ERCOT – Challenges & Opportunities

Trip Doggett
President & CEO
ERCOT

March 7, 2013

AGENDA

- **Overview of ERCOT**
- **Weather, Climate & Drought**
- **Wind Integration**
- **Resource Adequacy Challenges**
- **Demand Response & Advanced Metering**

Overview of ERCOT

History of Electric Reliability Council of Texas, Inc

- 1941 – Utilities band together to aid war effort
- 1970 – Texas Interconnected System (TIS) forms ERCOT to comply with North American Electric Reliability (NERC) requirements
- 1981 – ERCOT assumes central operating coordinator role
- 1995 – Texas legislature votes to deregulate wholesale generation
- 1996 – ERCOT becomes first Independent System Operator (ISO) in US
- 1999 – Legislature votes to deregulate retail electric market
- 2001 – Ten control centers merged into one control center
- 2002 – Retail electric market opens, enabling customer choice for 6.1 million
- 2010 – ERCOT implements Nodal Markets
- 2012 – ERCOT has an annual budget of about $170 million

Employee Growth
1999 – 50
2000 – 100
2005 – 500
Current – 600+

ERCOT OVERVIEW

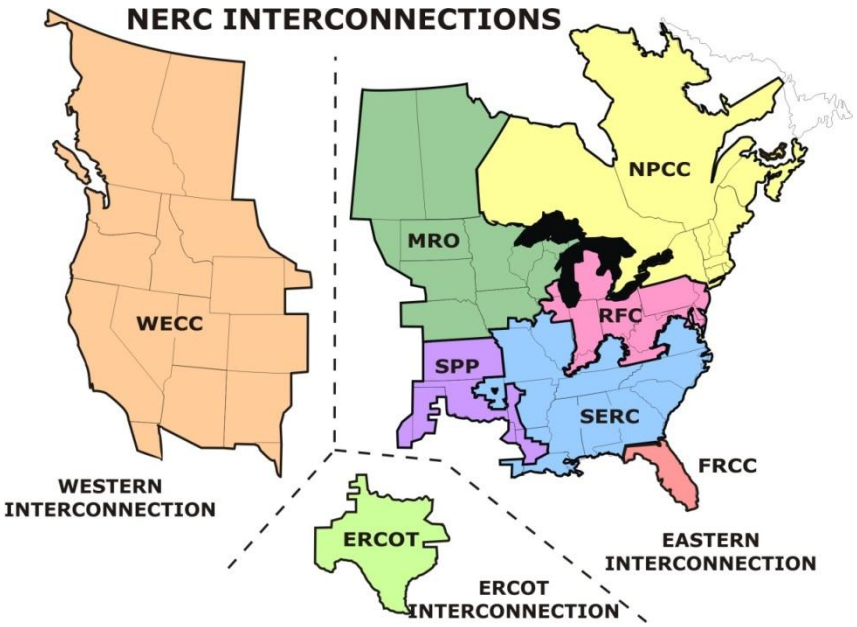
RESPONSIBILITIES

The Texas Legislature restructured the Texas electric market in 1999 by unbundling the investor-owned utilities and creating retail customer choice in those areas, and assigned ERCOT four primary responsibilities:

- System reliability – planning and operations
- Open access to transmission
- Retail switching process for customer choice
- Wholesale market settlement for electricity production and delivery.

QUICK FACTS

- 75% of Texas land
- 85% of Texas load
- More than 40,500 miles of transmission lines
- 550+ generation units
- 68,305 MW peak demand (set August 3, 2011)
- Physical assets are owned by transmission providers and generators, including Municipal Utilities and Cooperatives

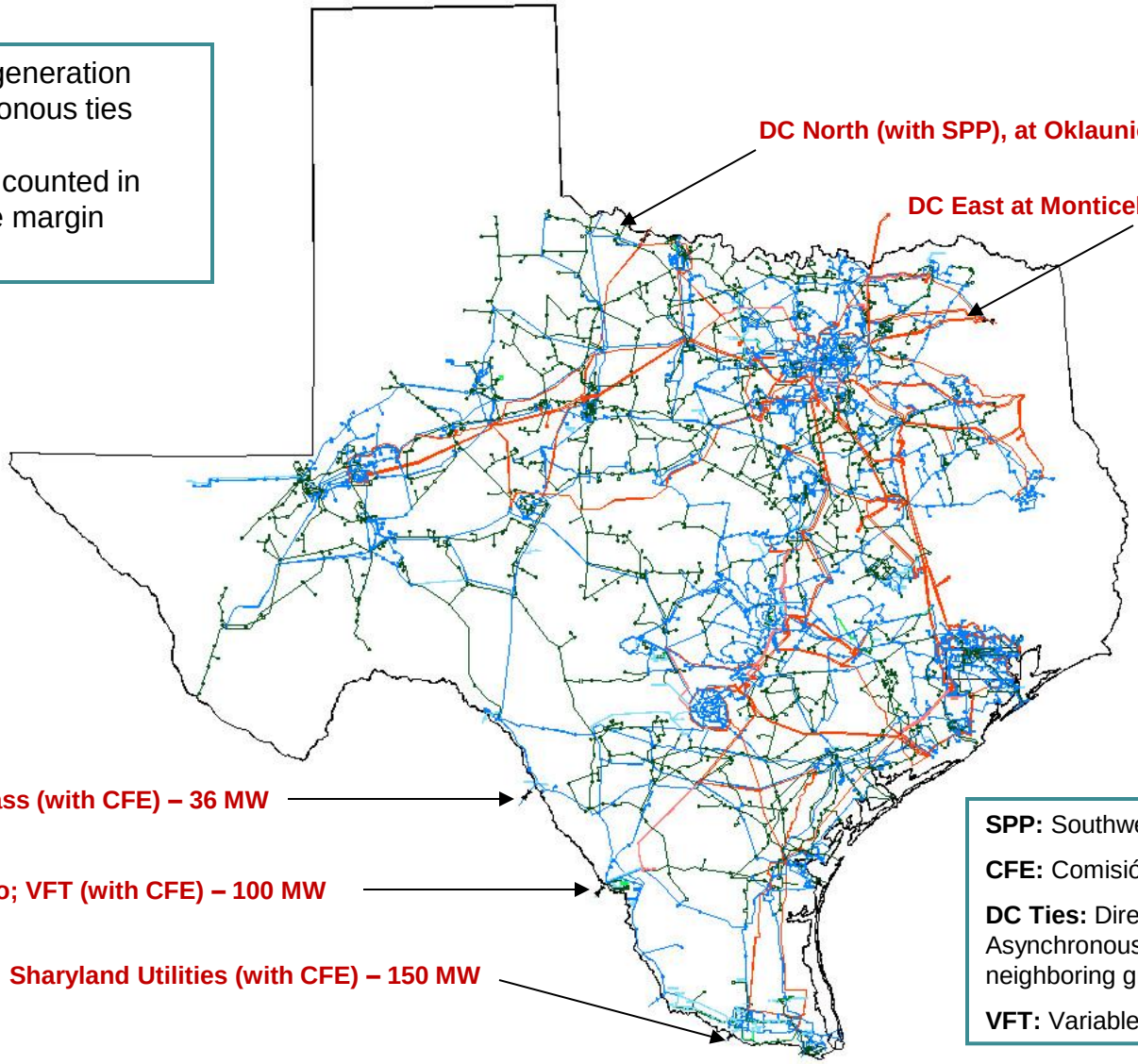


ERCOT connections to other grids are limited to direct current (DC) ties, which allow control over flow of electricity

ERCOT Ties with Neighboring Grids – 1,106 MW

1,106 MW total generation from non-synchronous ties

553 MW or 50% counted in summer reserve margin calculation



DC North (with SPP), at Oklaunion – 220 MW

DC East at Monticello (with SPP) – 600 MW

DC South at Eagle Pass (with CFE) – 36 MW

DC Laredo; VFT (with CFE) – 100 MW

DC Railroad at McAllen; Sharyland Utilities (with CFE) – 150 MW

SPP: Southwest Power Pool

CFE: Comisión Federal de Electricidad

DC Ties: Direct Current ties – Asynchronous connections with neighboring grids

VFT: Variable Frequency Transformer

ERCOT's Primary Mandate

As the designated independent organization under Senate Bill 7, ERCOT was assigned the following responsibilities [Public Utility Regulatory Act (PURA) 39.151]

System Reliability

- Ensure reliability and adequacy of regional electric network

Open Access to Transmission

- Ensure nondiscriminatory access to transmission/distribution systems for all buyers and sellers

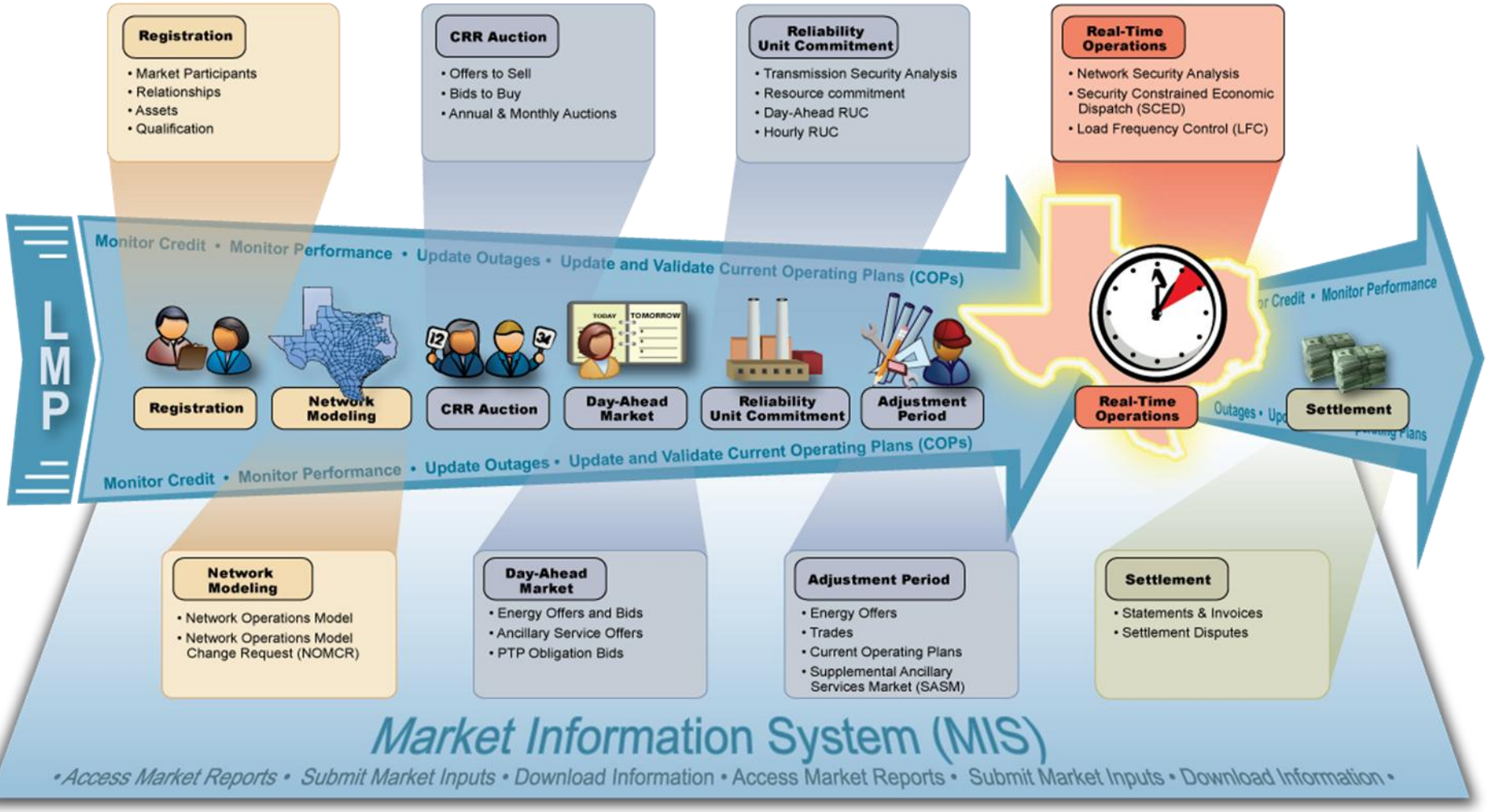
Competitive Retail Market

- Facilitate retail registration and switching

Competitive Wholesale Market

- Ensure accurate accounting for electricity production and delivery among the generators and wholesale buyers and sellers in the region

ERCOT's Business Processes



Current Records

Peak Demand Record: 68,305 megawatts

- 68,305 megawatts (MW), August 3, 2011
  - 4 percent increase over 2010 previous record – 65,776 MW

Summer 2012

- New Peak Demands
  - For June of 66,548 MW on June 26th
  - For July of 65,808 MW on July 31st

Weekend Record

- 65,159 MW, Sunday, August 28, 2011
  - 5 percent increase over 2010 previous record – 62,320 MW

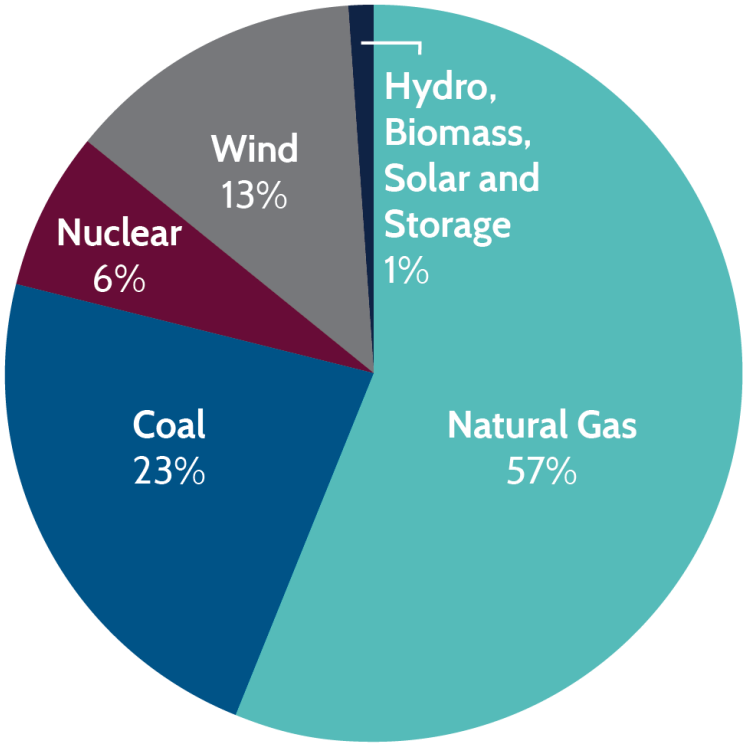
Winter Peak Record

- 57,315 MW (February 10, 2011)
  - 3 percent increase over 2010 previous record – 55,878 MW

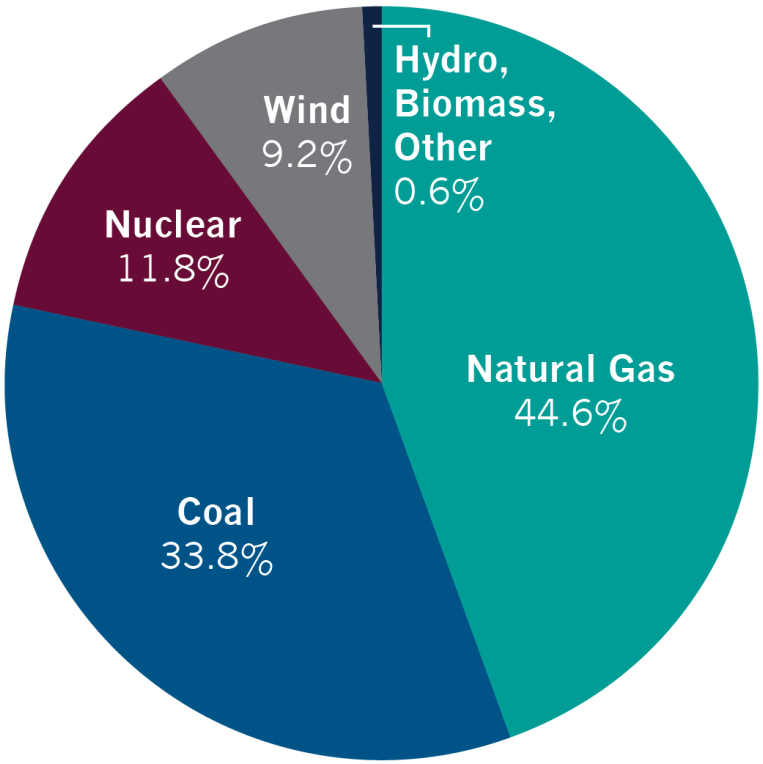
Wind Record

- A new wind record of 9481 MW occurred on February 09, 2013 at 7:08 pm
  - Non-Coastal Wind = 7,861 MW
  - Coastal Wind = 1,620 MW
  - Wind was supplying 27.82% of the 34,082 MW load

ERCOT Capacity and Energy by Fuel Type



2012 Generation Capacity



Energy Use 2012

Top Market in the United States & Canada

ERCOT consistently ranks as the top market in the United States and Canada

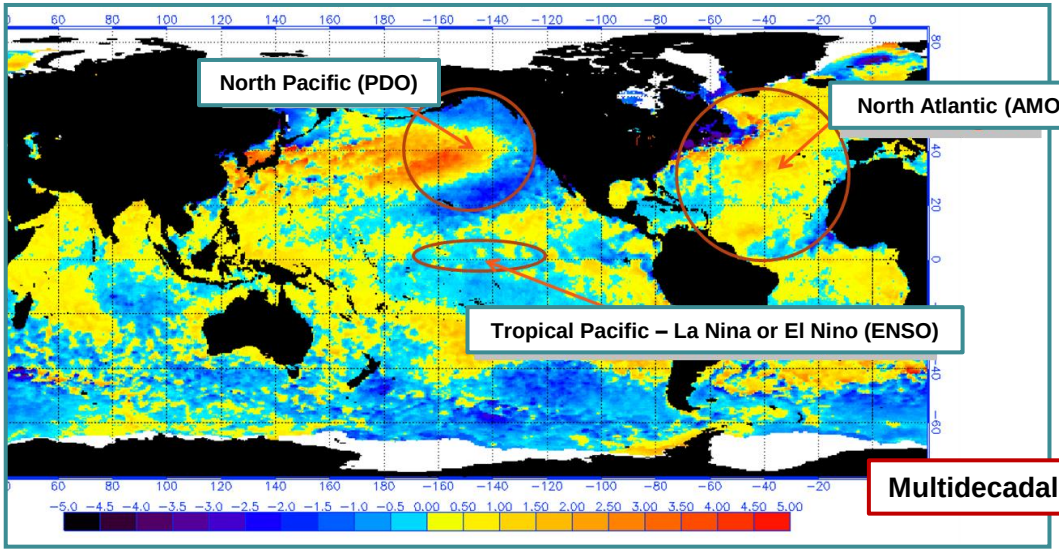
- **Texas residential and commercial/industrial electric markets ranked #1 in competitive markets in North America for the past six years in the Annual Baseline Assessment of Choice in Canada and the United States (Distributed Energy Financial Group, 2012).**
  - Texas was the only market that ranked "excellent" for both residential and commercial markets in 2012.
- **$34 billion market based on 334,000 GWh annual energy**
  - Approximately 240 counterparties active in the market, providing depth and liquidity
  - More than 1,000 active entities that generate, move, buy, sell or use wholesale electricity

"In Texas we refuse to rest on our laurels and have every intention of remaining number one by continuing to add features in our nation's leading electricity market. We keep finding ways to increase customer value in the marketplace through smart grid innovations and ongoing improvements in the shopping experience, just to name a few."

Chairman Donna L. Nelson, Public Utility Commission of Texas (ABACCUS, 2012)

Weather, Climate & Drought

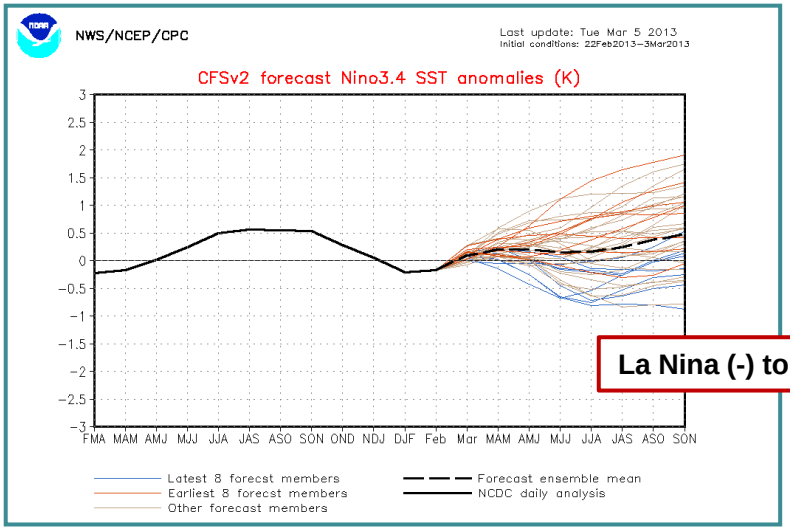
Long Term Climate – Influencing Factors



Multidecadal Influences

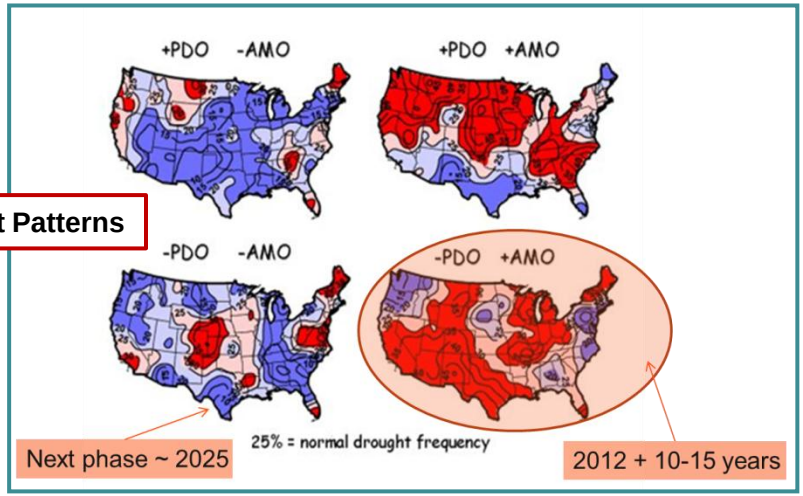
Long Term Forecast – Contributing Factors

- **Variations in SST (Sea Surface Temps)**
  - El Niño (+) & La Niña (-) (ENSO)
  - Pacific Decadal Oscillation (PDO)
  - Atlantic Multidecadal Oscillation (AMO)
- Certain shorter term phenomena (e.g. North Atlantic Ocean Blocking) can only be forecasted 10-14 days out – such effects are not included in longer term forecasts



La Nina (-) to El Nino (+)

Drought Patterns



Preliminary Summer 2013 Weather Outlook

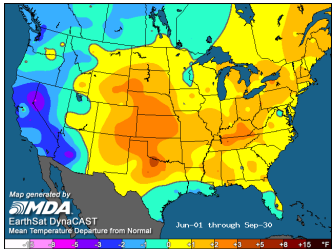
Temperature Outlook

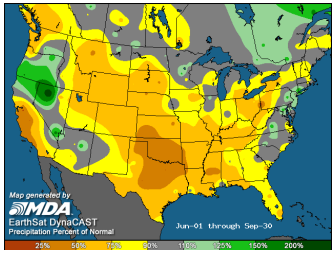
- The maps on the right are composites of 1950, **1952**, 1999, 2002, 2008, and 2012.
- Northern and western sections of Texas have the greatest likelihood of above normal temperatures.
- The Coast, South Central, and Southern regions show a slightly cooler than normal look; however, ongoing drought conditions in the Central and South support a warmer pattern. Houston has more opportunity for a milder summer.

Precipitation Outlook

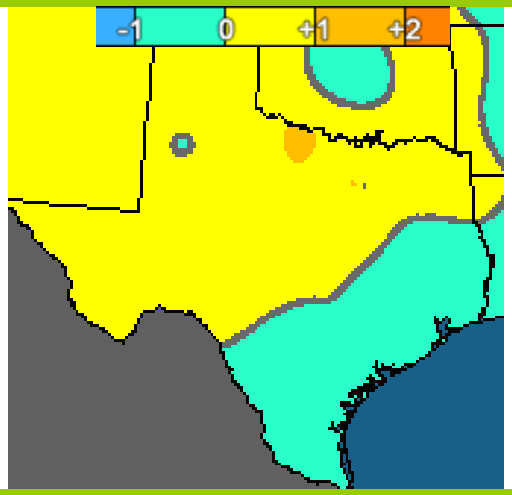
- This map is absent any clearly above normal regions, though the historical years of reference allow for some wetter periods (especially South) mid-summer. The preferred historical match, 1952, was drier than normal throughout Texas.
- This outlook would support continued drought concerns for most of ERCOT.

1952:





Summer 2013 (Jun-Sep)
Temperature Outlook



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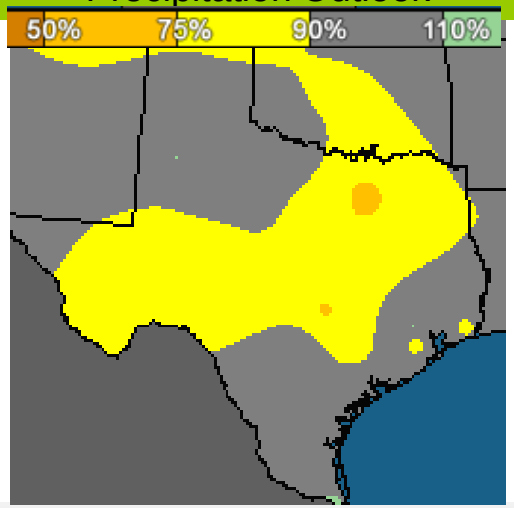


TEXAS DROUGHT CONDITIONS – OCT 4, 2011

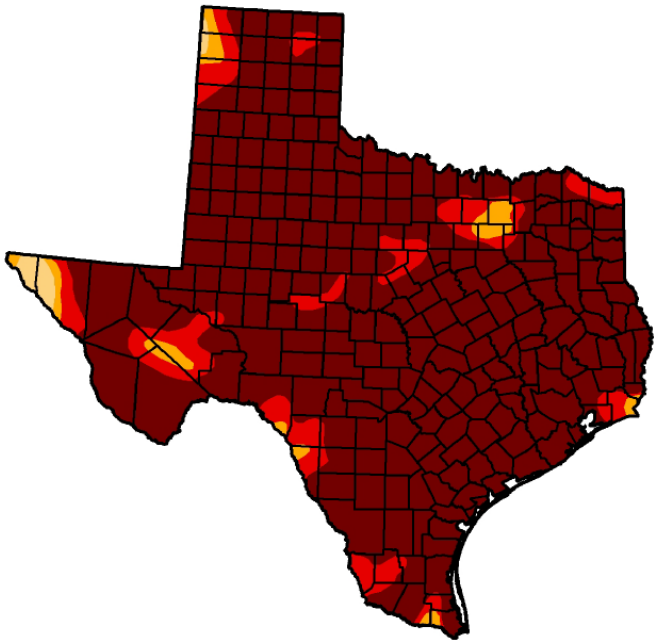
U.S. Drought Monitor

Texas

October 4, 2011
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	99.16	96.99	87.99
Last Week (09/27/2011 map)	0.00	100.00	100.00	99.16	96.65	85.75
3 Months Ago (07/05/2011 map)	2.41	97.59	95.73	94.39	90.21	71.30
Start of Calendar Year (12/28/2010 map)	7.89	92.11	69.43	37.46	9.59	0.00
Start of Water Year (09/27/2011 map)	0.00	100.00	100.00	99.16	96.65	85.75
One Year Ago (09/28/2010 map)	75.57	24.43	2.43	0.99	0.00	0.00



Intensity:

- *D0 Abnormally Dry*
- *D1 Drought - Moderate*
- *D2 Drought - Severe*
- *D3 Drought - Extreme*
- *D4 Drought - Exceptional*

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu

USDA National Drought Mitigation Center

Released Thursday, October 6, 2011

TEXAS DROUGHT CONDITIONS – MAY 15, 2012

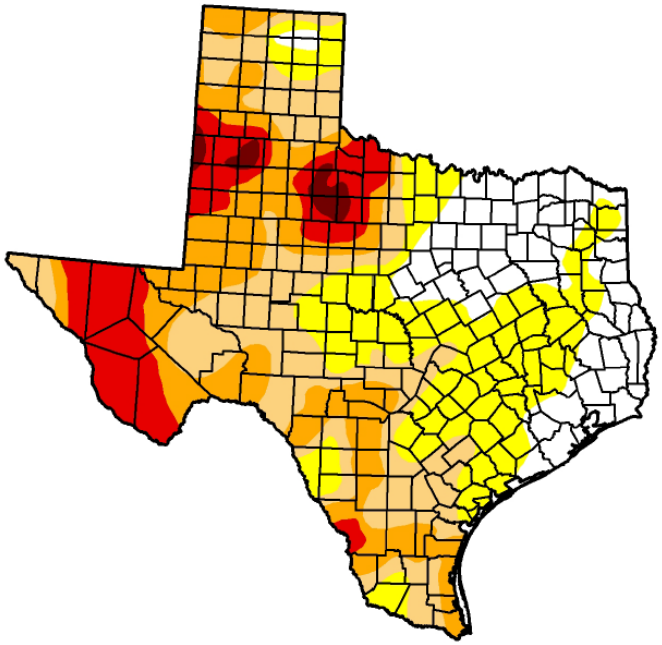
U.S. Drought Monitor

Texas

May 15, 2012
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	18.50	81.50	56.79	33.55	13.54	1.40
Last Week (05/08/2012 map)	17.80	82.20	65.93	48.16	23.57	7.38
3 Months Ago (02/14/2012 map)	4.93	95.07	89.08	76.46	53.27	20.41
Start of Calendar Year (12/27/2011 map)	0.01	99.99	97.83	84.81	67.32	32.36
Start of Water Year (09/27/2011 map)	0.00	100.00	100.00	99.16	96.65	85.75
One Year Ago (05/10/2011 map)	0.00	100.00	97.78	93.89	82.06	47.55



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The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu

Released Thursday, May 17, 2012
Brad Rippey, U.S. Department of Agriculture

TEXAS DROUGHT CONDITIONS – FEB 26, 2013

U.S. Drought Monitor

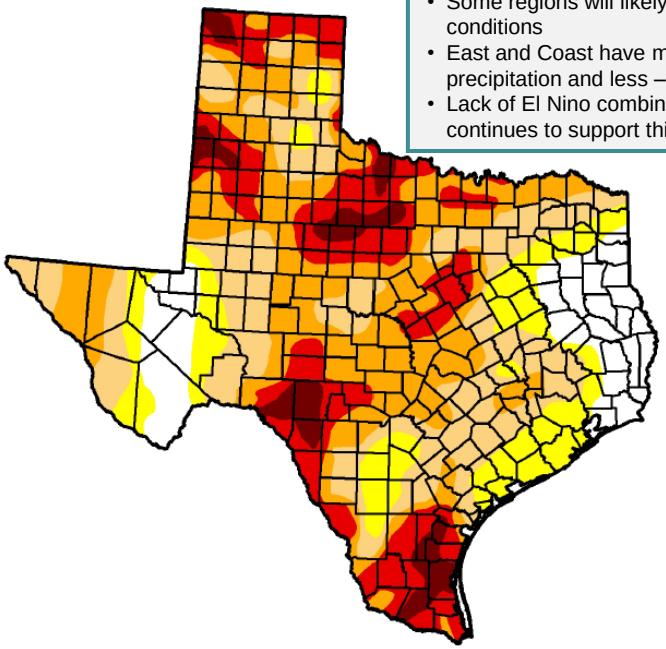
Texas

February 26, 2013
Valid 7 a.m. EST

- Drought conditions will likely not improve for most regions in Texas
- Some regions will likely experience worsening conditions
- East and Coast have more potential for precipitation and less –ve impact on the drought
- Lack of El Nino combined with AMO+/PDO- continues to support this trend

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	11.29	88.71	75.11	49.85	22.02	5.17
Last Week (02/19/2013 map)	12.01	87.99	73.58	49.06	25.80	7.89
3 Months Ago (11/27/2012 map)	6.16	93.84	80.51	54.47	24.50	7.63
Start of Calendar Year (01/01/2013 map)	3.04	96.96	87.00	65.39	35.03	11.96
Start of Water Year (09/25/2012 map)	9.13	90.87	78.73	57.41	24.91	5.18
One Year Ago (02/21/2012 map)	6.05	93.95	85.21	67.48	38.68	13.93



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http://droughtmonitor.unl.edu

Released Thursday, February 28, 2013
Brian Fuchs, National Drought Mitigation Center

LAKE LEVELS UPDATE – FEB 1, 2013

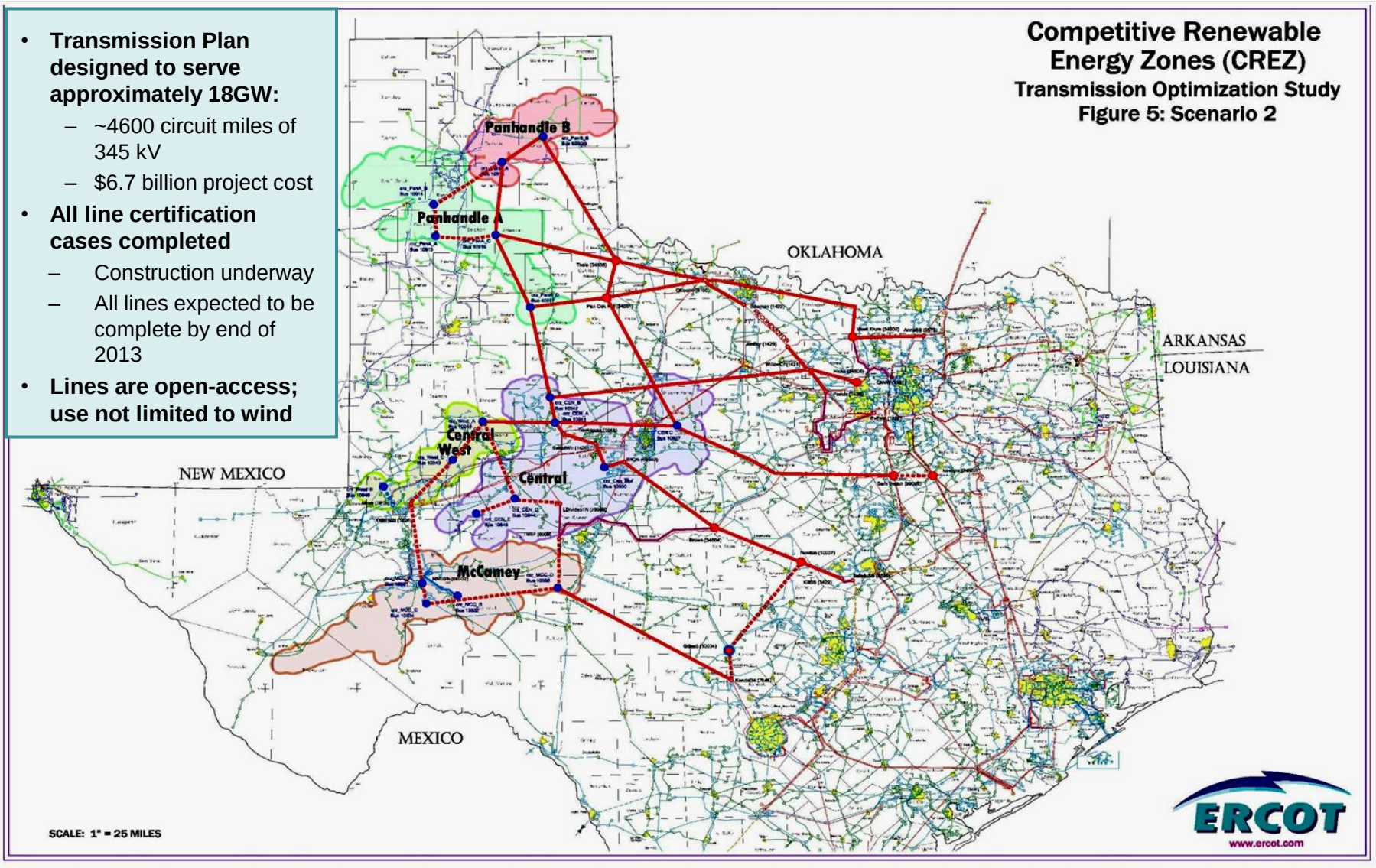
Surface Water & (MW)	*Level @ Full Conservation Pool	*Level on Jan 1, 2011	*Level on Oct 7, 2011	*Level on Feb 1, 2013
Lake Texana (56)	44.50	41.00	32.81	42.46
Bardwell Lake (312)	421.00	420.71	416.23	418.55
Lake Colorado City (407)	2,070.20	2057.33	2052.4	2053.18
Lake Ray Hubbard (916)	435.50	432.37	429.22	432.40
Lake Granbury (983)	693.00	691.90	686.27	687.69
Lake Houston (1016)	41.73	42.10	36.76	42.10
Twin Oaks Reservoir (1616)	400	398.87	398.27	400.12
Lake Limestone (1689)	363	359.03	354	360.07
Martin Lake (2425)	306	300.48	295.06	302.80

* In Feet above Mean Sea Level

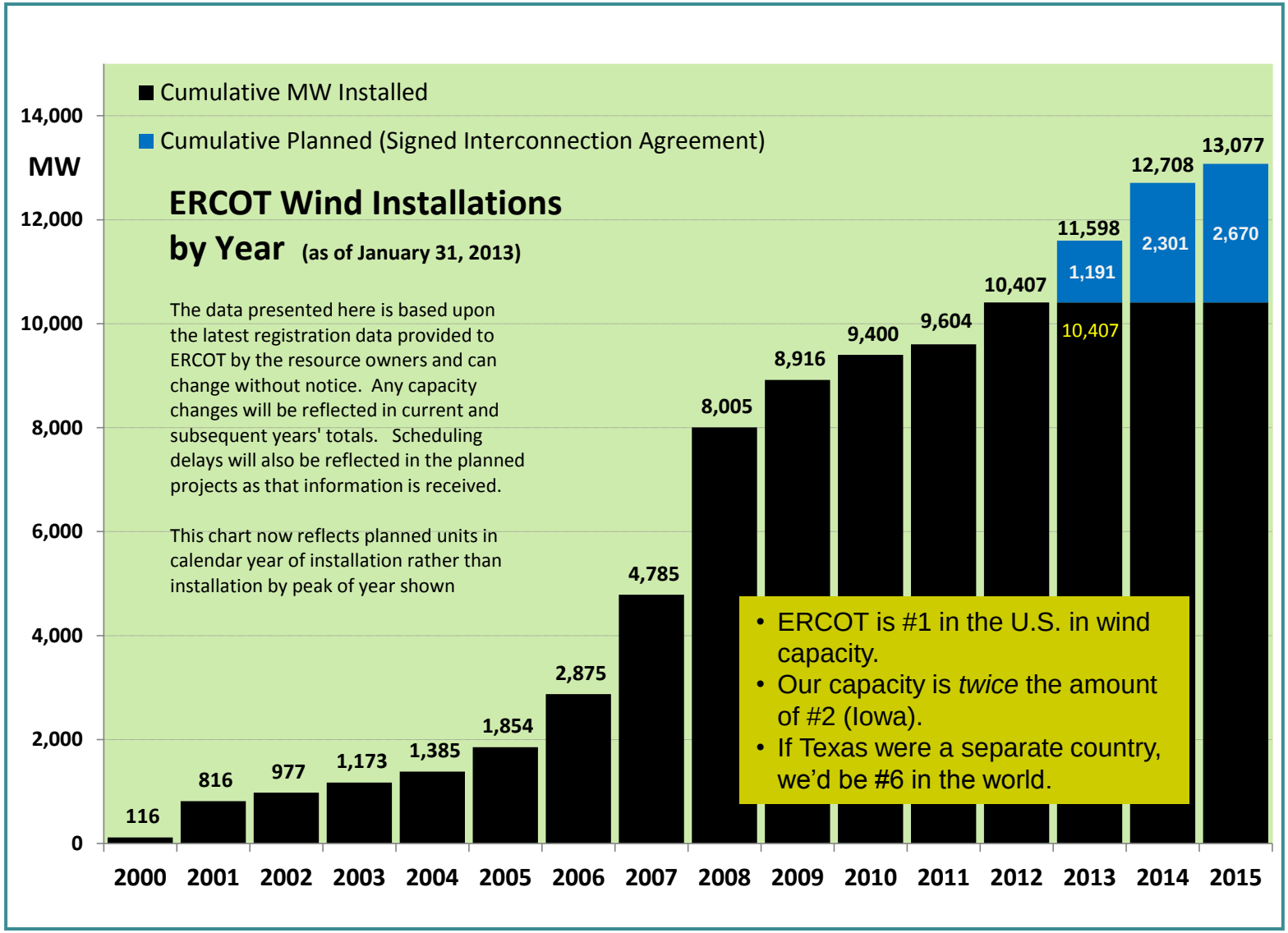
Wind Integration

CREZ Scenario 2 Transmission Plan (18GW)

- **Transmission Plan designed to serve approximately 18GW:**
  - ~4600 circuit miles of 345 kV
  - $6.7 billion project cost
- **All line certification cases completed**
  - Construction underway
  - All lines expected to be complete by end of 2013
- **Lines are open-access; use not limited to wind**

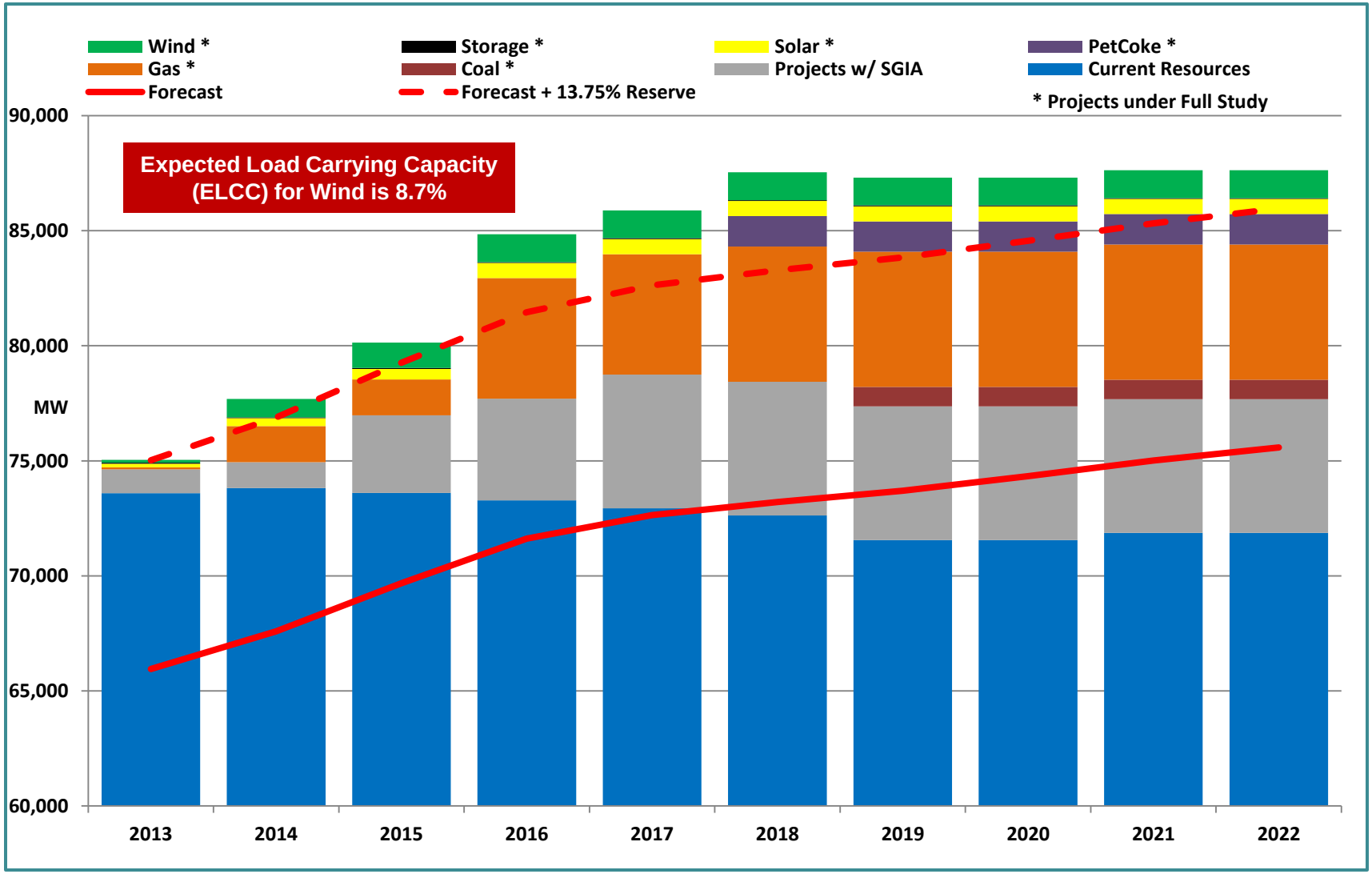


WIND GENERATION

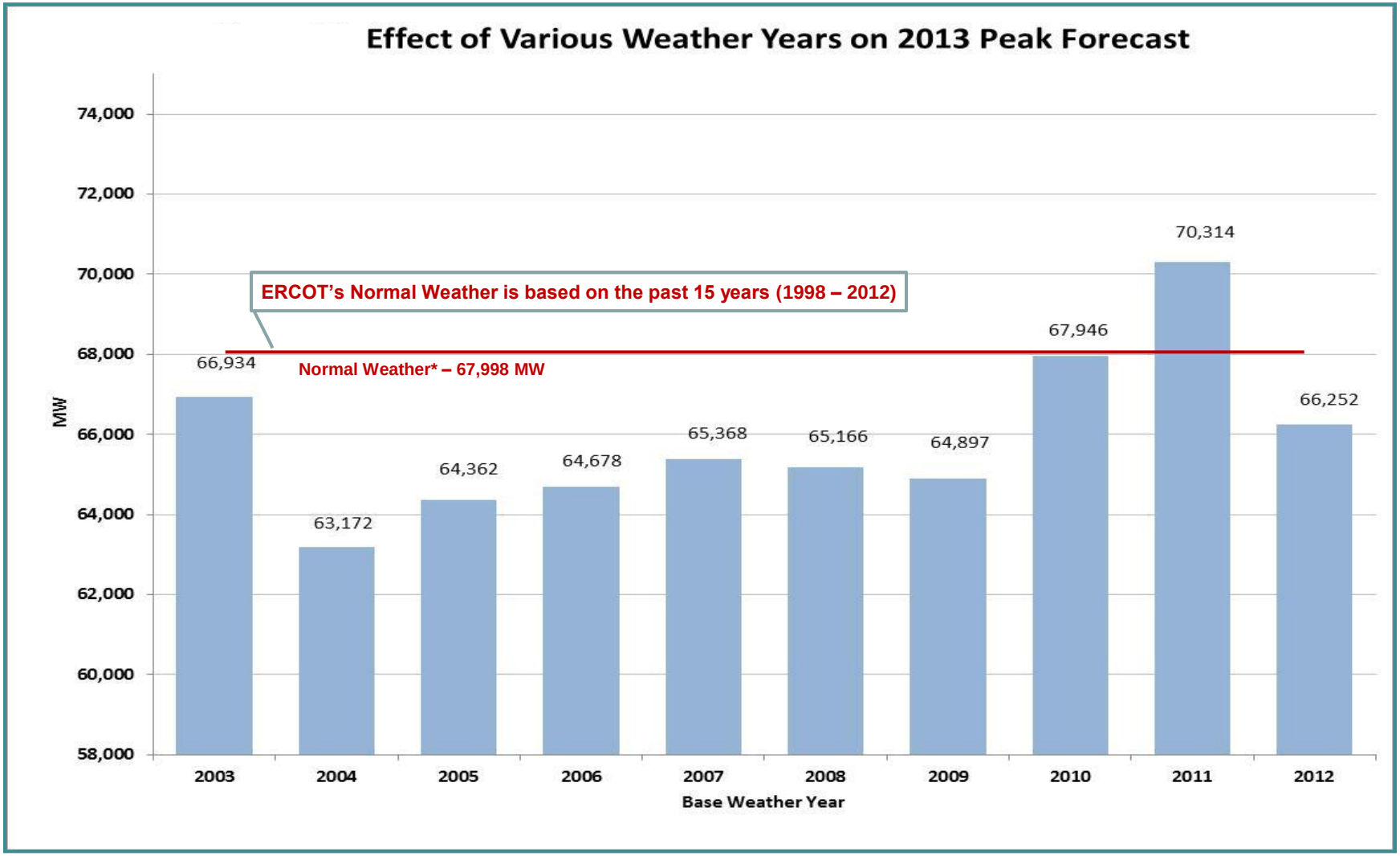


Resource Adequacy Challenges

DEC 2012 CAPACITY, DEMAND AND RESERVES REPORT (CDR)



2013 PEAK LOAD FORECAST – SENSITIVITY TO WEATHER



Overview of Actions to Promote Resource Adequacy

- **Ensure that reliability steps taken by ERCOT during times of extremely high demand do not inadvertently create price signals that discourage new generation investment**
- **Expand ERCOT's toolkit for addressing shortage/emergency conditions**
- **Sponsor and conduct analysis of the ERCOT market to provide policymakers the detailed information needed to assess alternatives**

Brattle Study Scope

ERCOT commissioned *The Brattle Group* to address three questions:

1. Investors and their Investment Criteria

- Identify, describe, and rank the relevant factors (e.g. credit, return on investment, risk appetite, regulatory, etc.) that influence investment decisions made by the development and financial community related to new capacity additions, capacity retirements, and repowering projects in ERCOT.

2. Market Outlook for Investment and Resource Adequacy

- Evaluate the current drivers (e.g. futures prices, demand response impact, emerging technologies, etc.) from both a wholesale and retail perspective that influence resource investment decisions in the ERCOT market.

3. Evaluation of Policy Options

- Provide suggestions for ways to enhance favorable investment outcomes for long-term resource adequacy in ERCOT.

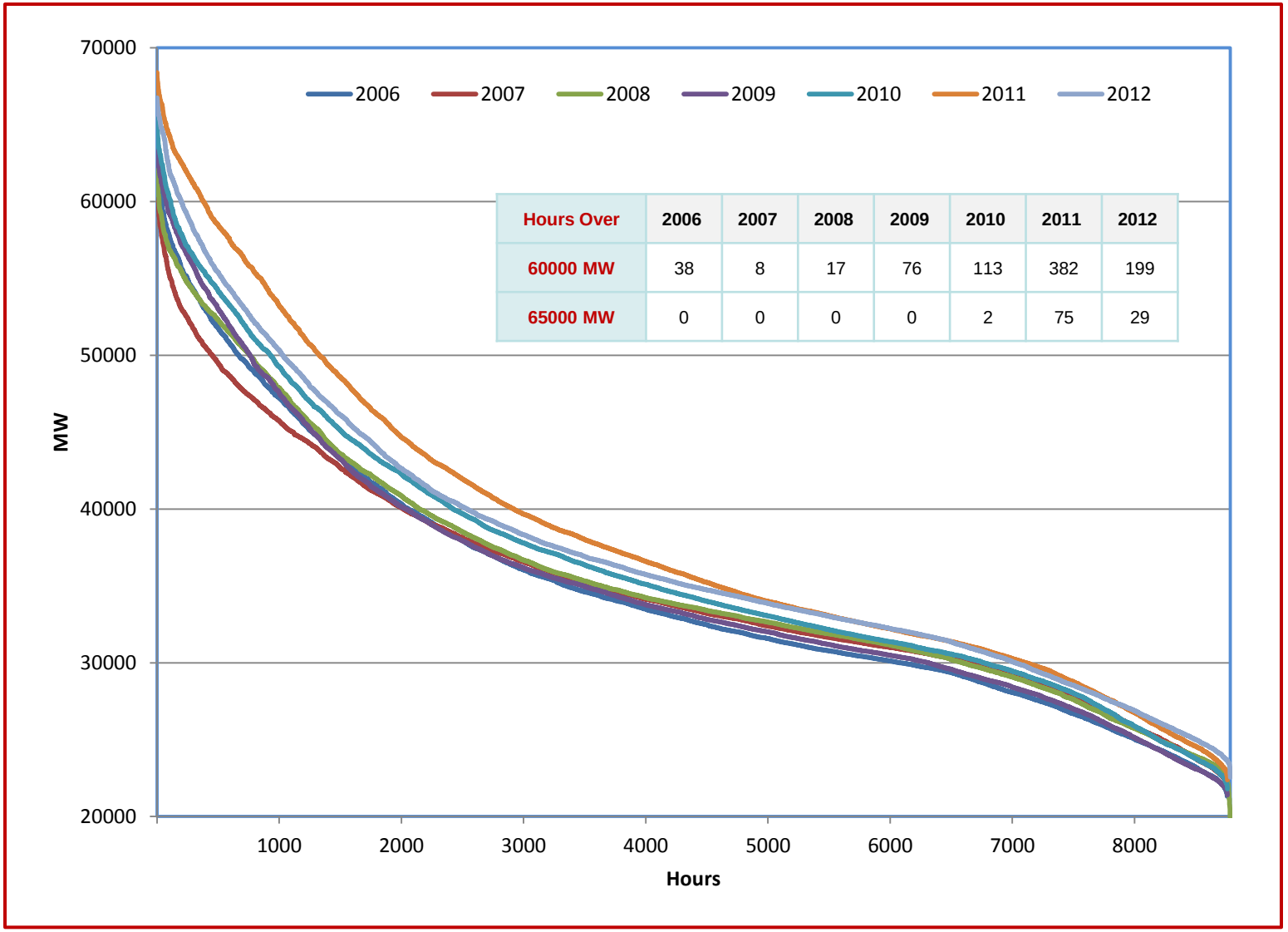
BRATTLE STUDY – RESOURCE ADEQUACY POLICY OPTIONS

Five options to consider based on policy objectives

1. Energy-only with market-based reserve margin
2. Energy-only with adders to support a target reserve margin
3. Energy-only with backstop procurement to meet minimum acceptable reliability
4. Mandatory resource adequacy requirement for Load Serving Entities (LSEs) based on bilateral contracts
5. Resource adequacy requirement with a centralized forward capacity market

Demand Response
&
Advanced Metering

ACTUAL LOAD DURATION CURVES – 2006 TO 2012

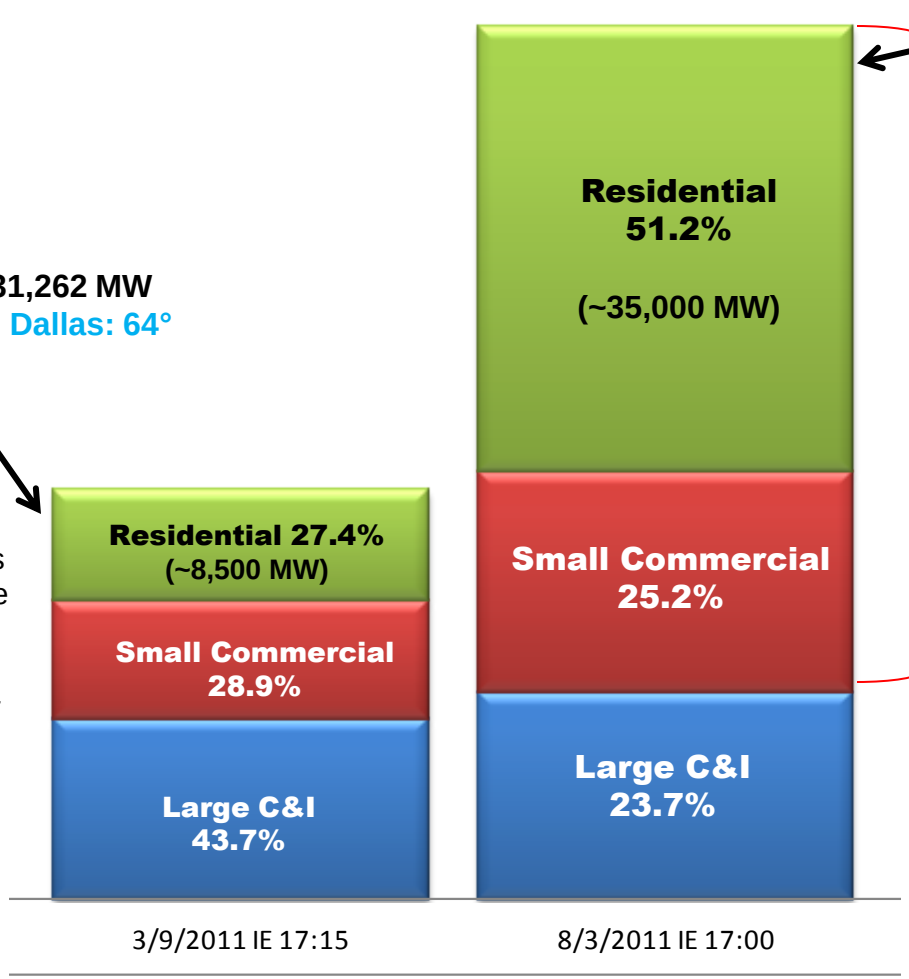


Hours Over	2006	2007	2008	2009	2010	2011	2012
60000 MW	38	8	17	76	113	382	199
65000 MW	0	0	0	0	2	75	29

FORECASTED LOAD DURATION CURVES – 2013 TO 2015

Hours Over	2013	2014	2015
60000 MW	97	181	324
65000 MW	4	18	51
70000 MW	0	0	8

On-peak DR Potential by Customer Type

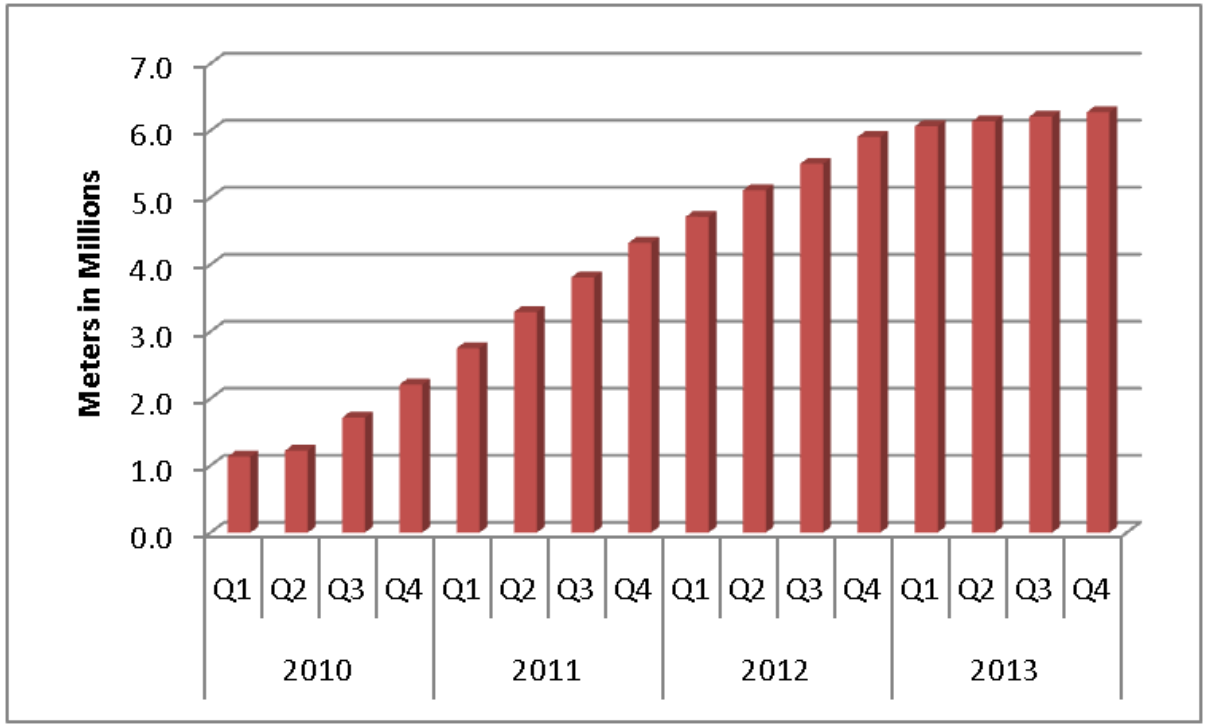


- Based on customer class breakdown in competitive choice areas and extrapolated to ERCOT
- Large C&I are IDR Meter Required (>700kW)

- ERCOT staff is working on Aggregated Load Response (ALR) enablement with market participants in both NOIE and competitive choice areas

TODAY WE'RE SETTLING OVER 6.1 MILLION ADVANCED METERS

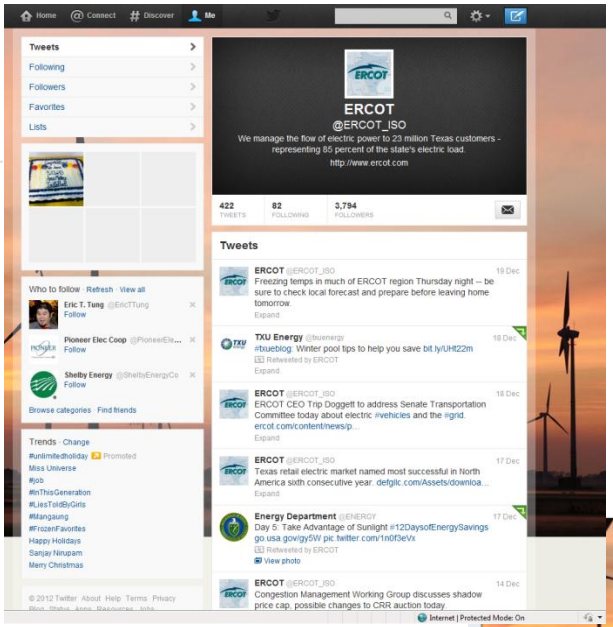
Advanced Meter Deployment Plan



January 2013
93.0% of the ERCOT Competitive Load settled with 15-min interval data (AMS and IDR)

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

OUTREACH: MOBILE APP, SOCIAL MEDIA PROVIDE REAL-TIME INFO



Social Media

- Focus on timely information, frequent updates
- Twitter – 3,700+ followers
- Facebook – 1,100+ followers
- Exploring other channels

ERCOT Mobile App

- iPhone and Android Phone users
- Instant access to users through "push notifications"
- Phase 1: Load curve, conservation tips and general info
- New features expected in 2013
- More than 10,000 downloads