IA is signed.

# Wind Regions within ERCOT

Panhandle:
2520 MW




North:
923 MW

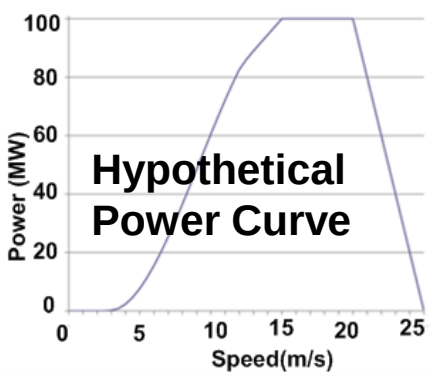
West:
9,432 MW

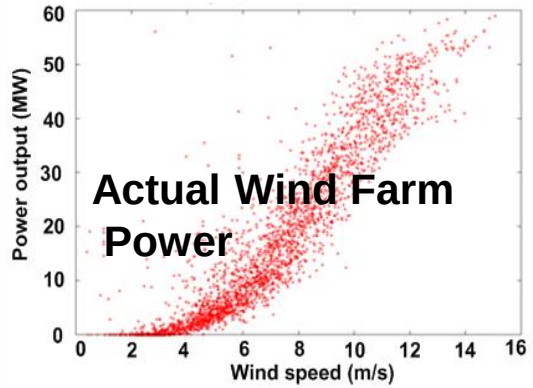
South:
241 MW

Coast:
2175
MW

# Challenges in Wind Forecast

1. Relatively concentrated geographic region for wind installation (lack of spatial diversity)
2. Texas weather can change rapidly
3. Severe changes in wind generation output caused by different types of extreme weather (large wind ramps)
    - *Frontal system, trough, or dry line/Thunderstorms/Low-level jets/Weakening pressure gradients/Strengthening pressure gradients*
4. There is an approximation of hypothetical wind speed-power curve to the real one

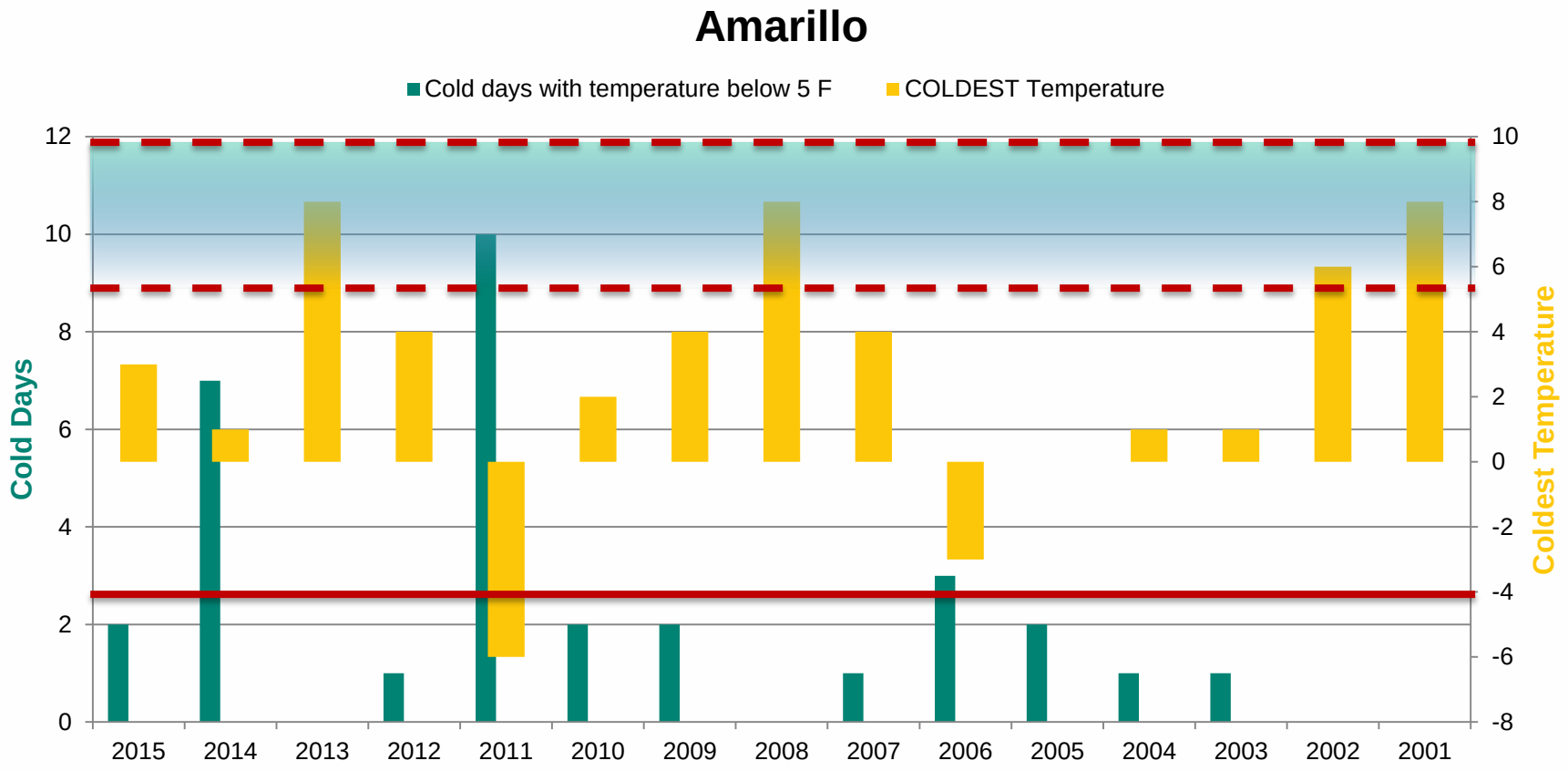


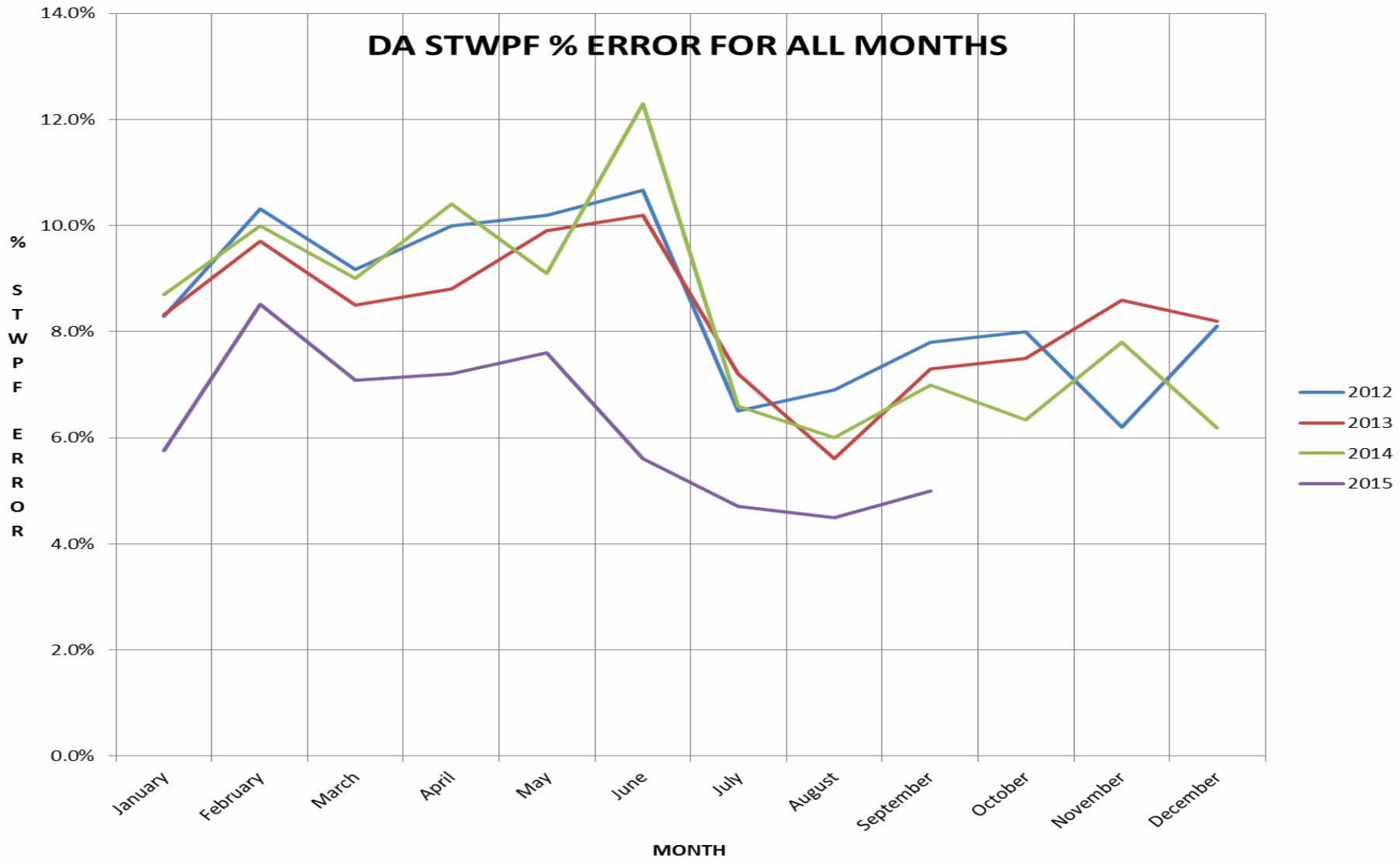


The steep part of the power curve from 4-12 m/s is where power increases strongly with speed.

# Cold Weather



# Day-Ahead Wind Forecast Error



# Wind Generation Record

| | WIND (MW) | LOAD(MW) | Penetration |
|---|---|---|---|
| 03/29/2015 02:12 | 10,308 | 25,400 | 40.58% |
| 10/22/15 12:48 AM | 12,237.6 | 33,245 | 36.81% |

# Wind Forecast

# 4.2.2 Wind-Powered Generation Resource Production Potential

(1) *ERCOT shall produce and update hourly a Short-Term Wind Power Forecast (STWPF) that provides a rolling 48-hour hourly forecast of wind production potential for each Wind-powered Generation Resource (WGR).* ERCOT shall produce and update an hourly Total ERCOT Wind Power Forecast (TEWPF) providing a probability distribution of the hourly production potential from all wind-power in ERCOT for each of the next 48 hours. Each Generation Entity that owns a WGR shall install and telemeter to ERCOT the site-specific meteorological information that ERCOT determines is necessary to produce the STWPF and TEWPF forecasts. ERCOT shall establish procedures specifying the accuracy requirements of WGR meteorological information telemetry.

*Please note : For a WGR going through commissioning process, ERCOT will start providing STWPF to the QSE once WGR receives approval to Generate into the ERCOT Grid (Part II of the Commissioning check list)*

# 3.9.1 Current Operating Plan (COP) Criteria

(7) For the first 48 hours of the COP, a QSE representing a Wind-powered Generation Resource (WGR) must enter an HSL value that is less than or equal to the amount for that Resource from the most recent Short-Term Wind Power Forecast (STWPF) provided by ERCOT.

**NPRR 686 Changing the IRR Forecast from Next 48 Hours to Next 168 Hours**

**[NPRR615: Replace paragraph (8) above with the following upon system implementation:]**

**(8) For the first 168 hours of the COP, a QSE representing a Wind-powered Generation Resource (WGR) must enter an HSL value that is less than or equal to the amount for that Resource from the most recent Short-Term Wind Power Forecast (STWPF) provided by ERCOT, and a QSE representing a PhotoVoltaic Generation Resource (PVGR) must enter an HSL value that is less than or equal to the amount for that Resource from the most recent Short-Term PhotoVoltaic Power Forecast (STPPF) provided by ERCOT.**

# WPF Process Inputs

| Source | Data |
|---|---|
| Registration system | 1. Resource Parameters<br>• Resource Name<br>• Location of wind farm (latitude and longitude or equivalent for the center point of wind farm)<br>• Location of the meteorological tower (latitude and longitude or equivalent)<br>• Type (manufacturer/model) and number of turbines<br>• Turbine hub height(s) above ground level with associated number of turbines<br>  • Manufacturer's power curve (capability curve) |
| Energy Management System (EMS) | 1. Resource Commercial Operation Date<br>1. Most recent Resource (wind farm) status with date/time<br>2. Most recent MW output of wind farm with date/time<br>3. Most recent wind speed and direction at hub height from one meteorological tower with date/time<br>4. Temperature and barometric pressure at 2 m above ground level on the meteorological tower |

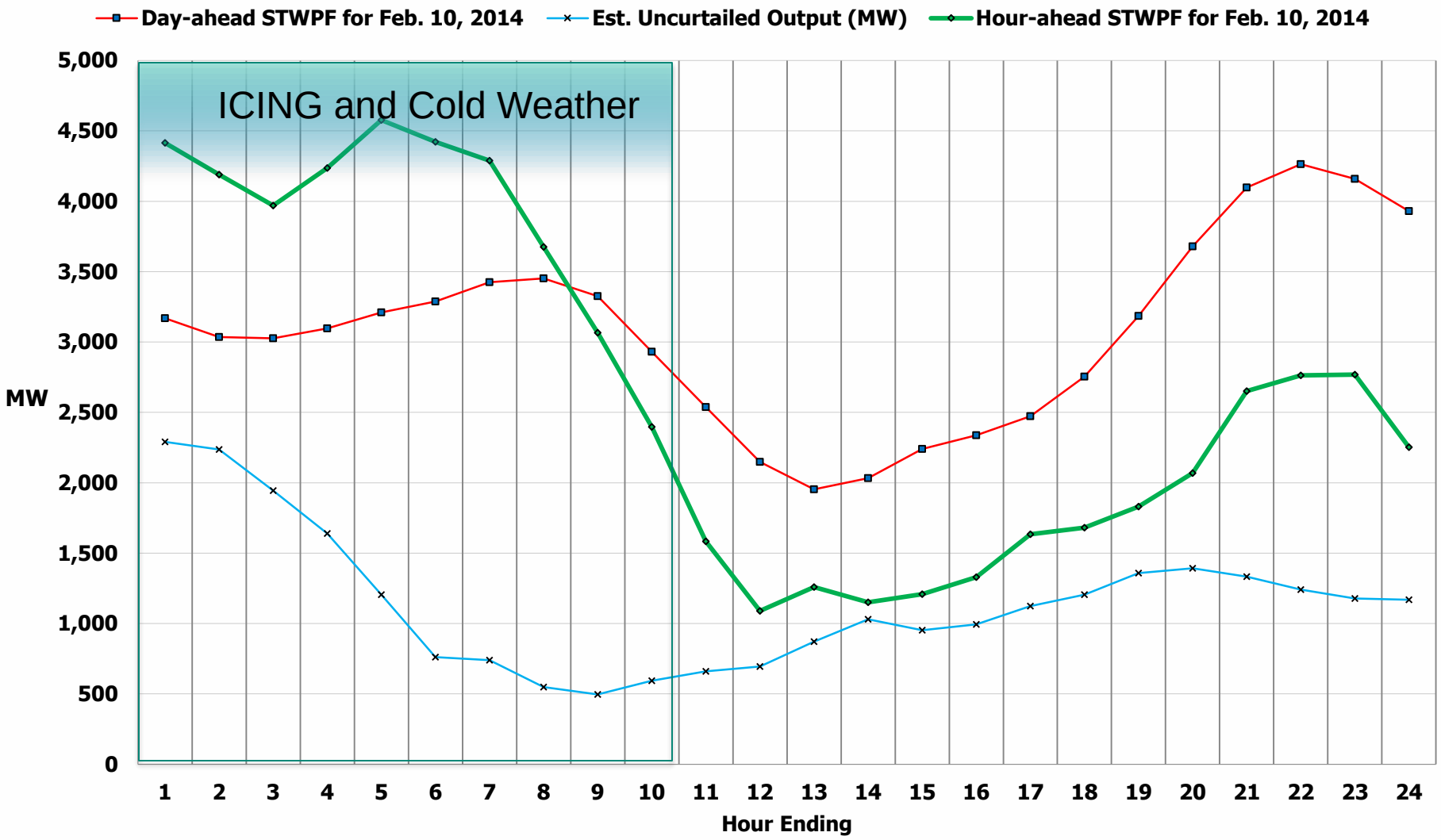
**Telemetry value**

SCADA telemetry values are sent every 5 minutes from EMS to the wind power forecast service provider (all of these are Unit specific information with their Qualified Scheduling Entities (QSE) mapping)

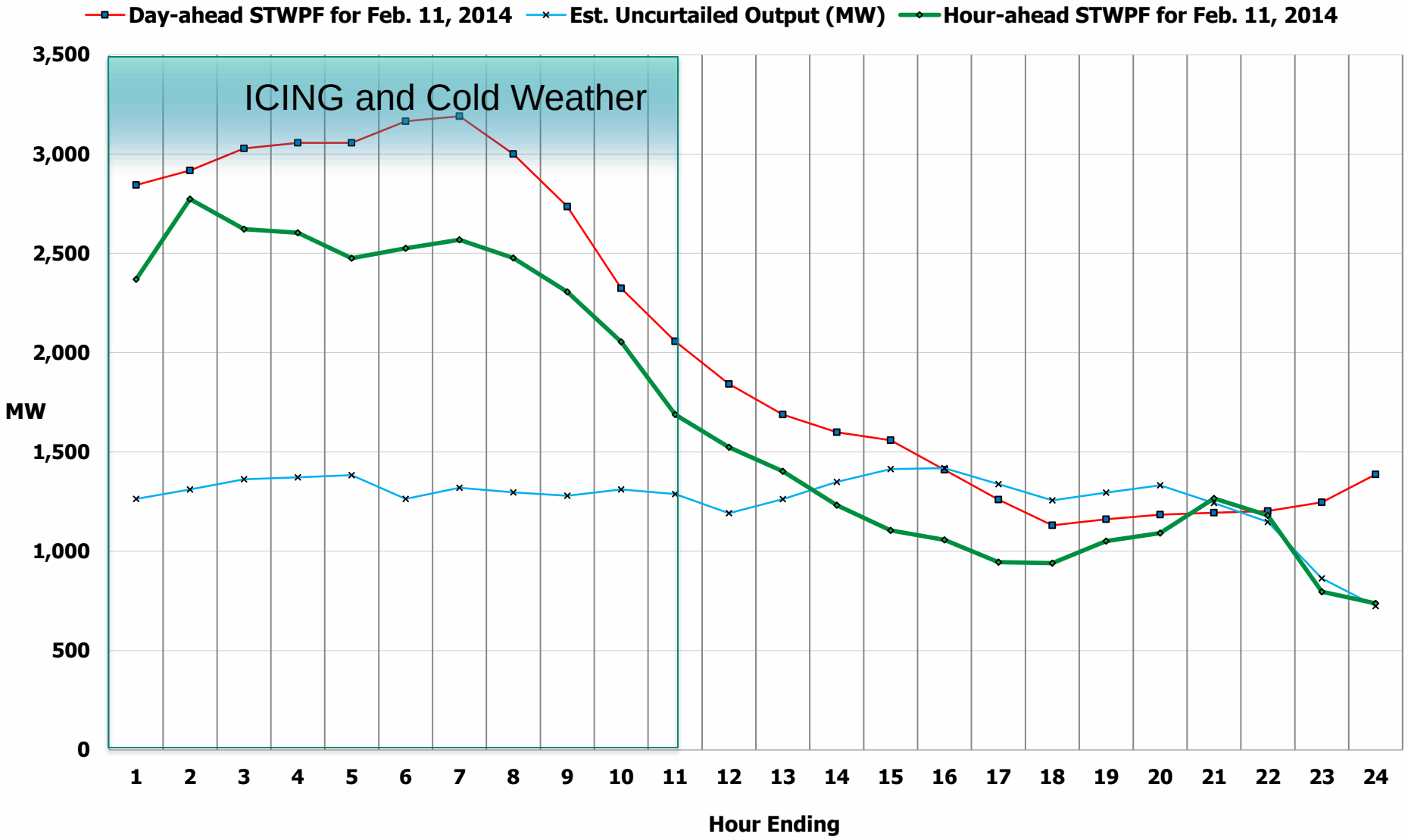
1. MW Average
2. Wind Speed
3. Wind Direction
4. Temperature
5. Barometric Pressure
6. HSL Average
7. Num of Turbines ON
8. Num of Turbines Off
9. Num of Turbines Unknown
10. Curtailment Flag

# Wind Forecast and Extreme Weather: ERCOT Perspective

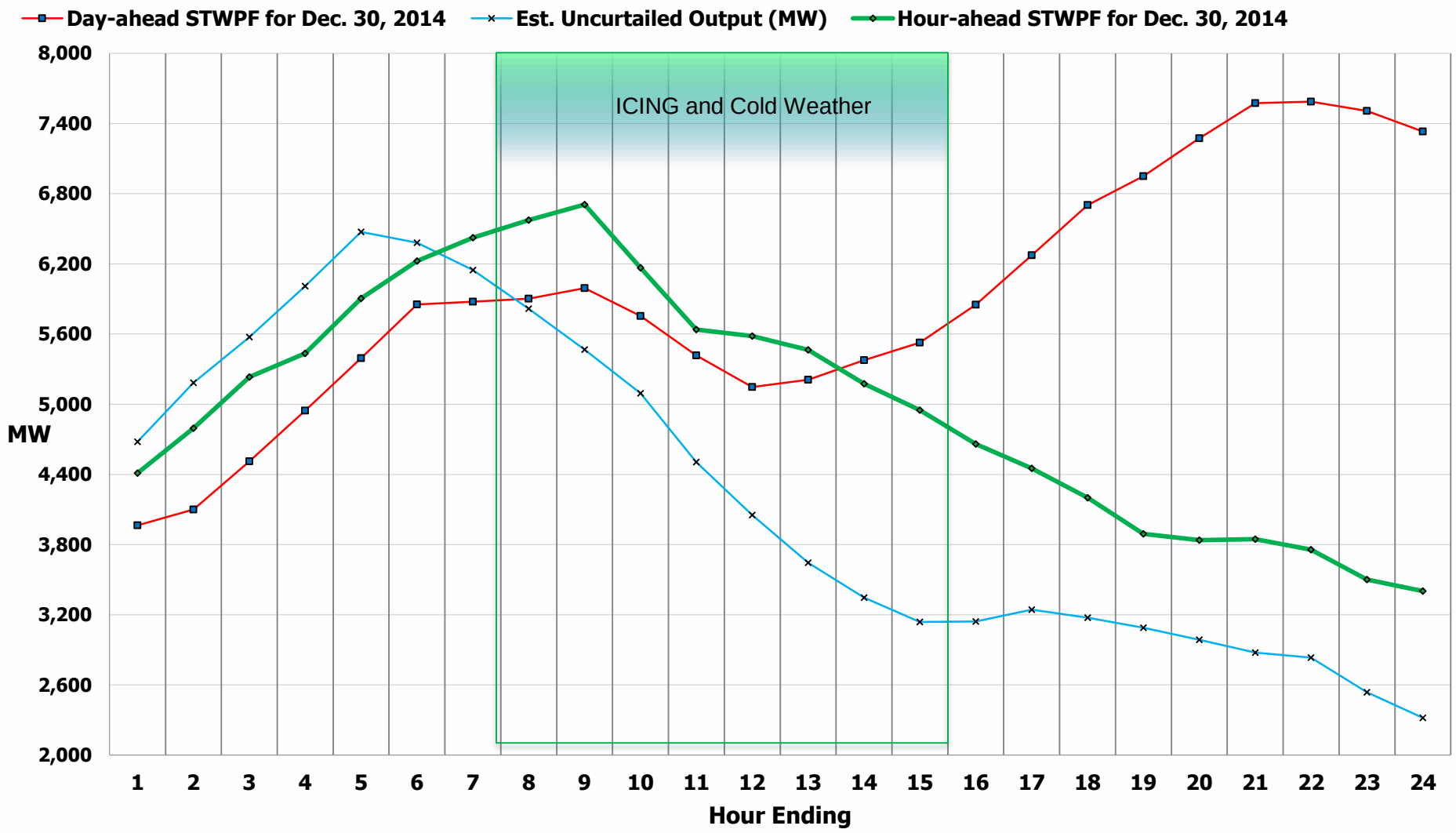
# Wind forecast on Feb. 10, 2014



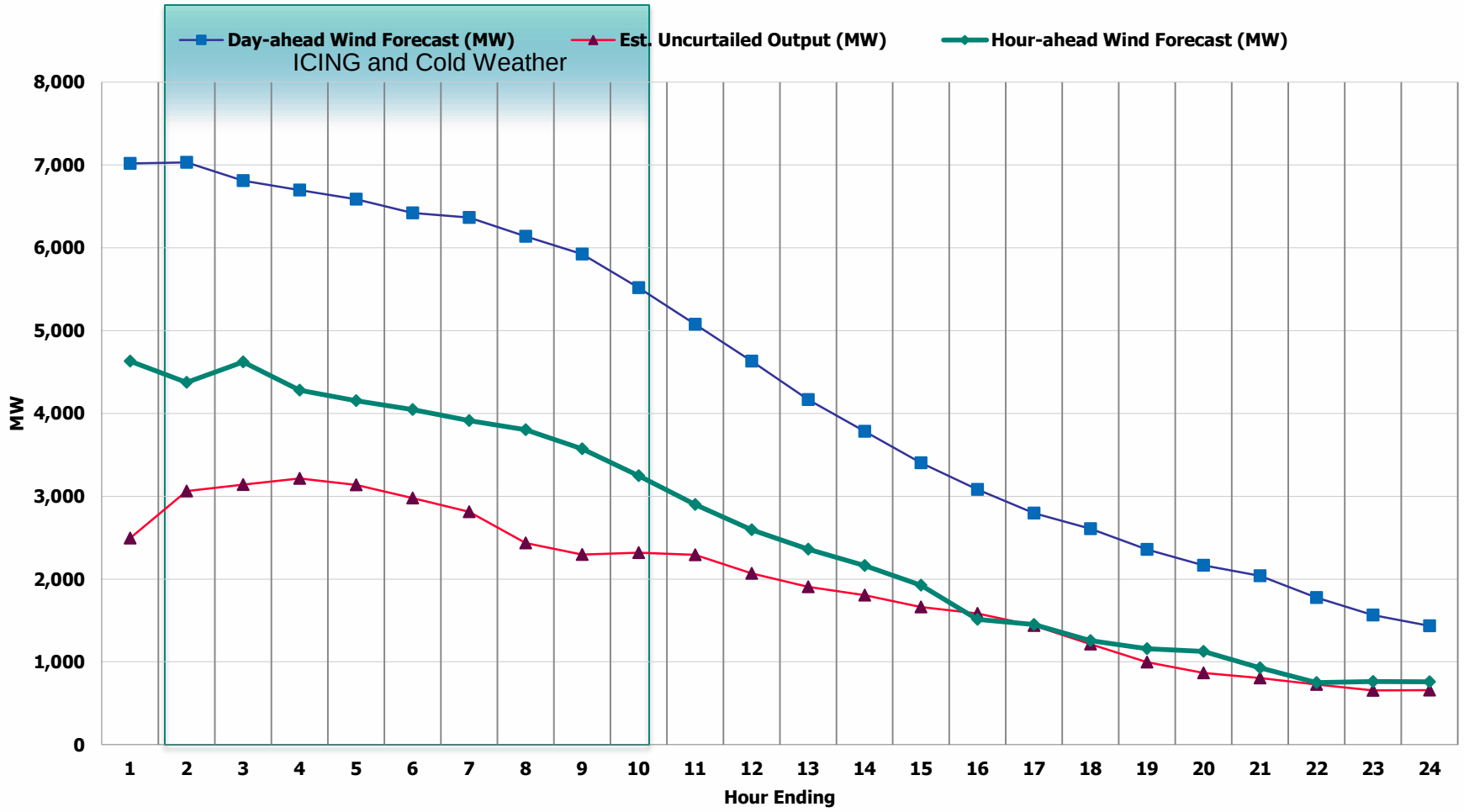
# Wind Forecast on Feb. 11, 2014



# Wind Forecast on Dec. 30, 2014



# Wind Forecast on Feb. 23, 2015



# Challenges Created by Icing

- Icing created a mismatch between the forecast and actual production.
- This created an error in the forecast which then was provided to WGRs.
- This error was used in the COP for RUC.
- Could lead to ERCOT counting on more wind than WGRs are able to generate.

# Addressing the Wind Turbine Icing

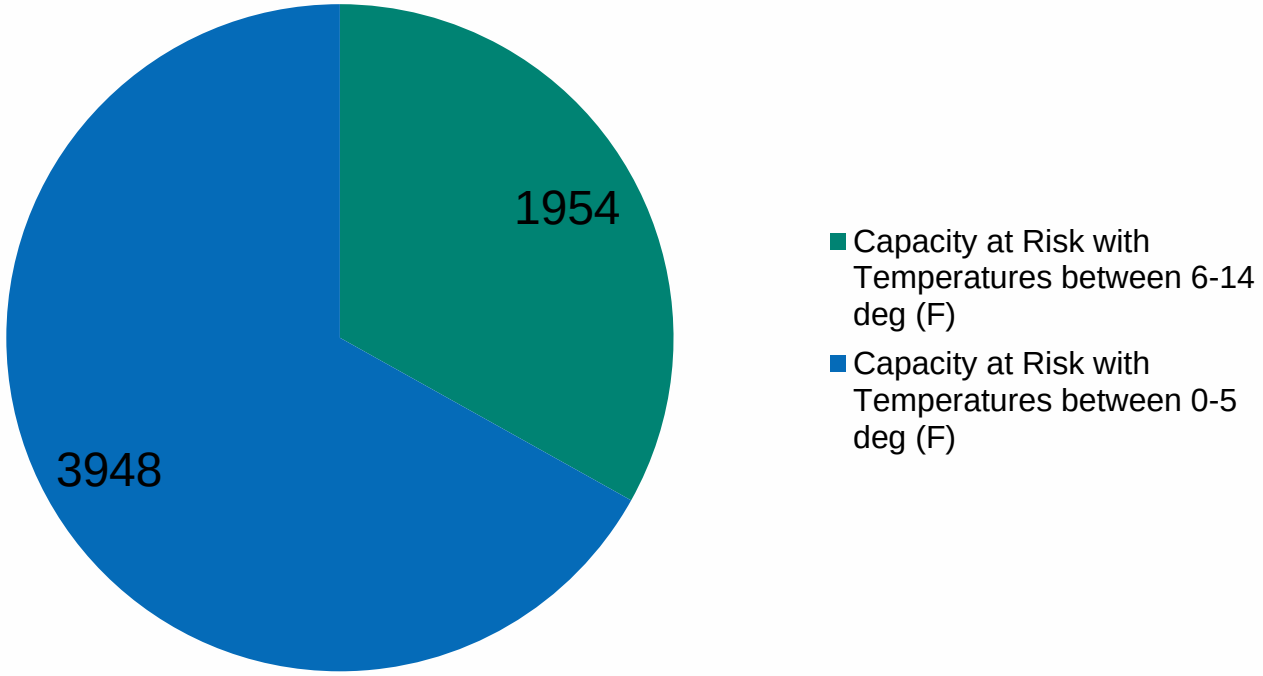
- Key to addressing Icing is to update the telemetry for number of turbines on and off.
- If the outage will last greater than 2 hours then enter into the outage scheduler.

**3.1.4.5 Notice of Forced Outage or Unavoidable Extension of Planned or Maintenance Outage Due to Unforeseen Events**
(2) Any Forced Outage that occurs in Real-Time must be entered into the Outage Scheduler if it is to remain an Outage for longer than two hours.

# RRGRR-0003

- Notice of request for information for wind-powered generation resources was issued in 2015
  - SITECODE
  - Resource Entity
  - Resource Name (Unit_Code_Mnemonic)
  - WGR GROUP_CODE
  - Turbine Manufacturer/Model
  - Maximum Operating Temperature (Fahrenheit (°F))
  - Minimum Operating Temperature(Fahrenheit (°F))
  - High Wind Speed Cut-Out (meters per seconds (m/s))
  - High Wind Speed Cut-Out time (minutes)
  - High Wind Speed Cut-Out Reset  (meters per seconds (m/s))
  - High Wind Speed Cut-Out Reset Time (minutes)

# ERCOT Wind Resources with Minimum Operating Temperatures > 0 deg F



# Weather Outlook

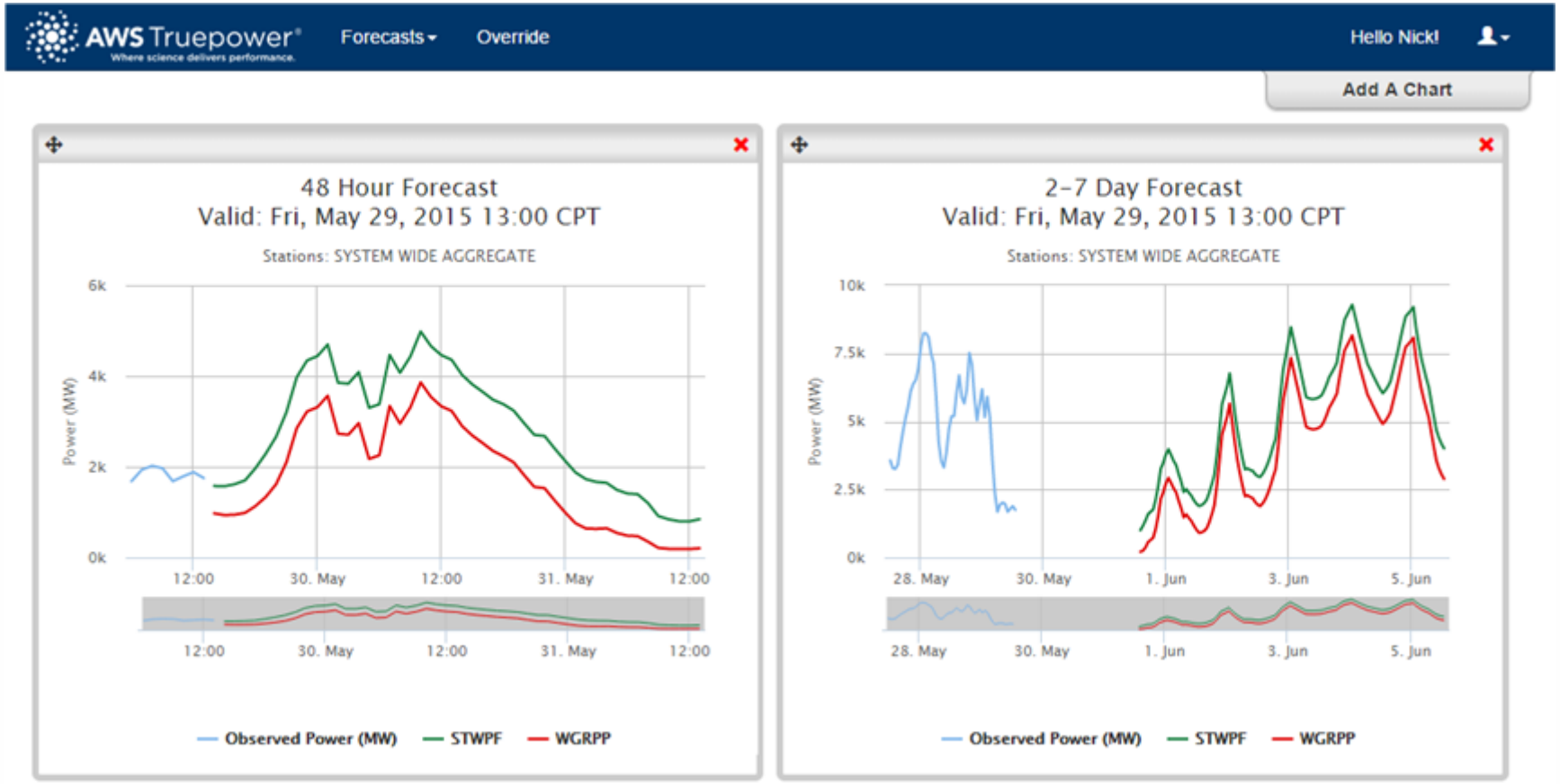
| North Central | *Normal* | Fri 1/9 | Sat 1/10 | Sun 1/11 | Mon 1/12 | Tue 1/13 | Wed 1/14 | Thu 1/15 |
|---|---|---|---|---|---|---|---|---|
| **Dallas-Fort Worth** | | | | | | | | |
| Low | *33* | 27 | 22 | 31 | 35 | 31 | 32 | 28 |
| High | *54* | 38 | 39 | 45 | 42 | 39 | 43 | 51 |
| **South Central** | | | | | | | | |
| **Austin** | | | | | | | | |
| Bergstrom Low | *38* | 37 | 29 | 31 | 36 | 35 | 32 | 28 |
| High | *61* | 39 | 36 | 49 | 52 | 41 | 47 | 56 |
| **San Antonio** | | | | | | | | |
| Low | *38* | 36 | 30 | 35 | 40 | 40 | 35 | 31 |
| High | *62* | 42 | 37 | 52 | 58 | 44 | 50 | 58 |
| **Coast** | | | | | | | | |
| **Houston** | | | | | | | | |
| Low | *41* | 38 | 34 | 38 | 46 | 41 | 38 | 34 |
| High | *62* | 40 | 41 | 52 | 58 | 48 | 49 | 58 |
| **East** | | | | | | | | |
| **Tyler** | | | | | | | | |
| Low | *32* | 29 | 23 | 32 | 37 | 33 | 30 | 29 |
| High | *54* | 38 | 38 | 40 | 47 | 39 | 42 | 50 |
| **North** | | | | | | | | |
| **Wichita Falls** | | | | | | | | |
| Low | *28* | 23 | 17 | 28 | 29 | 20 | 23 | 26 |
| High | *52* | 34 | 36 | 51 | 37 | 34 | 41 | 53 |
| **West** | | | | | | | | |
| **Abilene** | | | | | | | | |
| Low | *31* | 24 | 18 | 30 | 30 | 25 | 25 | 25 |
| High | *55* | 37 | 36 | 56 | 39 | 35 | 42 | 54 |
| **Far West** | | | | | | | | |
| **Midland** | | | | | | | | |
| Low | *29* | 23 | 20 | 29 | 31 | 25 | 22 | 27 |
| High | *57* | 36 | 37 | 59 | 41 | 35 | 44 | 54 |
| **Panhandle** | | | | | | | | |
| **Amarillo** | | | | | | | | |
| Low | *22* | 21 | 16 | 25 | 19 | 15 | 15 | 17 |
| High | *49* | 33 | 40 | 46 | 27 | 24 | 34 | 46 |
| **South** | | | | | | | | |
| **Brownsville** | | | | | | | | |
| Low | *50* | 43 | 38 | 38 | 46 | 51 | 46 | 39 |
| High | *69* | 53 | 42 | 56 | 64 | 59 | 55 | 61 |
| **Corpus Christi** | | | | | | | | |
| Low | *46* | 40 | 35 | 39 | 44 | 46 | 41 | 35 |
| High | *66* | 44 | 39 | 55 | 61 | 52 | 49 | 59 |

5°+ abv norm | 5°+ bel norm

Note: Normal values are 7-day averages for the location.

indicates hi/lo temp occuring at non-typical time

# Manual Override



# Preparation for Cold Weather: Wind Units Perspective

# Icing Impacts

**Wind Turbines in Cold Climates: Icing Impacts and Mitigation Systems, http://www.springer.com/us/book/9783319051901**

# Wind Units Failure in Cold Winter

## 1. Frigid Temperatures Exceeded Turbine Limits

- Wind turbines are typically designed to operate within ambient air temperatures of -15°C/-20°C (5F/-4F)
- Wind turbines have an automatic shutdown feature to protect components if that range is exceeded.

# Wind Units Failure in Cold Winter

**2. Blade Icing**

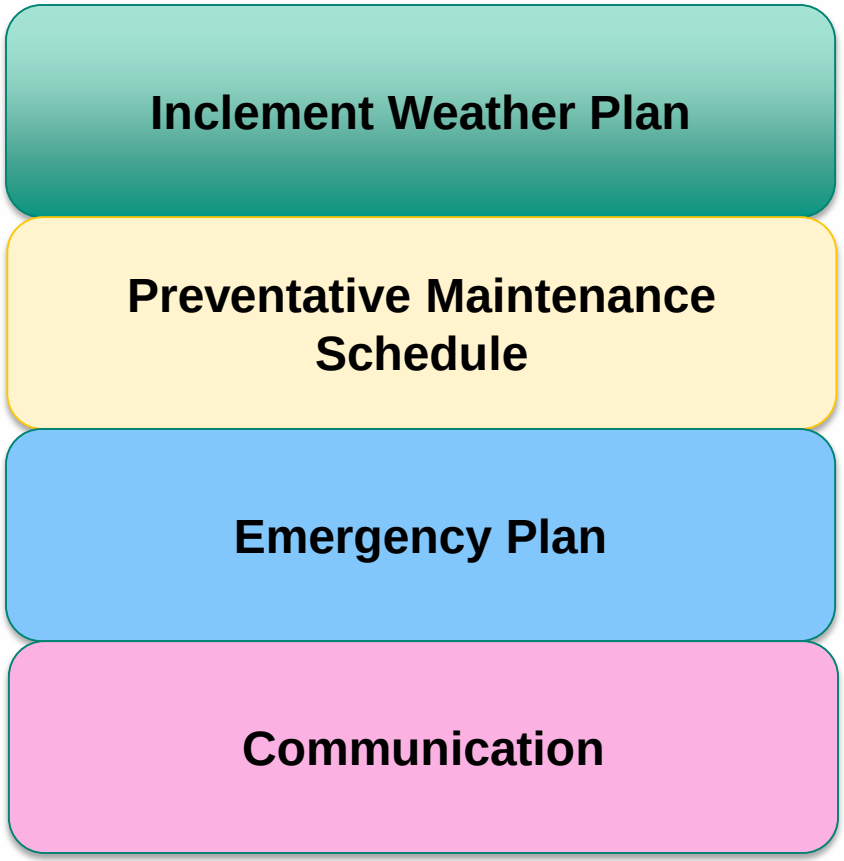
- **Icing on wind turbines affects three different aspects simultaneously**
  - the design (aerodynamics, load, control system, and material)
  - the safety (ice throw, unbalanced rotor spinning, over-power, and fatigue)
  - performance (annual energy output, wind measurements, and design life duration)

- **Other impacts**
  - wind sensors—rendering ineffective wind-measuring equipment
  - increase noise levels and generally decrease a turbine's cost-effectiveness.

# Blade Icing

# Safety

# Cold Weather Preparation



# Cold Weather Extreme Package for Wind Turbines

- It ensures that wind turbine operates in temperatures as low as -30C (-22F), and in survival mode without operation, at temperatures as low as -40C (-40F) (one example).

| | Minimum temperature (standard) operational / survival |
|---|---|
| Standard weather package | -15°C/-20°C (5F/-4F) |
| Cold weather package | -30 °C/-40 °C (-22F/-40F) |

- ERCOT is aware of at least one vendor that offers an extreme cold weather package. Resource Entities should check with their manufacturer.

# Cold Weather Packages

- “Cold Weather Packages” extend temperature ranges by heating components such as the nacelle space, yaw drive and pitch motors, and the gearbox, slip ring, controller and control cabinet, and battery.

- Heating could also prevent another insidious cause of turbine failure.
  - When a turbine is not running, oil that is stationary in radiator passages can quickly cool, and its viscosity can increase. Even if wind turbines are not being used, an important lesson worth learning is that the turbines should be cycled online to provide flow of cooling oil. All cooling equipment for radiators on wind turbines should also be disabled for cold weather events.

# Icing Prevention Technologies

Efforts have also been done in the area of icing prevention technologies. They can be classified in two categories: active and passive.

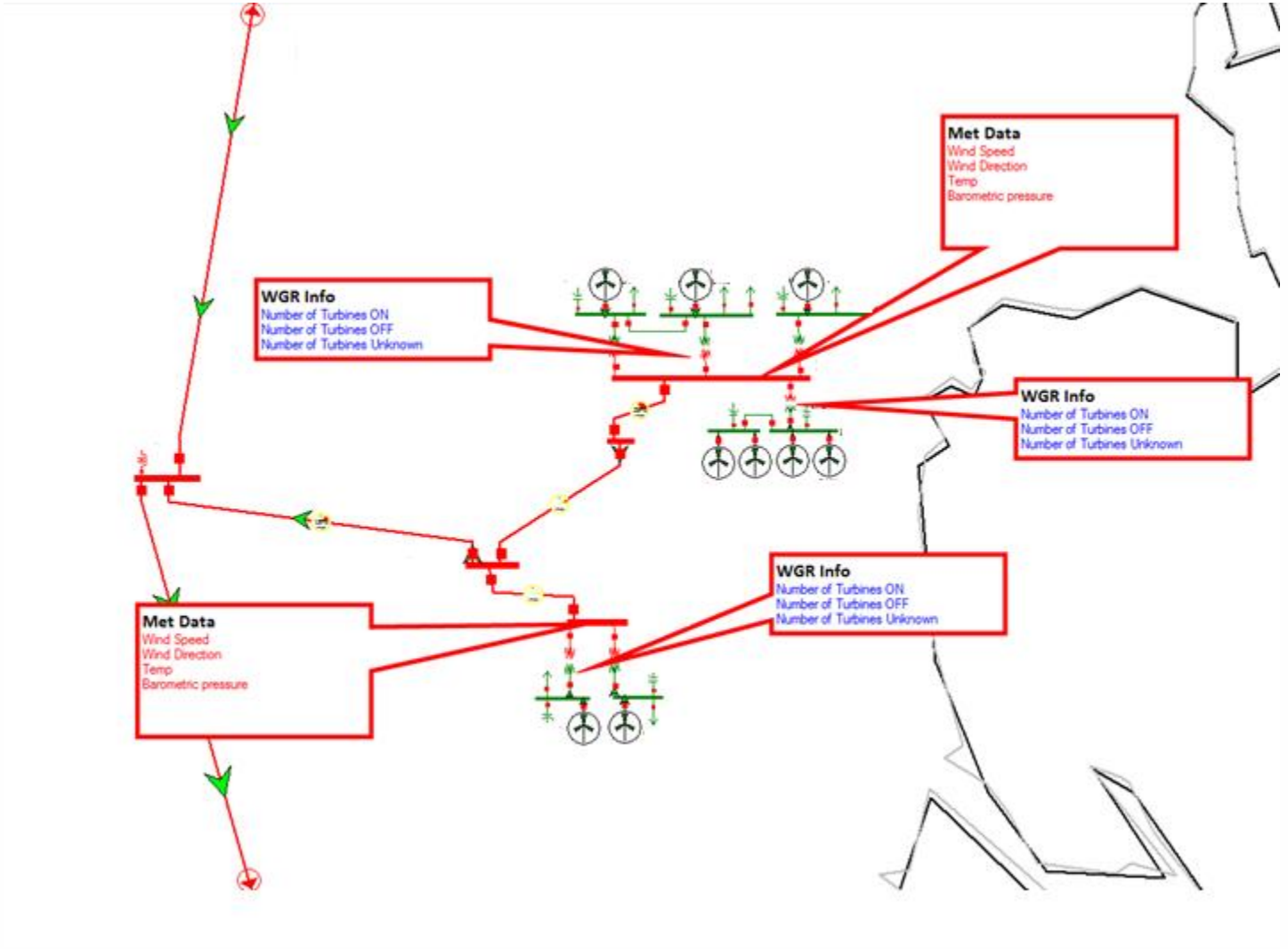
- Passive icing prevention methods
  - Rely on the physical properties of the blade surfaces to prevent ice accumulation.
  - An example of passive icing prevention is the application of an anti-adhesive coating on the blade such as teflon.
  - Another approach takes advantage of the heat absorbing capacity of dark colored surfaces and consists in the use of black coated blades.

# Icing Prevention Technologies

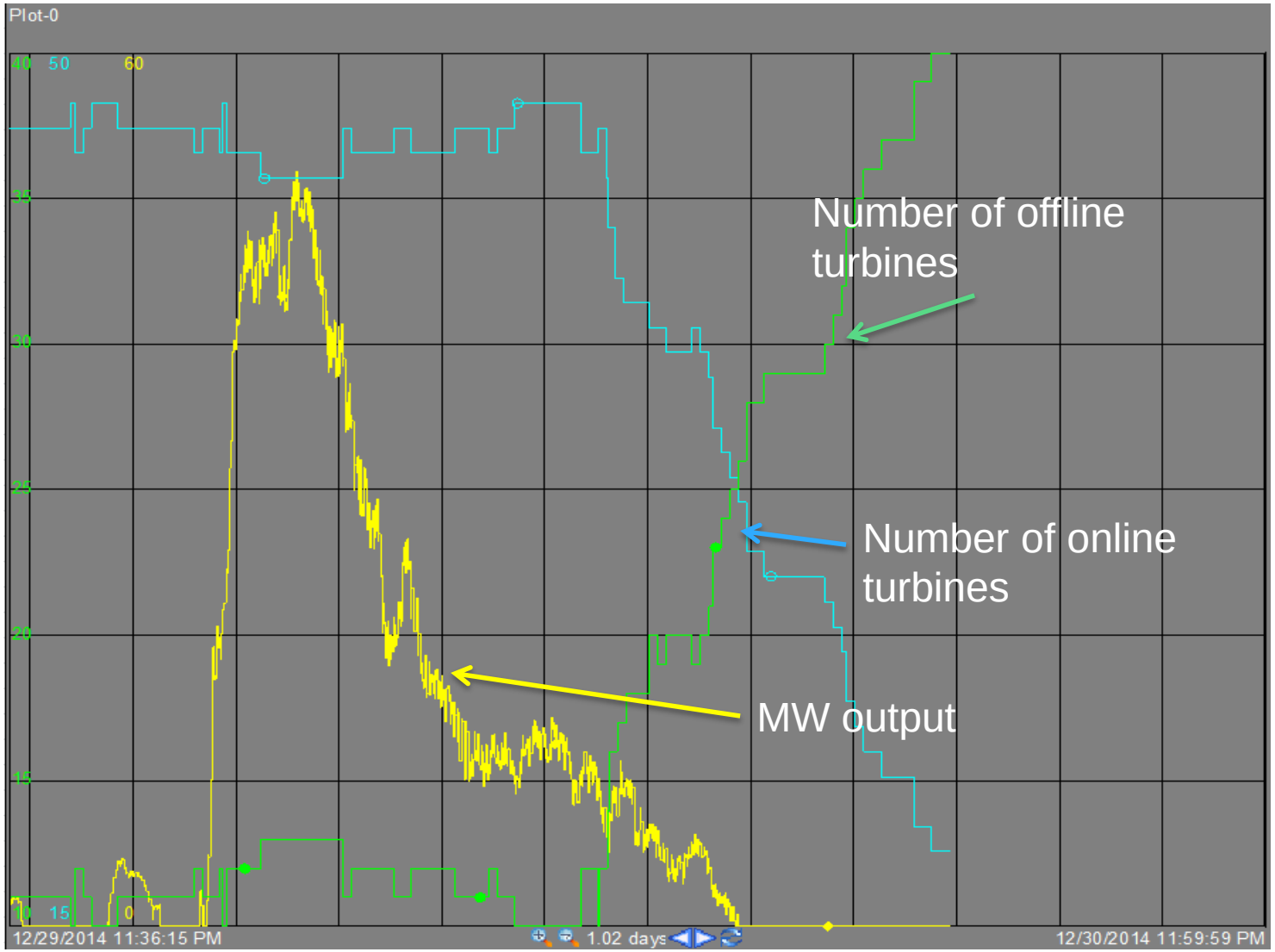
- Active de-icing methods
  - Consist of thermal, chemical and impulse de-icing
  - In thermal deicing, electrical elements, similar to the one found on the rear window of a car, can be used to warm and melt the ice accumulation off the blades.

In a comprehensive wind turbine icing prevention approach, **sensors** that could detect the build-up of ice on the rotor could be considered.

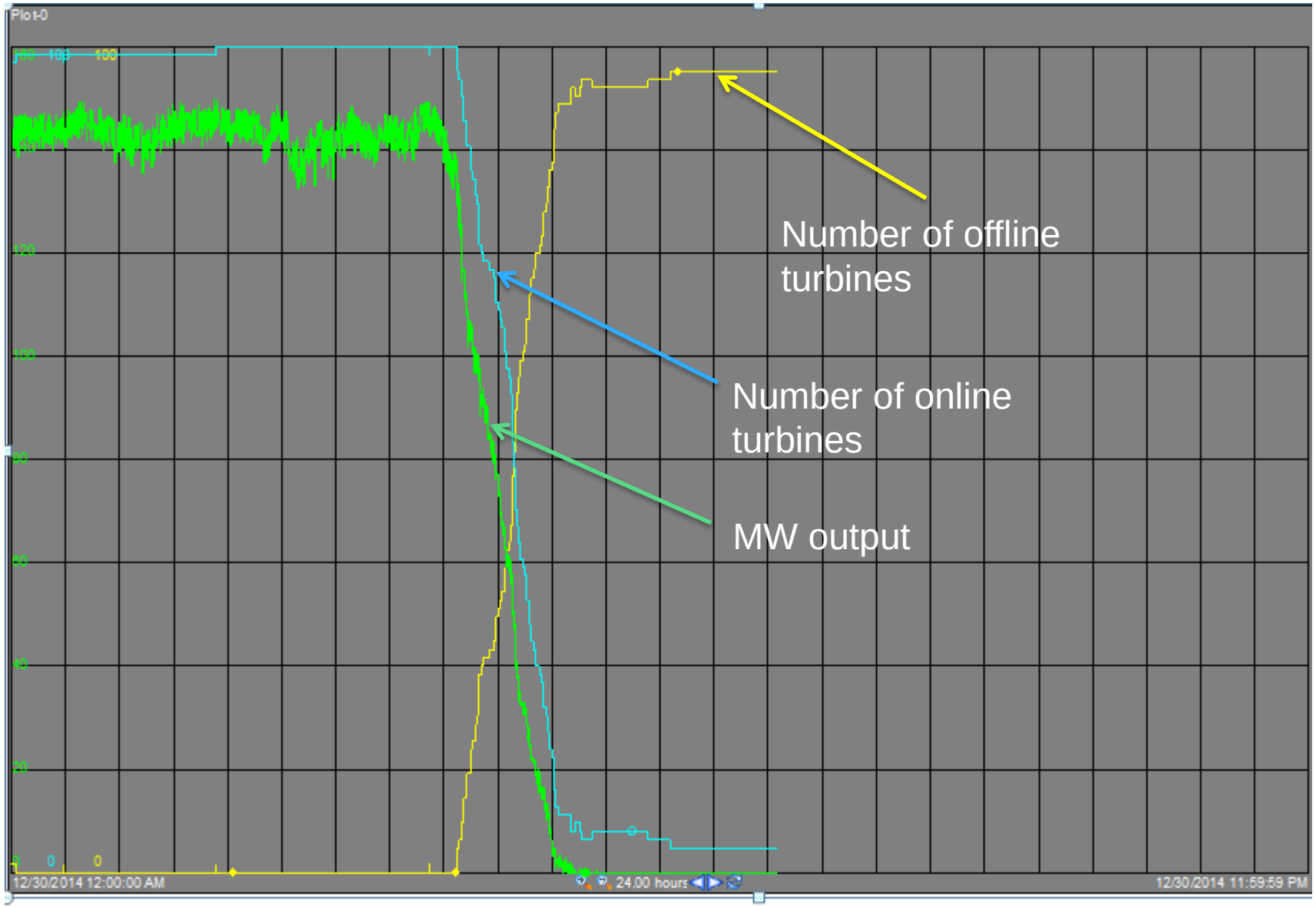
# Real-time Telemetered Data



# Delay in Updating Telemetered Data



# Correctly Updated Telemetered Data



# A list of Questions

- Do you have a plan to add cold-weather package in 2016/2017?
- Did you experience shut-down caused by icing in 2014 and 2015? For how long? How many individual wind turbines were impacted?
- What time did the turbines begin to shut down due to temperature or icing?
- What time were the turbines returned to normal operation? If the ambient temperature had an impact on the amount of time needed to bring the unit back on line, please explain why.
- Did Turbines loose protective systems such as Nacele based wind speed sensing which impacted turbines?
- Was the wind plant's High Sustainable Limit (HSL) and number of available turbines (provided via ICCP telemetry) updated in real-time to reflect the loss of wind turbines? If not, why not?
- When was the wind plant brought back to full capability? Please provide some examples for the resource capability (HSL) and the number of available turbines that was provided to the ERCOT ISO through the Current Operating Plan and ICCP telemetry (including any changes to the HSL) during the icing event.
- When was the ERCOT ISO notified during icing events?
- Please provide any additional information you feel would be beneficial for sharing of best practices or lessons learned
- Were there any protection system or MET tower misoperations? Please include details about any Reactive or auxiliary equipment including Automatic Voltage Regulators and MET tower if they were not functional during the icing events.

# Lessons Learned

- Preventative measures can reduce the likelihood and impact of wind units failure due to inclement weather
- To have real-time telemetered data and COP correctly and timely updated from QSEs is critical for ERCOT to handle inclement weather
- Coordinated communication between site personnel, QSEs, wind forecast vendor and control room is the key to respond to inclement weather

# Questions?

# Wind Generator Winter Preparation in the ERCOT Region

**Allen D. Schriver**
**General Manager Compliance**

**Pete Whittier**
**Wind Site Manager**

**Kevin McWhorter**
**Fleet Performance & Diagnostic Center Leader**

**11/11/2015**

Proprietary & Confidential Information

# Agenda

- Purpose and Introduction
- Procedures specific to wind turbine technology
- Remote Wind Farm Operating Center
- Questions



NEXTera® ENERGY RESOURCES

# NextEra Energy Resources Wind Generator Winter Preparation in the ERCOT Region

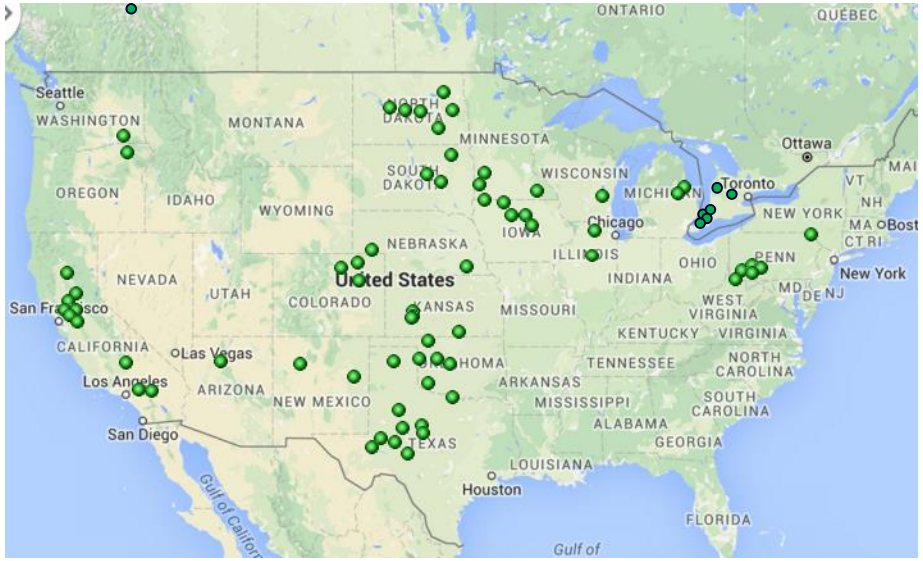
## Purpose of Presentation

- To discuss typical winter preparation actions specific to wind turbine generators
- Some actions only apply to certain turbine technologies, however, turbine models will not be specified
- Some preparation actions that apply to any generating unit will not be discussed, including high voltage equipment
- The preparations discussed here are not all inclusive

# NextEra Energy Resources Wind Generator Winter Preparation in the ERCOT Region

## NextEra Energy Resources – Wind Generation

- One of the worlds largest generators of wind power
- More than 100 wind farms in 19 states and Canada
- Nearly 11,300 net MW
- In ERCOT, over 20 wind farms with nearly 3,600 net MW



# NextEra Energy Resources Wind Generator Winter Preparation in the ERCOT Region

## Procedures specific to wind turbine technology

- **In general winter prep includes**
  - Reliability checks of
    - -- Heaters
    - -- Thermostats
    - -- Pumps
    - -- Cooling fans, including direction of rotation
- **Check radiator fins for obstruction and cleaning**
- **Torque coolant hose clamps**
- **Verify coolant pressure/level and add coolant if required**
- **Check vent covers and filters and replacement if needed**



NEXTera® ENERGY RESOURCES

# NextEra Energy Resources Wind Generator Winter Preparation in the ERCOT Region

## Procedures specific to wind turbine technology (continued)

- Check cabinet doors and verify they close and latch correctly
- Verify no openings in junction boxes that could let ice and snow in
- Check thermostat set points
- Verify heaters turn on/off correctly
- Check that temperature sensors are located correctly
- Check security of relays and make sure electrical connections are tight
- Check dampers and diverters



NEXTera® ENERGY RESOURCES

# NextEra Energy Resources Wind Generator Winter Preparation in the ERCOT Region

## Procedures specific to wind turbine technology (continued)

- Inspect control circuit cards and wiring
- Verify applicable retrofits for winterization have been performed
- Verify additional thermostats and heating blankets
- Verify hatch to first deck is closed

# NextEra Energy Resources Wind Generator Winter Preparation in the ERCOT Region

## Remote Wind Farm Operating Center

- Use of models based on weather to predict operations workload and adjust staffing levels
- Use of models to predict blade icing and loss of power so de-rates can be accurately reported
- Use of weather services to predict which sites will have icing or cold temperature issues, and require close monitoring

# Questions?

November 11, 2015

# Wind Generation Facility Winter Preparations and Communications

Mitchell G. Kerley
Keechi Wind, LLC Site Supervisor
Enbridge Green Power and Transmission

ENBRIDGE

# Green Power and Transmission

Enbridge Green Power and Transmission operates power generation and transmission assets through out north America.

Installed Generation Capacity

- Enbridge has a combined total of 2.2 GWh' s of combined owned and operated renewable assets.

Installed Transmission Capacity

- Enbridge GP&T has a total of 300 MW owned transmission capacity.



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# Enbridge Green Power and Transmission Generating Facilities

- Keechi Wind, LLC
  - Jacksboro Texas – 55 Vestas V100 2.0 MW turbines – 110 MW nameplate capacity
- Magic Valley
  - Harlingen, TX – 112 Vestas V100 1.815 MW turbines – 203.3 MW nameplate capacity (162.6 MW owned)
- Cedar Point Wind, LLC
  - Limon, Co – 139 Vestas V90 1.815 MW turbines – 252.3 MW nameplate capacity
- Chin Chute
  - Taber, AB – 20 General Electric 1.5 MW turbines – 30 MW nameplate capacity (9.9 MW owned)
- Greenwich
  - Dorion, ON – 43 Siemens SWT-101 2.3 MW turbines – 98.9 MW nameplate capacity
- Blackspring Ridge
  - Carmangay, AB – 166 Vestas V100 1.815 MW – 301.3 MW name plate capacity
- Magrath
  - Magrath, AB – 20 General Electric 1.5 MW – 30 MW name place capacity (9.9 MW owned)



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# Enbridge Green Power and Transmission Generating Facilities

- Massif Du Sud
  - Buckland, QC – 75 Repower MM 82/92 2.05 MW turbines – 123 MW nameplate capacity
- Ontario Wind
  - Tiverton, ON – 115 Vestas V82 1.65 MW turbines – 189.9 MW nameplate capacity
- Saint Robert Bellarmin
  - Saint-Robert-Bellarim – 40 MM92 2.05 MW wind turbines – 41.0 MW nameplate capacity
- Sunbridge
  - Gull Lake, SK – 17 Vestas V47 .66 MW turbines – 5.6 MW name plate capacity
- Talbot
  - Ridgetown, ON – 43 Siemens SWT 101 2.3 MW turbines – 98.9 MW name plate capacity
- Sarina Solar
  - Sarina, ON – 1300 K - First Solar PV 75W – 80 MW nameplate capacity
- Silver State North
  - Primm, NV – 810K First Solar PV 85W – 52 MW nameplate capacity

# Site Operations during inclement weather Conditions

**Preparing for inclement weather operations**

- Emergency Response Plan (ERP)
  - Site access during hazardous weather conditions

    The use of day-ahead and five day-ahead forecasting tools develop safe action plans. The plans would be for scheduled work, faulted turbines, and response to site emergencies regarding the collection system, substation and transmission lines.
- Remote Access to Site
  - Edmonton Control Center (ECC)

    Provides remote updates to site personnel regarding any collection system, substation, or transmission line alarms/outages
  - Vestas Americas

    Vestas site leaders will provide remote monitoring and updates to Keechi personnel on a normal interval for turbines that are off-line or cannot be brought back online due to limited site access.

**Communicating to and from Site, QSE, and ERCOT**

- Communications
  - Keechi Wind, LLC

    Keechi site supervisor will provide updates to our QSE of unexpected production changes +- 10% of the total name plate capacity of Keechi. The updates are based on faulted turbines that can not be returned to service.
  - QSE

    Any outages at the interconnect, loss of communications, and transmission line issues will be communicated directly to the appropriate Keechi personnel.

    Any changes the effect the grid as relayed by ERCOT will be relayed to Keechi personnel as appropriate.



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# Experiences and Observations

**Weather related challenges to wind generation**

- Technology Limitations: Not all turbines operate/react the same to inclement weather
  - Vestas – V80/100 – The Vestas technology has a tendency to stay on longer than some other technologies during icing events. The technology also comes back on line fairly easy when it has icing issues.
  - GE – 1.5 ESS – More challenging in my experience during icing, and freezing fog storms. In addition, when the turbine faults the temperature generally needs to get above freezing level at hub height before they start to come back on line.
  - Siemens - 2.3MKII – These turbines in my experience will either fault out due to frozen anemometers or blade imbalance caused by ice build up. In addition, once they shut down, if left for a long time, it is difficult to get the IO boards heated to the right temperature in the converter cabinet to come back on line.

**Lessons Learned**

- Solutions
  - Technical solutions
    - Anemometers - Heated and ultrasonic anemometers have in the past reduced the down time due to some icing events, but not all of them. The frozen fog can over come these if the storm duration is excessive with extremely low temperatures
    - Hub Access Doors/Hub Heaters– The GE hub has access doors that may have fallen off during normal operation resulting in colder then normal temperatures causing the IO boards to not operate correctly. These should be replaced to help minimize the temperature impacts. In addition the hub heaters at times will not work or be placed in a non-operational mode during hotter months. These need to be tested and placed in the operational position prior to winter operations.
    - Liquid Cooled Converter systems - The converters that are liquid cooled or heated need to be serviced regularly, ensuring proper coolant/mixture levels to provide optimal cooling/heating.



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# Observations from WGR spot checks

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2015 ERCOT and Texas RE Wind Generation and Winter Preparation Webinar
November 11, 2015

# PUCT PROJECT NO. 39160

## §25.53. Electric Service Emergency Operations Plans

- (2) An electric utility that operates an electric generation facility or a PGC shall include in its emergency operations plan for its generation facilities, but is not limited to, the following:
  - (A) A plan that addresses severely cold weather and severely hot weather.
  - (B) A plan that addresses any known critical failure points, including any effects of weather design limits.
  - (E) A plan for the inventory of pre-arranged supplies for emergencies.
  - (F) A plan that addresses staffing during severe weather events.

# Declaration of Completion of Generation Resource Weatherization Preparations (Winter)

*Nodal Protocol 3.20 (3)*

- ***No earlier than November 1 and no later than December 1 of each year***, each Resource Entity shall submit the declaration Section 22, Attachment K, Declaration of Completion of Generation Resource Weatherization Preparations, to ERCOT stating that, at the time of submission, each Generation Resource under the Resource Entity's control has completed or will complete all weather preparations required by the weatherization plan for equipment critical to the reliable operation of the Generation Resource during the winter time period (December through February).
- ***If the work on the equipment that is critical to the reliable operation of the Generation Resource is not complete at the time of filing the declaration, the Resource Entity shall provide a list and schedule of remaining work to be completed.***
- The declaration shall be executed by an officer or executive with authority to bind the Resource Entity.

✓ Submit declaration to: eop@ercot.com

*Nodal Protocol 3.20 (5)*

✓ ***On or before January 15 each year, ERCOT shall report to the Public Utility Commission of Texas (PUCT) the names of Resource Entities failing to provide the declaration required by paragraph (3).***

# What does a spot check entail?

- Objective is to build a working relationship with generators operators so that they are comfortable sharing information and are receptive to recommendations.
- Lessons learned from previous winter, observations, best practices and NERC lessons learned are all shared at each site.
- Generators are spot checked that they are following their weatherization plan.
- The spot check is NOT a comprehensive review of all plant equipment.
- ***ERCOT does not certify a generator is prepared for winter operations.***
- Every plant is left with recommendations to improve reliability.

## Criteria for selection of spot checks

- ✓ New generator resources commissioned start by December 1.
- ✓ Generator resources that experienced freezing equipment from previous winter.
- ✓ Generators that notified ERCOT improvements were planned from previous winter.
- ✓ Randomly selected generators, including black start or next start resources.

# Comparing Feb 2, 2011 to Jan 6, 2014

8000MW of capacity tripped, failed to start or derated that was freeze related.

ERCOT declared EEA3 – 4000MW firm load shed

**February 2, 2011**

**Dallas**: 13° (20MPH wind)
**Houston**: 21°(16MPH wind)
**San Antonio**: 19° (25MPH wind)
**Austin**: 18° (26MPH wind)
**Brownsville**: 32° (26MPH wind)
**Abilene**: 7° (16MPH wind)
**Midland**: 6° (16MPH wind)

3541MW of capacity tripped that was freeze related.

ERCOT declared EEA2

**January 6, 2014**

**Dallas**: 15° (9MPH wind)
**Houston**: 27°(16MPH wind)
**San Antonio**: 27° (15MPH wind)
**Austin**: 20° (13MPH wind)
**Brownsville**: 37° (17MPH wind)
**Abilene**: 11° (5MPH wind)
**Midland**: 14° (12MPH wind)

Weather Source: Chris Coleman, ERCOT

# Comparing Jan 6, 2014 to Jan 8, 2015

3541MW of capacity tripped that was freeze related.

ERCOT declared EEA2

**January 6, 2014**

**Dallas**: 15° (9MPH wind)
**Houston**: 27°(16MPH wind)
**San Antonio**: 27° (15MPH wind)
**Austin**: 20° (13MPH wind)
**Brownsville**: 37° (17MPH wind)
**Abilene**: 11° (5MPH wind)
**Midland**: 14° (12MPH wind)

750 MW of capacity tripped that was freeze related.

Normal Operations in ERCOT

**January 8, 2015**

**Dallas**: 16° (5MPH wind)
**Houston**: 28°(6MPH wind)
**San Antonio**: 28° (8MPH wind)
**Austin**: 21° (7MPH wind)
**Brownsville**: 39° (16MPH wind)
**Abilene**: 16° (8MPH wind)
**Midland**: 20° (7MPH wind)

Weather Source: Chris Coleman, ERCOT

# Observations from WGR spot checks

Seven WGR plants spot checked to date

- One plant does not have cold weather package on turbines
  - Communication to QSE for reporting to ERCOT shows need for improvement
    - Temperature is forecasted to be at automatic shutoff of 14 DegF for turbines
    - Icing conditions are forecasted or begin to affect turbines
    - Training for plant staff during cold weather

- Six plants have cold weather packages on turbines
  - Potential source for cold weather package is supplied from generator when on line
  - Situational awareness for monitoring units auxiliary equipment operating temperatures during cold weather
  - Communication to QSE for reporting to ERCOT when icing is forecasted or occurring

# Spot check common recommendations to WGR

- Add winter weather supply inventory to cold weather procedure
- Add winter weather safety training to cold weather procedure
- Improve communications to QSE so the QSE can report to ERCOT
  - When icing is forecasted or begins to form
  - When automatic temperature shutoff is forecasted
  - When automatic temperature shutoff begins to occur

# Lessons Learned and Training

- http://www.nerc.com/pa/rrm/ea/Pages/February-2011-Southwest-Cold-Weather-Event.aspx#
  - Lessons learned (13)
    - Wind Farm Storm Issues
    - Plant Operator Training to Prepare for a Winter Weather Event
    - Transformer Oil Level Issues During Cold Weather
      - During a winter event, over half of a wind farm facility (approximately 100 MW) could not generate after a substation transformer tripped due to low oil level.
      - Before winter, equipment which may be affected by cold temperatures should be checked to ensure the facility can continue to operate at those temperatures
      - Transformers and other equipment oil levels should be checked periodically to ensure they are at the proper level
  - Previous Cold Weather Event Analysis
  - Southwest Cold Weather Event
  - Webinars and Information (2)
  - Cold Weather Training Materials
    - Reliability Guideline: Generating Unit Winter Weather Readiness
    - FERC NERC Findings and Recommendations

# Questions?