



# ERCOT

METROPOLITAN BREAKFAST CLUB  
NOVEMBER 9, 2011

Trip Doggett  
President & CEO  
ERCOT

# CONTENT

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- **Overview of ERCOT**
  - History
  - ERCOT as a North American Electric Reliability Corporation (NERC) interconnect
  - ERCOT as an Independent System Operator
  - “Old” World vs. “New” World
- **ERCOT Major Roles**
  - Grid Operations
  - Capacity Planning
  - Market Operations
- **Growth of Wind Generation**
- **Future**
  - Advanced Metering and Demand Response

# HISTORY – ACT 1

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- **ERCOT stands for The Electric Reliability Council of Texas, Inc.**
- **1941 – Utilities Band Together to Aid War Effort**
  - At the beginning of World War II, several electric utilities in Texas banded together as the Texas Interconnected System (TIS) to support the war effort. They sent their excess power generation to industrial manufacturing companies on the Gulf Coast to provide reliable supplies of electricity for energy-intensive aluminum smelting.
  - Recognizing the reliability advantages of remaining interconnected, the TIS members continued to use and develop the interconnected grid and established two monitoring centers, one in North Texas and one in South Texas.
- **1970 – TIS Forms ERCOT to Comply with North American Electric Reliability Requirements**
  - ERCOT was staffed by two retired employees from utilities.
- **1981 – ERCOT Assumes Central Operating Coordinator Role**
  - TIS members transferred all operating functions to ERCOT, and ERCOT became the central operating coordinator for Texas. ERCOT opened its first office in 1986 and hired four full-time employees.

## HISTORY – ACT 2

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- **1995 – Texas Legislature Votes to Deregulate Wholesale Generation**
  - The Texas Legislature amended the Public Utility Regulatory Act to deregulate the wholesale generation market. The Public Utility Commission of Texas (PUCT) began the process of expanding ERCOT's responsibilities to enable wholesale competition and facilitate efficient use of the power grid by all market participants.
- **1996 – ERCOT Becomes First ISO in US**
  - On August 21, 1996, ERCOT became the first Independent System Operator (ISO) in the US. Their job was to ensure an impartial, third-party organization was overseeing equitable access to the power grid among the competitive market participants.

## HISTORY – ACT 3

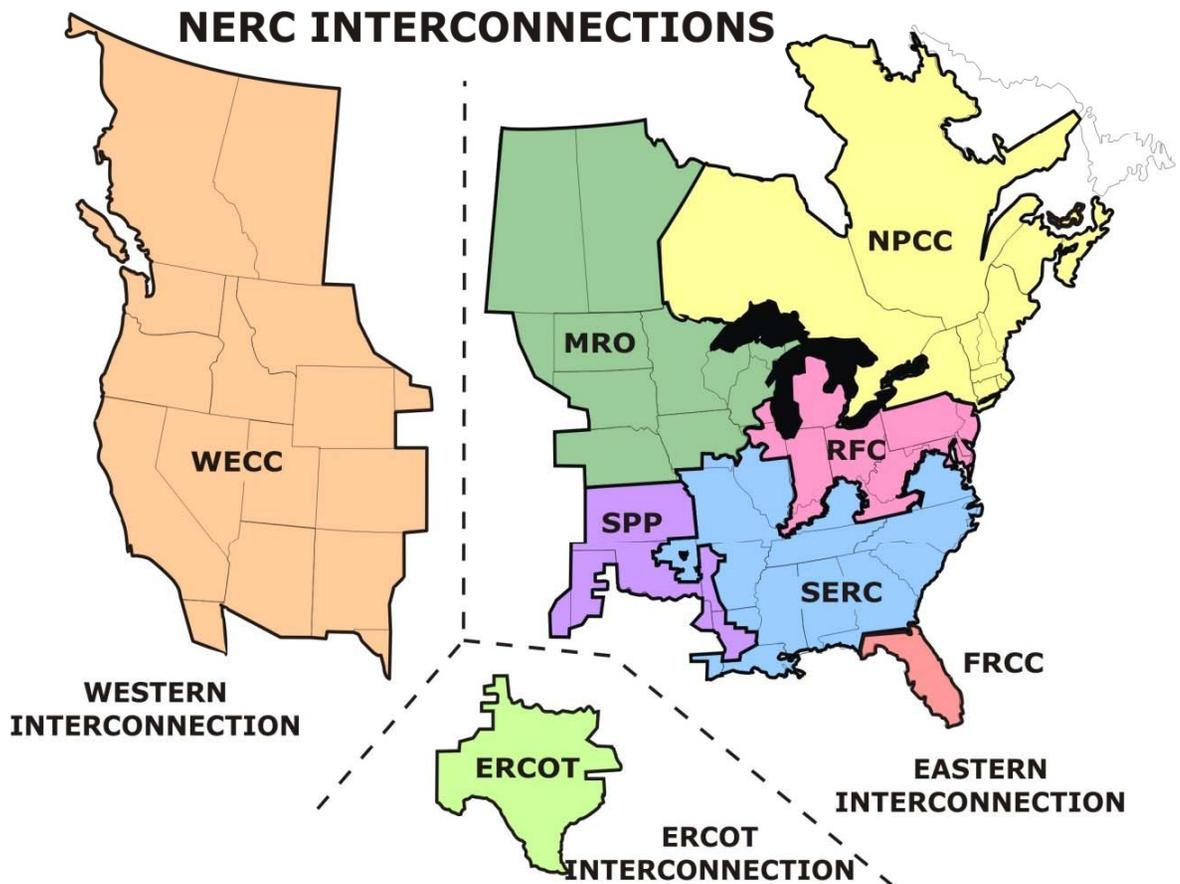
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- **1999 – Legislature Votes to Deregulate Retail Electric Market**
- **2001 – Ten Control Centers Merged into One Control Center**
  - On July 31, 2001, the existing 10 control areas in the ERCOT region were consolidated into a single control area.
- **2002 – Retail Electric Market Opens, Enabling Customer Choice for 6.1 Million**
- **2010 – ERCOT implements Nodal Markets**
- **2011 – ERCOT has over 600 employees and an annual budget of over \$170M**

# NORTH AMERICAN INTERCONNECTED GRIDS

**ERCOT 'directs traffic' on the grid to maintain reliability and ensure supply of electricity:**

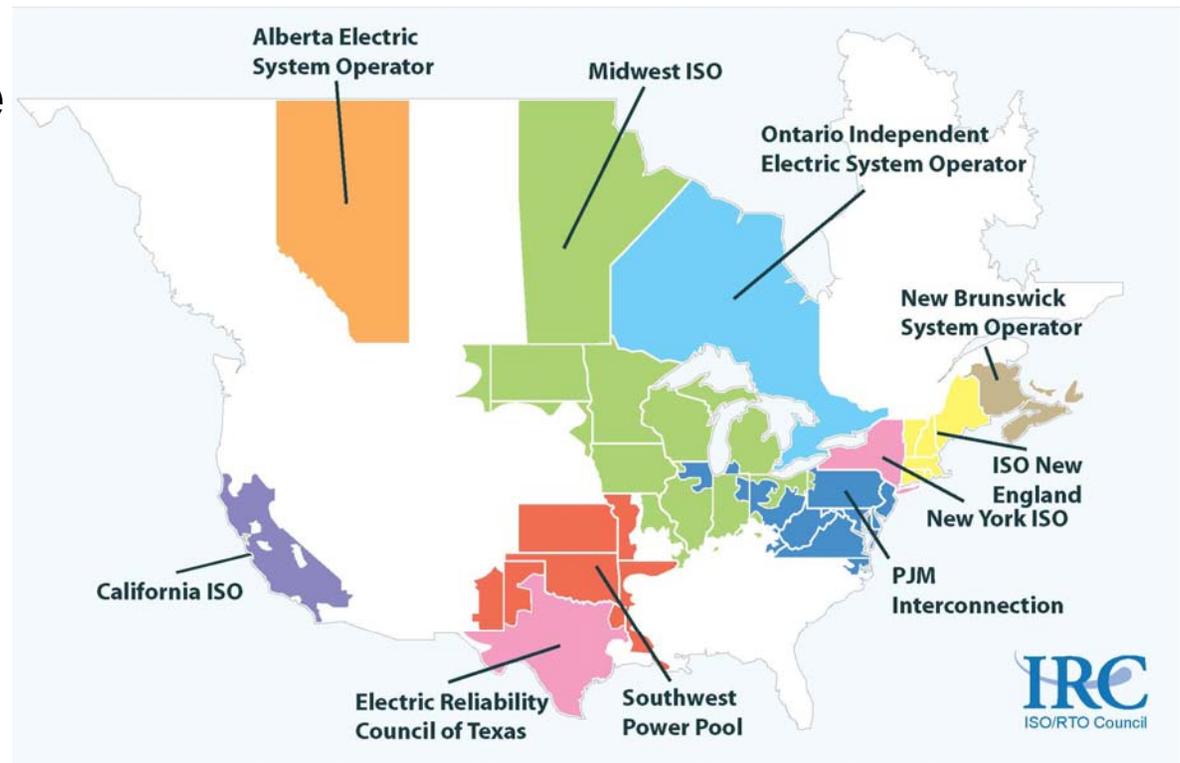
- 75% of Texas land
- 85% of Texas load
- More than 40,000 miles of transmission lines
- 550+ generation units
- Physical assets that are owned by transmission providers and generators
- 68,379 MW Summer peak demand (set August 3, 2011)
- 57,315 MW Winter peak demand (set February 10, 2011)



# ERCOT AS INDEPENDENT SYSTEM OPERATOR

## ❖ ERCOT IS ONE OF 10 NORTH AMERICAN ISOs/RTOs

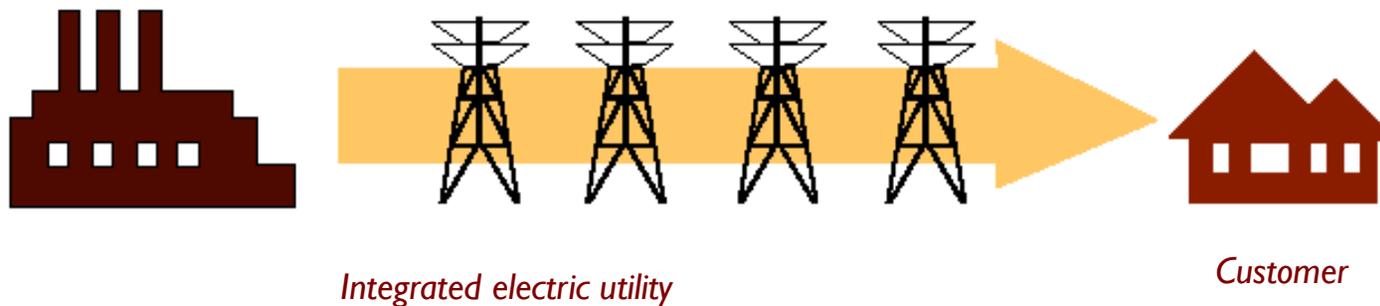
- ISOs/RTOs serve 67% of U.S. population
- Goal: Reliability, Efficiency, Transparency & Impartiality



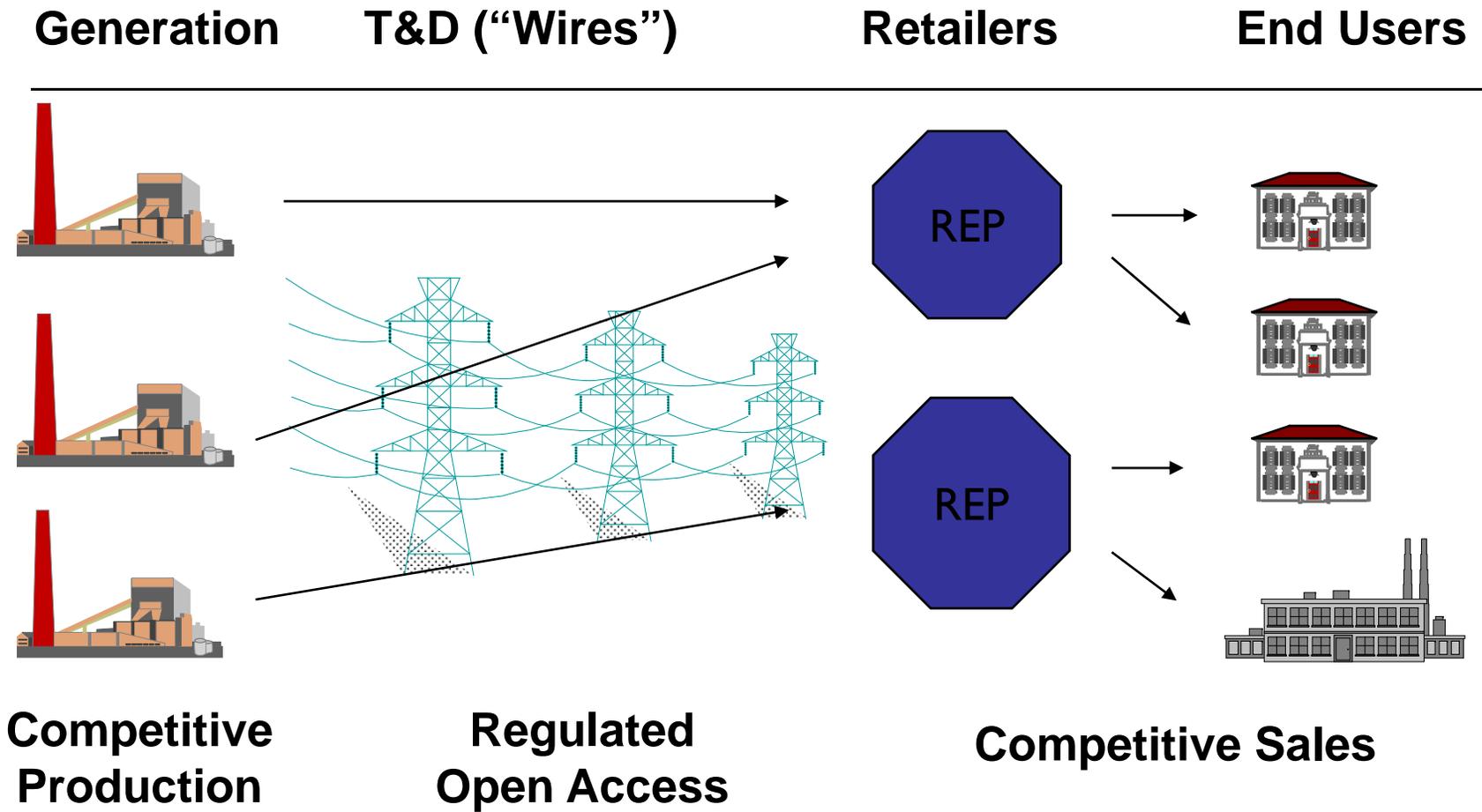
## THE OLD WORLD: PRE-2002

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**Each utility was vertically integrated, from generation to customer service.**



# THE NEW WORLD: TEXAS COMPETITIVE MODEL



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# **ERCOT ROLES: GRID OPERATIONS**

# ELECTRIC GRID OPERATIONS

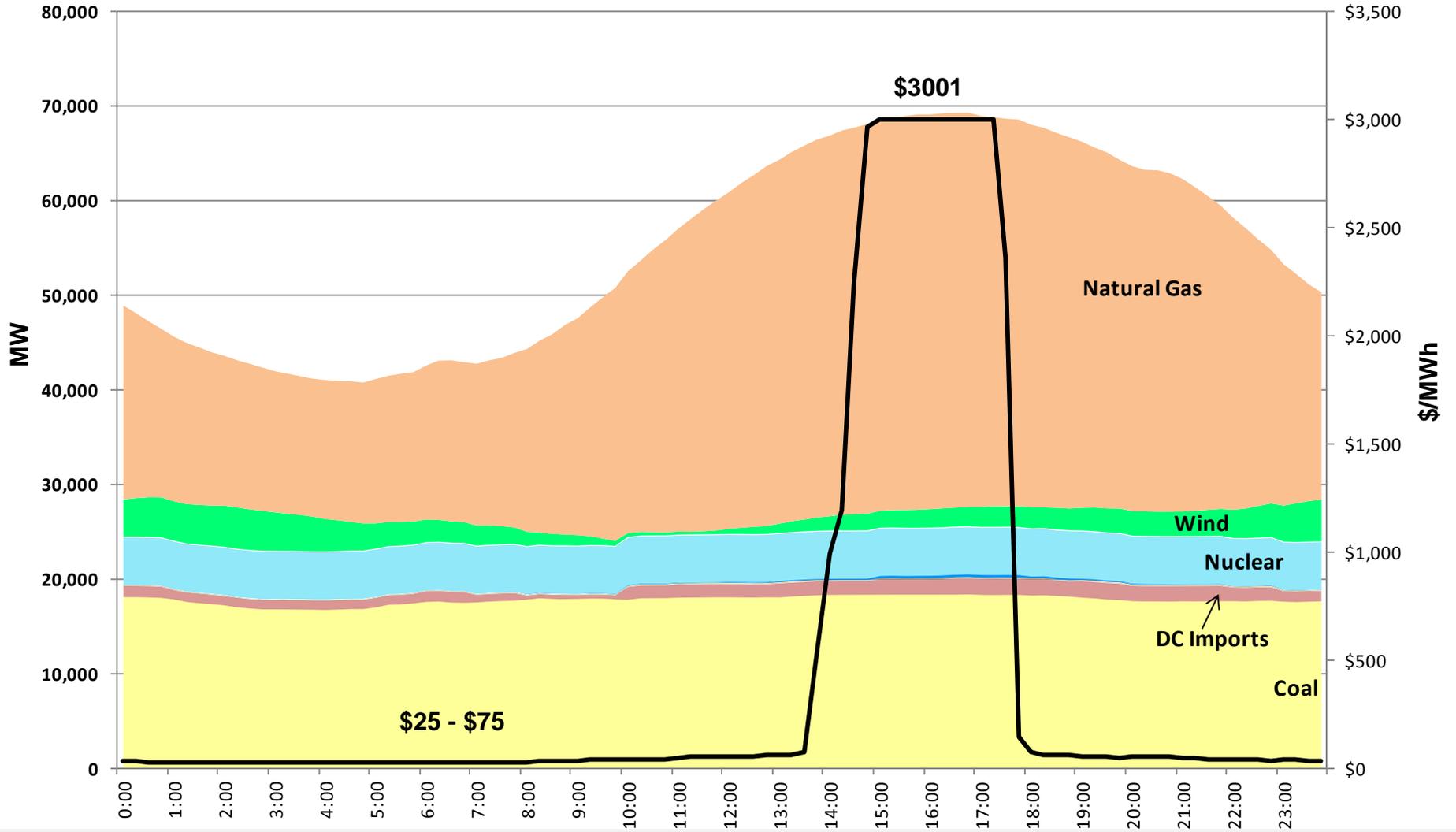
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- ❖ **ERCOT ‘directs traffic’ on the grid to maintain reliability and ensure supply of electricity:**
  - Coordinates scheduling of power by market participants
  - Analyzes grid conditions continuously in real-time
  - Dispatches generation to ensure power production matches load at all times
    - *Balancing Energy Service*
    - *Load Frequency Control*
  - Secures available generation capacity to meet reliability requirements including contingencies
  - Coordinates planned outages of generators and transmission lines
  - Relieves transmission system congestion
  - Coordinates emergency actions & recovery
  - Operates markets to meet regional energy & capacity requirements not met through bilateral arrangements

# SUMMER PEAK DAY LOAD SHAPE WITH FUEL MIX

August 3, 2011

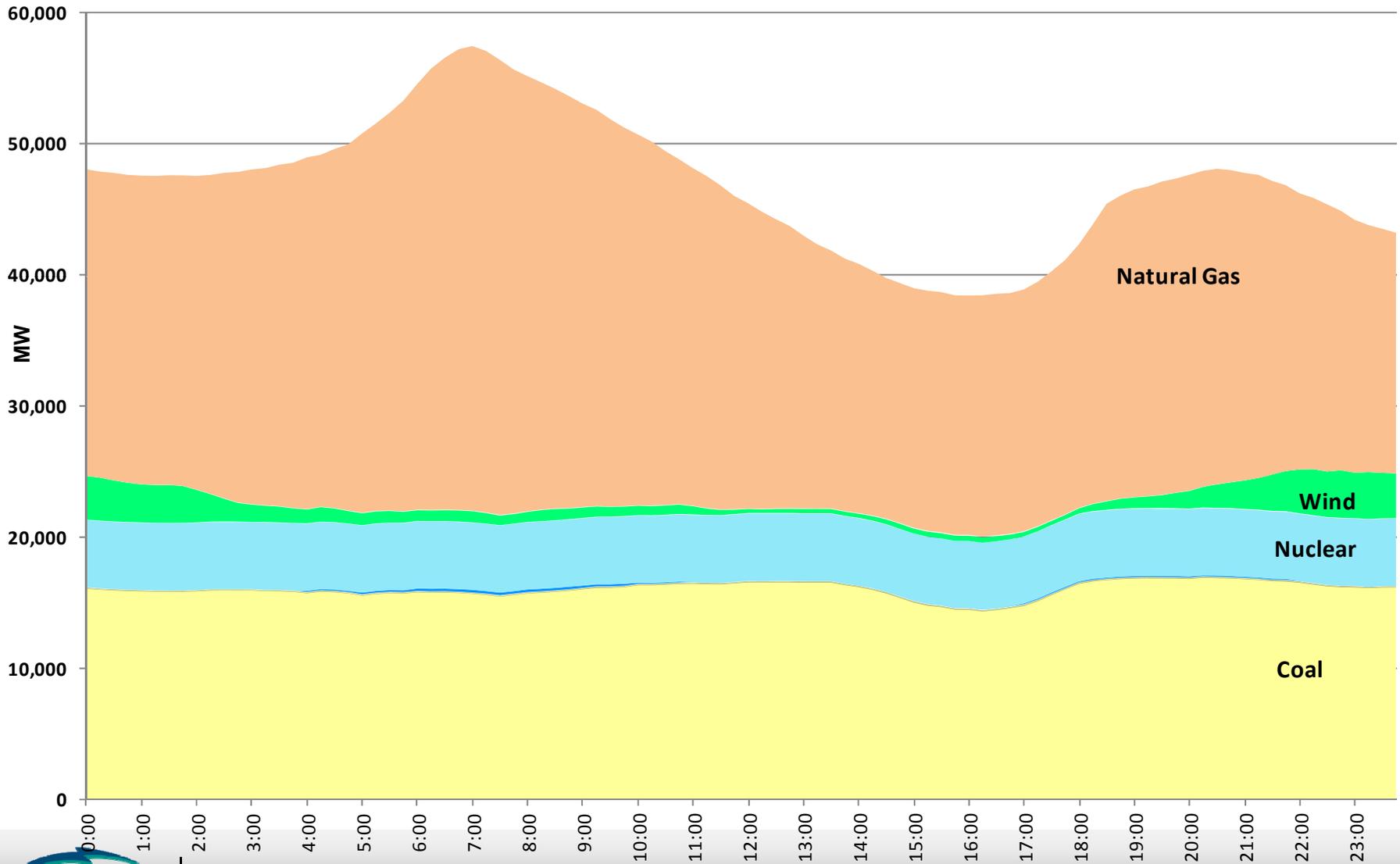
■ Natural Gas    ■ Wind    ■ Nuclear    ■ Hydro  
■ Other    ■ DC Imports    ■ Coal    — Energy Price



# WINTER PEAK DAY LOAD SHAPE WITH FUEL MIX

February 10, 2011

Natural Gas Wind Nuclear Hydro Other Coal



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# ERCOT ROLES: CAPACITY PLANNING

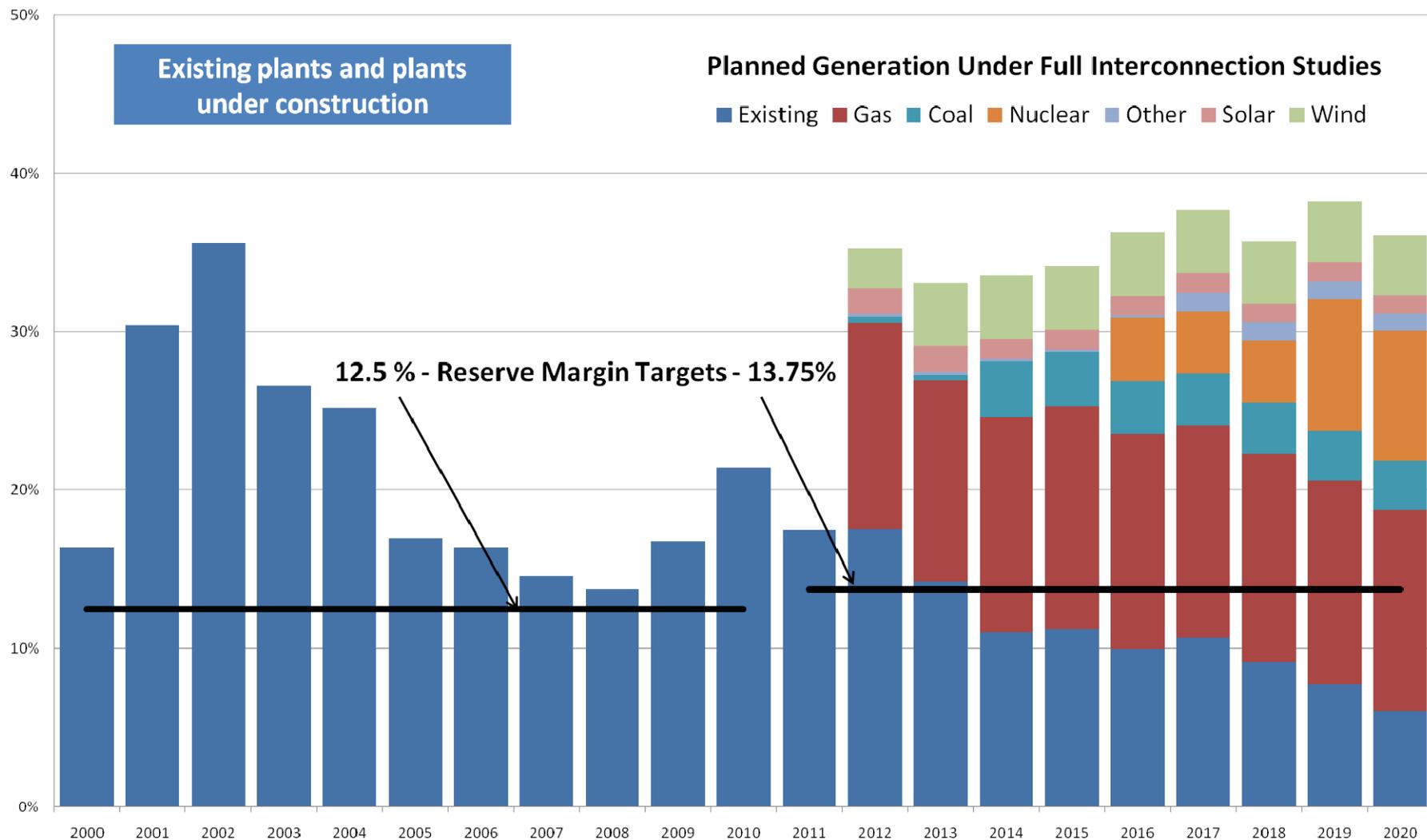
# RESERVE MARGINS: PROJECTING ADEQUACY OF SUPPLY

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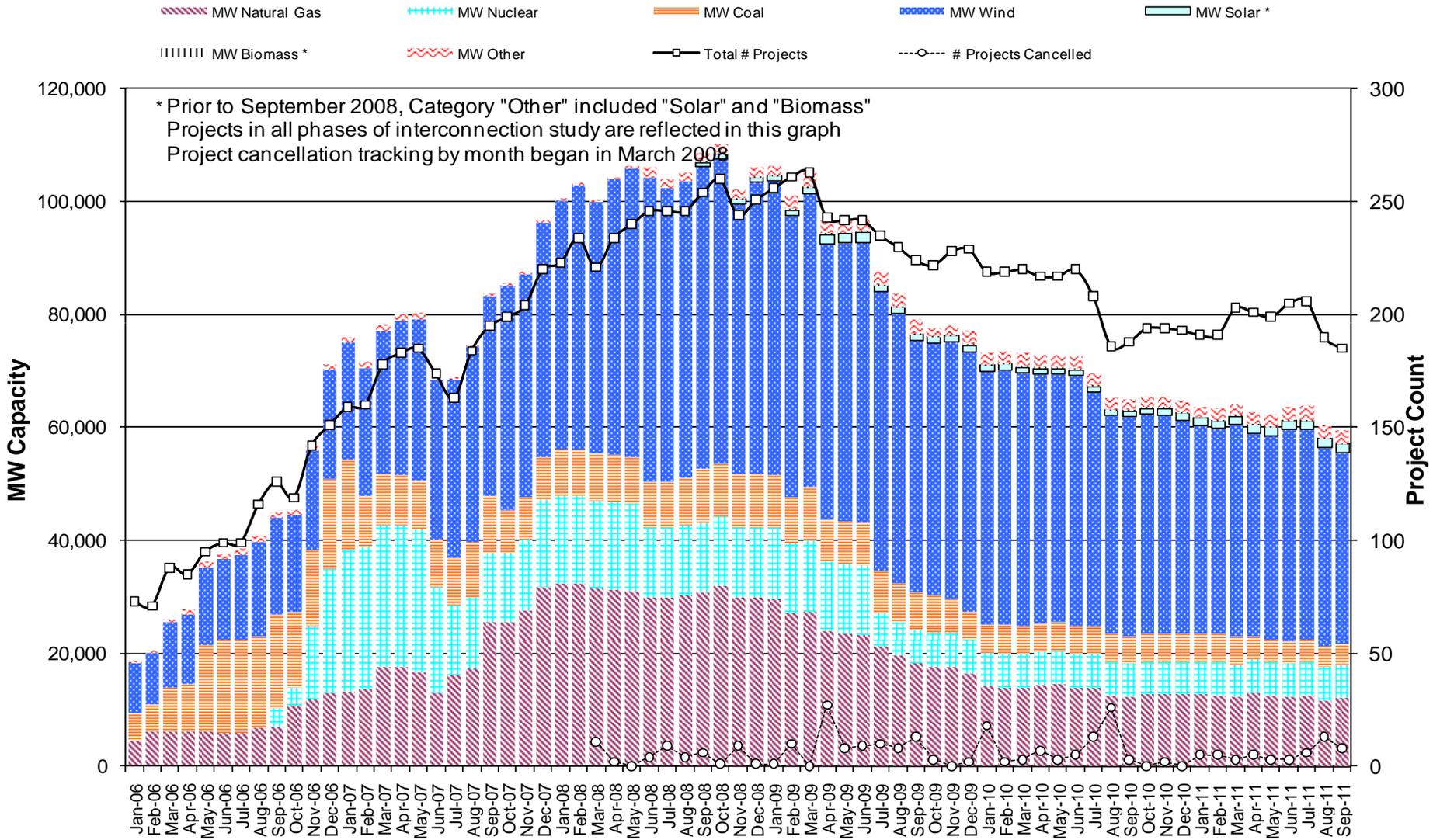
- **Target reserve margin for the ERCOT Region is 13.75%**
- **Defined as:**
  - Percentage difference between available generating capacity and forecasted peak system load
- **Ensures (but does not guarantee) adequate electric supply will be available in case of contingency need**
  - Unexpected weather extremes or loss of major generation units
- **Available capacity includes:**
  - Gas, coal and nuclear fuel units accounted at their season operating limit level (unless scheduled to retire or mothball)
  - Hydro plants and wind farms at their “high confidence summer peak” level
  - Planned units (with signed transmission interconnection agreements and required permits)
  - Loads Acting as Resources - Large customers registered and bidding to provide capacity services in market-based load participation programs
  - DC Ties - capacity that can be imported through DC links from neighboring grids

# ERCOT RESERVE MARGINS – 2000-2020

## RESERVE MARGINS 2000 - 2020



# Generation Interconnection Activity



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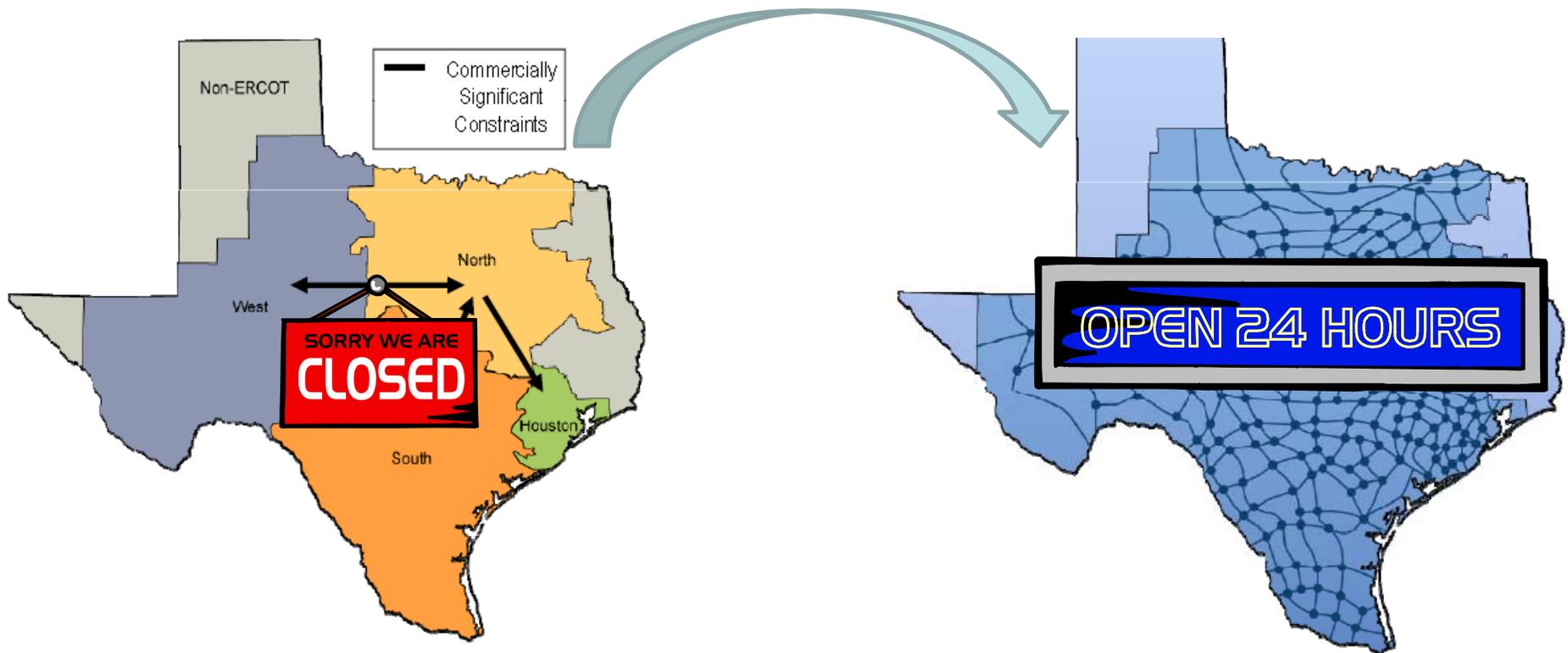
# ERCOT ROLES: MARKET OPERATIONS

# NODAL MARKET OPERATIONS EFFECTIVE DECEMBER 1, 2010

Zonal Market

Dec 1, 2010

Nodal Market

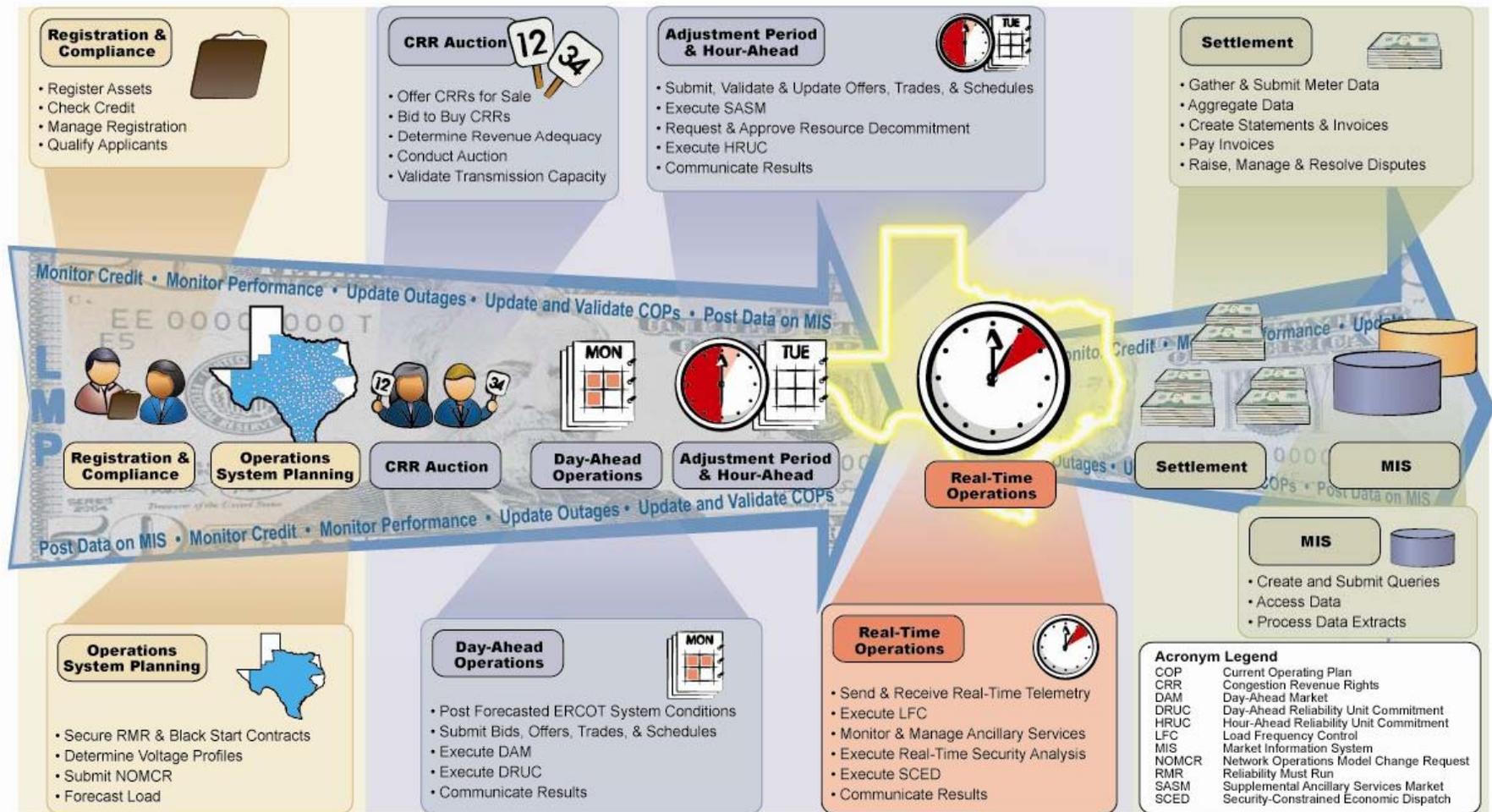


## NODAL MARKET BENEFITS

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- Improved price signals
  - More granular pricing will encourage additional generation and/or transmission investment in the proper locations
- Improved dispatch efficiencies
  - Dispatching at the resource level will yield a lower overall cost of power supply and more efficient congestion management
- More direct assignment of local congestion
  - Settlement prices are based on locational marginal costs

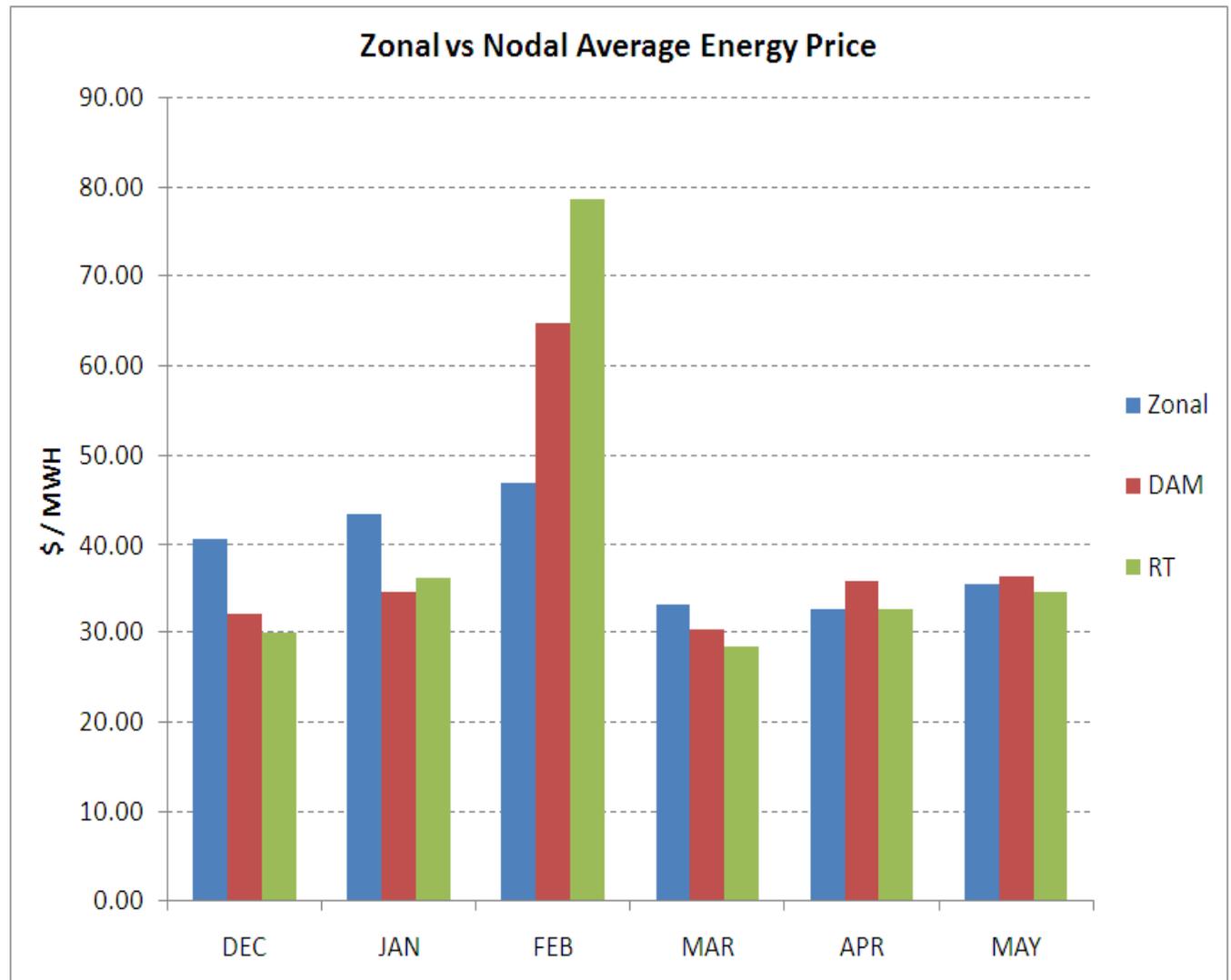
# ERCOT BUSINESS PROCESS



DISCLAIMER - This overview of the Texas Nodal Market is not intended to substitute for the ERCOT Nodal Protocols, as amended from time to time. If any conflict exists between this overview and the ERCOT Nodal Protocols, then the ERCOT Nodal Protocols shall control in all respects.

# ENERGY COST COMPARISON SUMMARY

- Resource specific offers and dispatch are more efficient in serving demand and managing congestion
- Co-Optimization of Ancillary Services and energy results in a reduction of overall system cost

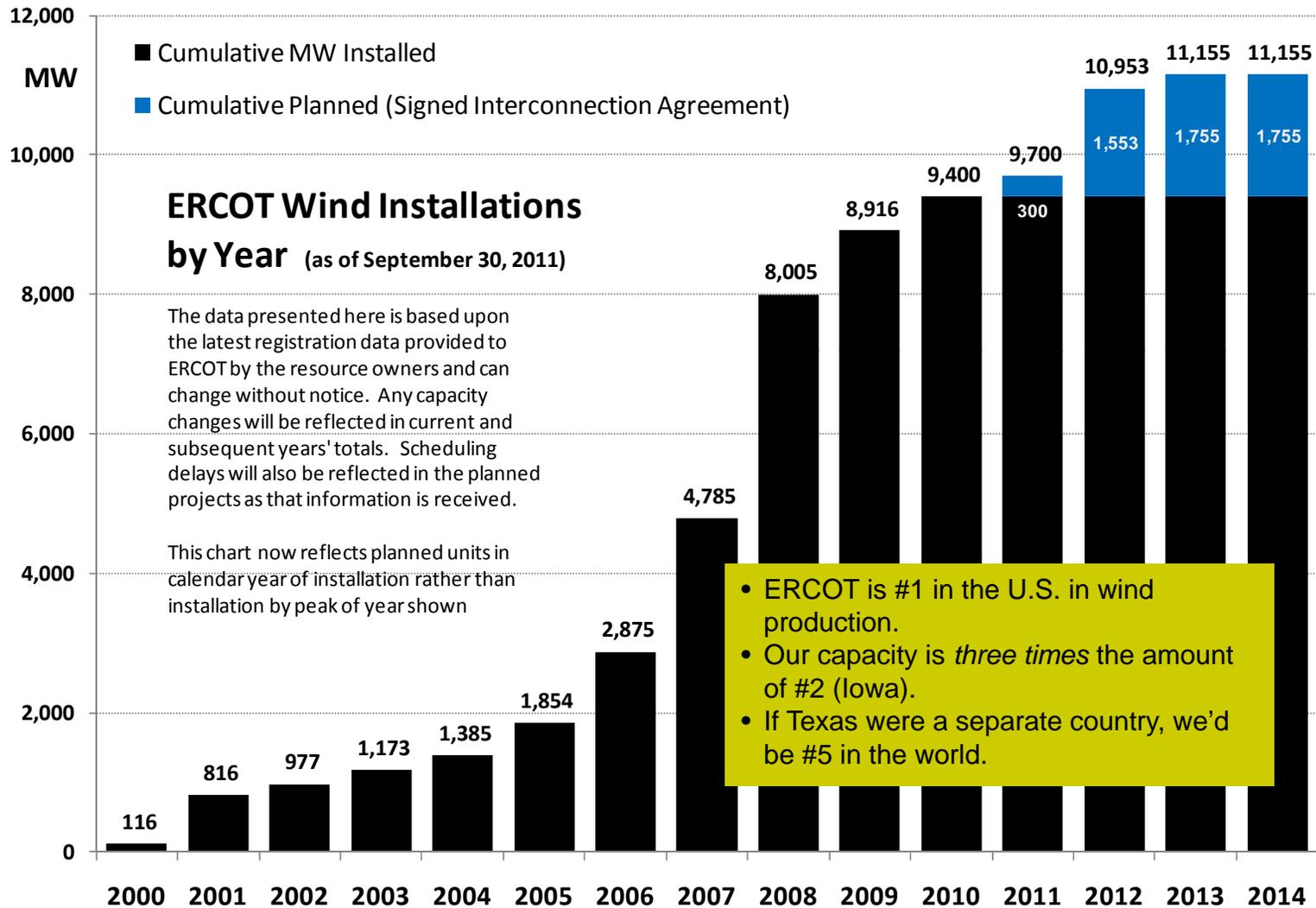


\* Graph revised July 5, 2011

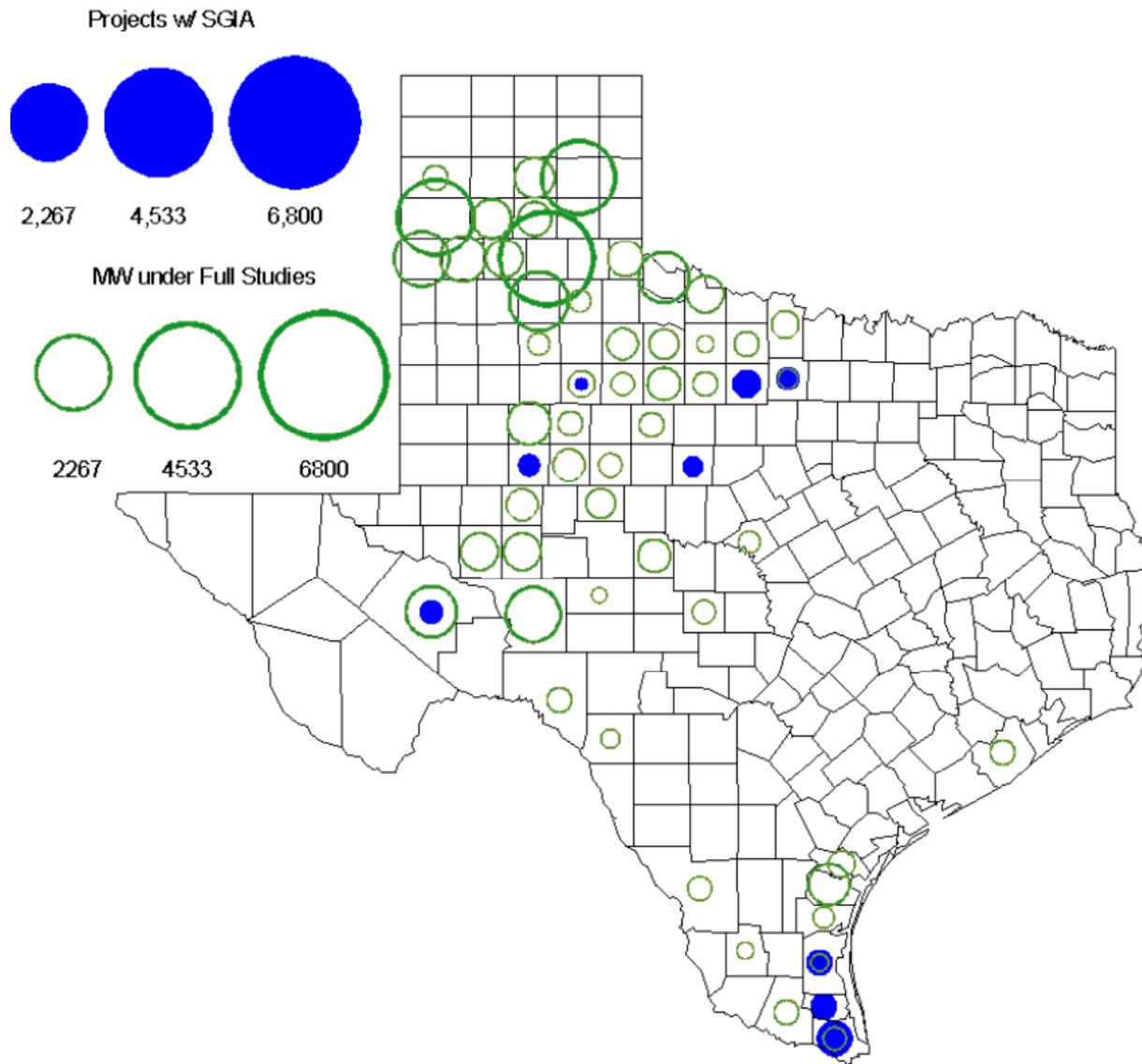
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# GROWTH OF WIND GENERATION

# WIND GENERATION

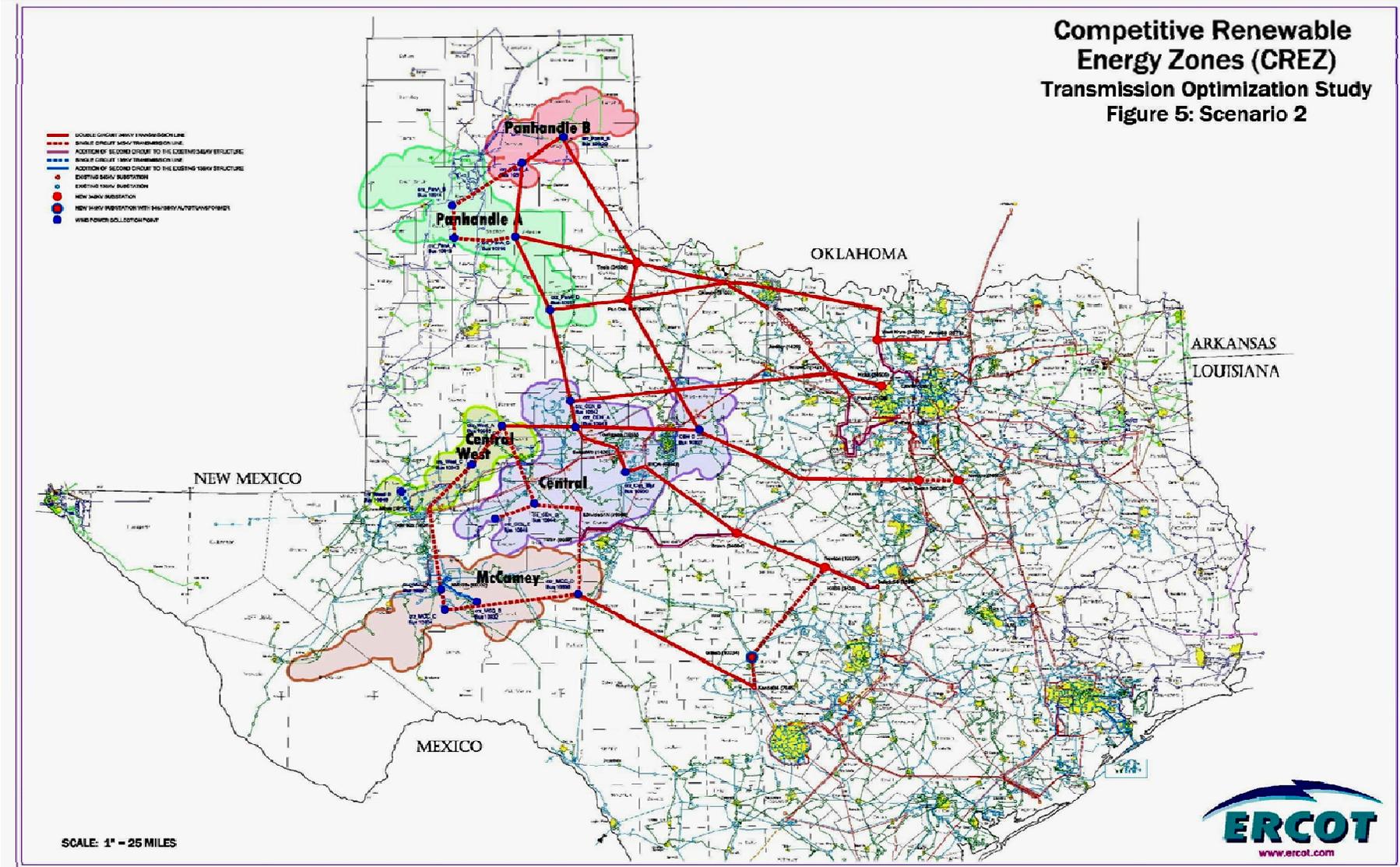


# COUNTY LOCATION OF PLANNED GENERATION WITH INTERCONNECTION REQUESTS (WIND) SEPTEMBER 2011

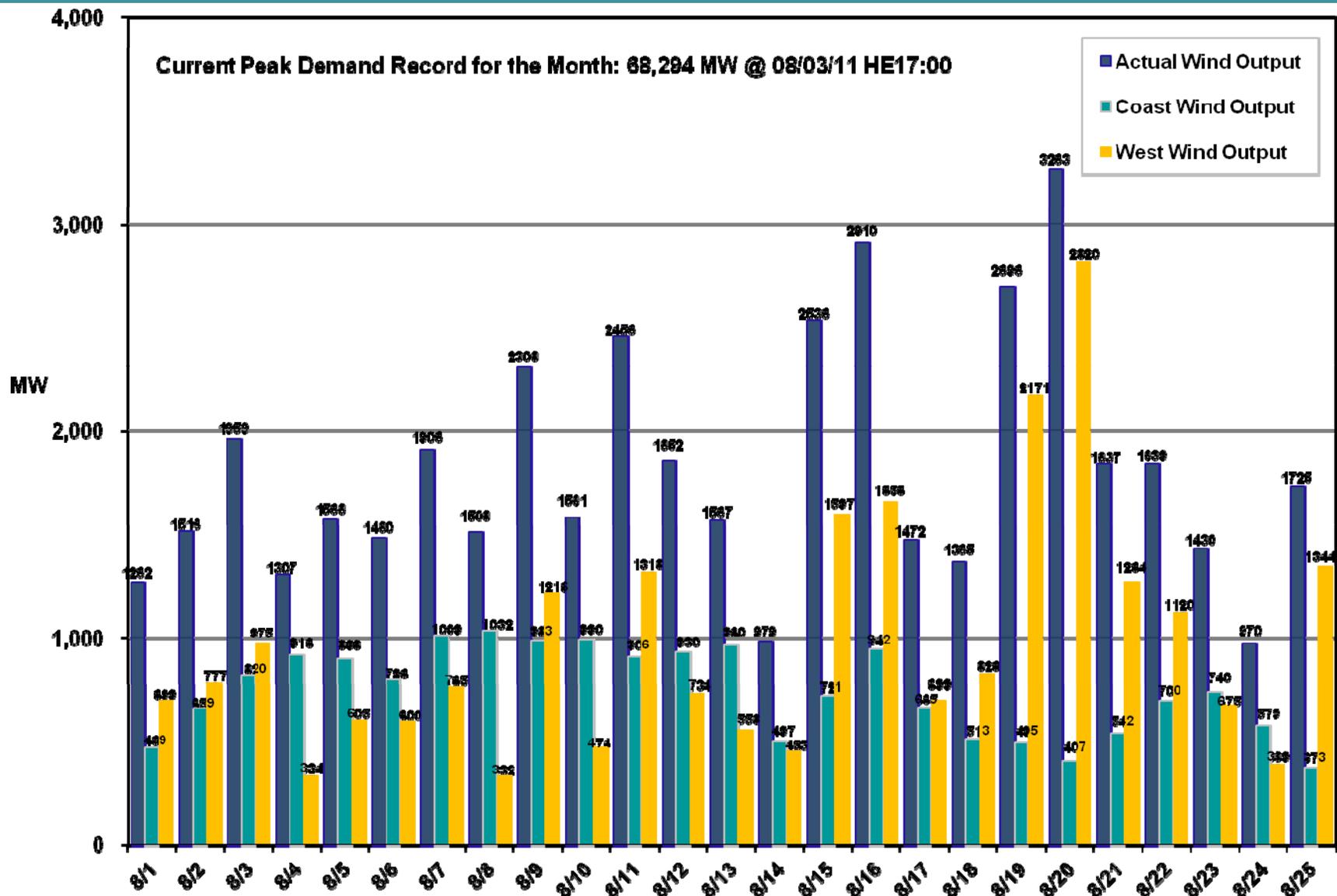


# SCENARIO 2 TRANSMISSION PLAN (18GW)

Competitive Renewable Energy Zones (CREZ)  
Transmission Optimization Study  
Figure 5: Scenario 2



# DAILY WIND GRAPH AT PEAK



## CHALLENGES RELATED TO INCREASED WIND RESOURCES IN ERCOT

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- **Wind is not as controllable or predictable as traditional generation**
  - Highly dependent on weather conditions
  - Cannot be dispatched (with exceptions)
  - Voltage control and reactive coordination are difficult
- **Works best in conjunction with other generation in same area**
  - Conventional resources available to provide regulation & responsive reserve services
  - Possible ancillary service impacts
- **Creates new challenges in system design & operation**
  - Difficulty in coordination of transmission outages and construction, *i.e.*, system off peak = wind peak production
  - Development of standard software stability models for operations & planning environment

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# **FUTURE: ADVANCED METERING & DEMAND RESPONSE**

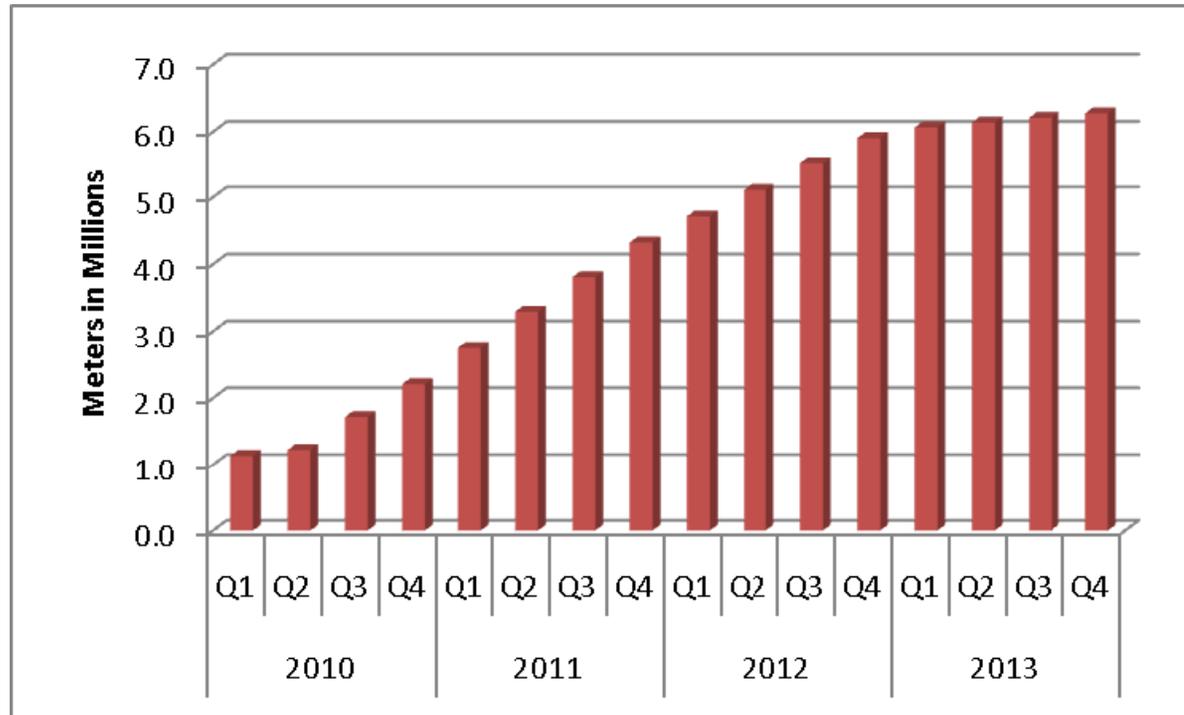
# ADVANCED METERING

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- **Part of “Smart Grid” efforts**
- **Remote meter reading**
- **Informed Consumers**
- **Time of Day pricing**
- **Demand Response Programs**
  - Decrease Consumption
  - Increase Consumption

# TODAY WE'RE SETTling MORE THAN TWO MILLION ADVANCED METERS

## Advanced Meter Deployment Plan



Advanced meters give customers the data they need to make educated decisions about their electricity usage.

# DEMAND RESPONSE POTENTIAL IN ERCOT

- **FERC estimates >18 GW of DR potential in Texas by 2019**
  - Attributed to high peak demand
  - This would represent 20-25% of total ERCOT peak

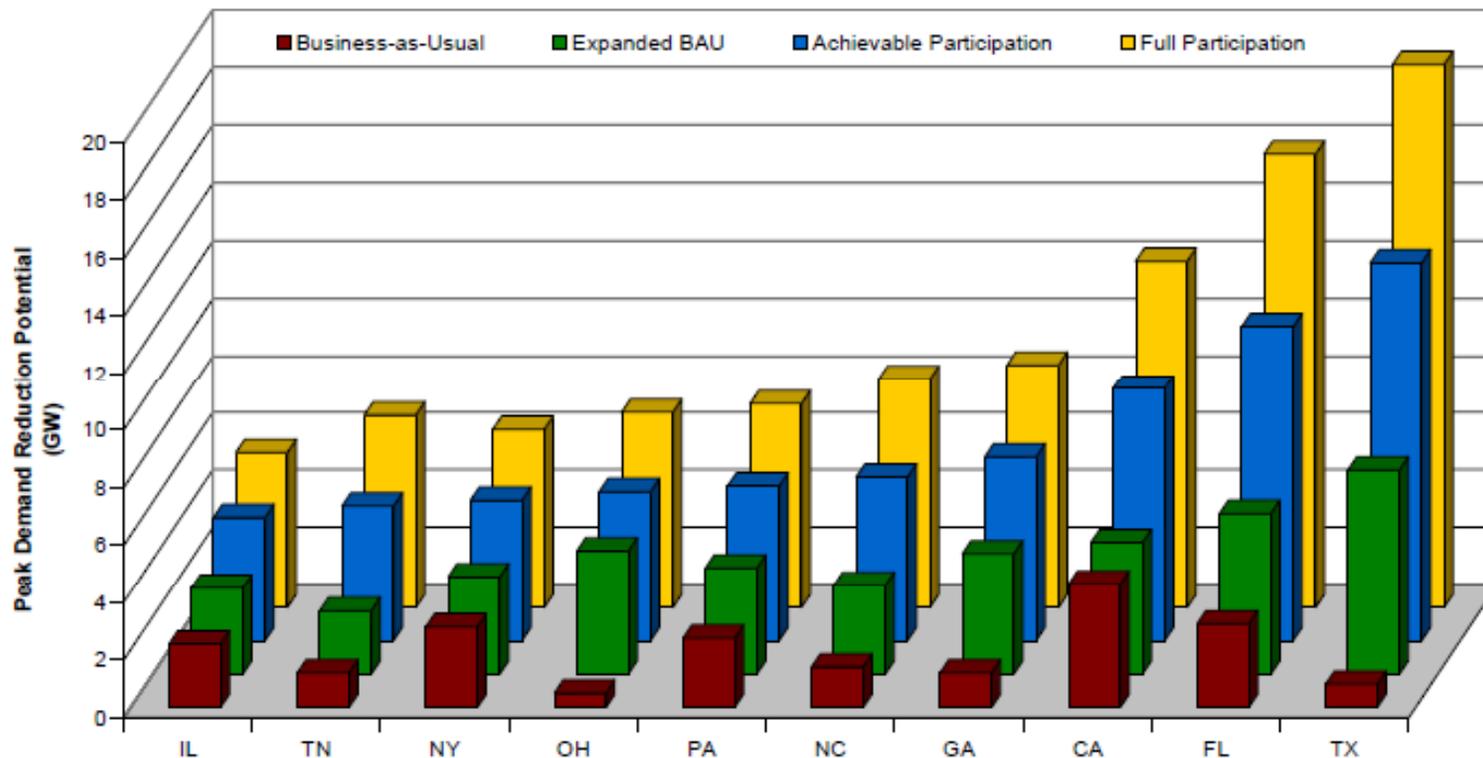


Figure 16: Top Ten States by Achievable Potential in 2019 (GW)

Source: FERC 2009 National Assessment of DR, page 42

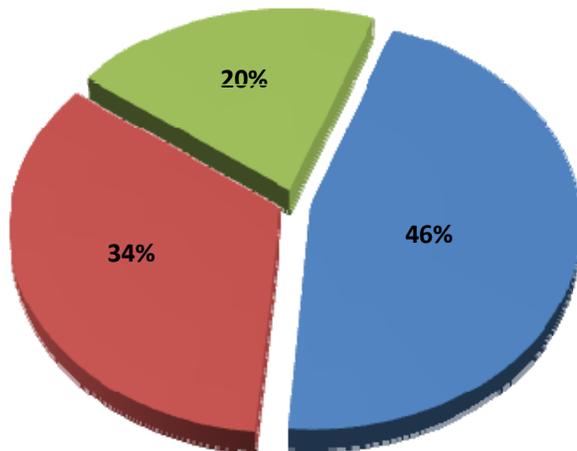
# OFF-PEAK VS. ON-PEAK LOAD

**21,000 MW of residential summer peak load**

Moderate day, low A/C load

**10-11 AM, March 31, 2010**

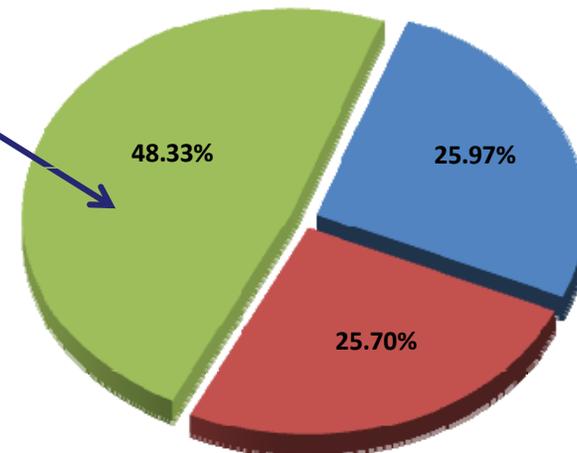
■ Business IDR Required ■ Business non-IDR Required ■ Residential



Hot day, high A/C load

**4-5 PM, Aug. 4, 2010**

■ Business IDR Required ■ Business non-IDR Required ■ Residential



- Both days were Wednesdays
- Customer class breakdown is for competitive choice areas only
- IDR meters are required at >700kW

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**QUESTIONS?**