TEXAS RENEWABLE ENERGY INDUSTRIES ASSOCIATION
APRIL 9, 2012

Trip Doggett
President & CEO
ERCOT
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• Capacity/Energy Production
• Successes
  – CREZ
  – West to North Constraint
  – Generation Interconnection
• Challenges
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  – Resource Adequacy
  – Drought
ERCOT OVERVIEW

The ERCOT market covers roughly 85% of Texas’ overall power usage

Record peak demand: **68,379 MW**
• Occurred on August 3, 2011

Total installed wind capacity of **9,838 MW**
• over 18,000 MW of new wind capacity generation requests under review

Wind generation record: **7,917 MW**
• Representing 24% of 33,373MW load at 4:13pm on March 18, 2012
ERCOT Capacity and Energy by Fuel Type

Installed Capacity, January 2012
~ 80,000 MW

Energy Produced, 2011
335 billion kilowatt-hours
SUCCESSES
FIRST INTERCONNECTION AGREEMENT FOR A CREZ SUBSTATION

- Completed March 27, 2012, between Wind Energy Transmission Texas and Stephens Ranch Wind Energy
- Interconnection point is the Long Draw Substation in Borden County
- Wind farm will include 233 turbines for total of 377 MW
- Scheduled for commercial operations in November 2013
LOWER RIO GRANDE VALLEY PROJECT

- **Driver – Reliability Need**
- **Project Components**
  - Lobo-Rio Bravo-N. Edinburg 163 mile single circuit 345 kV line on double circuit structures with 50% series compensation
  - Energized reconductor of Lon Hill-N. Edinburg and Lon Hill-Rio Hondo 345 kV lines
  - Reconfigure N. Edinburg and Rio Hondo series capacitors
- **Cost Estimate - $527 million**
- **Expected in-service - 2016**
CROSS VALLEY 345KV PROJECT

- Driver – Reliability Need
- Project Components:
  - New La Palma-Palo Alto 138 kV line (~12 miles) with a rating of at least 215 MVA
  - New North Edinburg-Loma Alta 345 kV line (double circuit capable with one circuit in place) routed in proximity to the existing South McAllen Substation (~106.5 miles)
  - New 345kV bus at the Loma Alta station with one 345/138kV autotransformer
- Cost estimate = $274.7M
- Expected in-service - 2016
REPORTED IMPACT OF WEST TO NORTH CONSTRAINT IN 2011

Real-Time Transmission Constraints

Top 10 Constraints by Total Congestion Rent

*as reported by the ERCOT Independent Market Monitor  February 21, 2012 Board of Directors report
EXAMPLE OF THE IMPROVEMENT OF USING TSAT AND VSAT ACROSS SEVERAL HOURS

Operators will now be able to control using the “Green” or “Black” limit depending on which is lower in real-time. Over the Planning “Red” this will allow more flow from West to North.

Blue = actual flow
Red = RTMONI (planning old limits)
Black = VSAT (new voltage limit)
Green = TSAT (new stability limit)
BENEFITS OF REAL-TIME TRANSIENT STABILITY ANALYSIS TOOL (TSAT)

TSAT estimated (back casted) reduction in Congestion Rent for 2011 by month

- Actual testing showed between 200 and 500 MW improvements in West to North transfers
- Estimated benefit was calculated using 200 MW as the maximum improvement and using average shadow prices and average limits for each hour
- IMM reported actual Congestion Rent for West to North constraint in 2011 was $95,000,000

Total = $27,000,000

APRIL 9, 2012
ERCOT Wind Installations by Year (as of February 29, 2012)

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 now reflects planned units in calendar year of installation rather than installation by peak of year shown.

- ERCOT is #1 in the U.S. in wind capacity.
- Our capacity is three times the amount of #2 (Iowa).
- If Texas were a separate country, we’d be #6 in the world.
GENERATION INTERCONNECTION ACTIVITY BY FUEL

* Prior to September 2008, Category "Other" included "Solar" and "Biomass"
Projects in all phases of interconnection study are reflected in this graph
Project cancellation tracking by month began in March 2008
NEW RECORDS IN USAGE

New Peak Demand Record: 68,379 megawatts
- 68,379 megawatts (MW), Aug. 3, 2011
- The 2010 peak demand – 65,776 MW, Aug. 23, 2010 – was broken 3 consecutive days:
  - Aug. 1, 2011  66,867 MW
  - Aug. 2, 2011  67,929 MW
  - Aug. 3, 2011  68,379 MW

New Weekend Record
- 65,159 MW, Sunday, Aug. 28
  - 5 percent increase over 2010 previous record – 62,320 MW

Winter Peak Record
- 57,282 MW (February 10, 2011)
  - 3 percent increase over 2010 previous record - 55,878 MW

Wind Record
- A new instantaneous wind record of 7,917 MW occurred on March 18 at 4:13pm.
RESERVE MARGINS: PROJECTING ADEQUACY OF SUPPLY

• 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
METRICS RELATED TO RESOURCE ADEQUACY

Reserve Margin for Capacity in the ERCOT Region

- Installed Capacity
- Natural Gas *
- Solar *
- CSAPR Stay ***
- Planned Units
- Nuclear *
- Wind *
- Coal *
- Other *
- Suspended Projects **

Reserve margin target 13.75%

• 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)
• Updated economic forecast from Moody’s
  – Slower growth in near-term
• Updated assessment of normal weather profile

Average annual peak load growth over next ten years = 2.4% per year
SUMMER PEAK SCENARIOS

2011 Summer Peak Scenarios

- Normal Weather – 63,898 MW

MW

1996 weather
1997 weather
1998 weather
1999 weather
2000 weather
2001 weather
2002 weather
2003 weather
2004 weather
2005 weather
2006 weather
2007 weather
2008 weather
2009 weather
2010 weather
2011 weather
GENERATION OUTAGES: 08/01 – 08/07

ERCOT Outaged Capacity (HSL): 08/01/11 00:00 - 08/07/11 23:59
Pulled: 08/09/11 08:01
**Seasonal Assessment of Resource Adequacy (SARA) Release Schedule**

<table>
<thead>
<tr>
<th>SARA</th>
<th>Preliminary Release</th>
<th>Final Release</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spring</strong> – Mar, Apr &amp; May</td>
<td>November 1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>March 1&lt;sup&gt;st&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Summer</strong> – Jun, Jul, Aug &amp; Sep</td>
<td>May 1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>September 1&lt;sup&gt;st&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Fall</strong> – Oct &amp; Nov</td>
<td>September 1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>November 1&lt;sup&gt;st&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Winter</strong> – Dec, Jan &amp; Feb</td>
<td>September 1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>November 1&lt;sup&gt;st&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

- Release date of final SARA for upcoming season and preliminary SARA for the following season would be aligned.
- Release date of final SARA for Summer and Winter seasons would be one month prior start of season (May 1 and November 1, respectively).
- This results in only four releases per year and sets those dates as March 1, May 1, September 1 and November 1.
## 2012 Summer SARA (Preliminary)

<table>
<thead>
<tr>
<th>Item</th>
<th>Summer 2012</th>
<th>Base Case</th>
<th>Extreme Load &amp; Typical Gen Outages</th>
<th>Extreme Load &amp; Extreme Gen Outages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total Resources</td>
<td></td>
<td>73,301</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Peak Demand</td>
<td></td>
<td>67,492</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Uses of Reserve Capacity</td>
<td>3,814</td>
<td>7,395</td>
<td>9,462</td>
</tr>
<tr>
<td>4</td>
<td>Capacity Available for Operating Reserves* (1-2-3)</td>
<td>1,995</td>
<td>-1,586</td>
<td>-3,653</td>
</tr>
<tr>
<td>5</td>
<td>Demand Adjustment during Scarcity**</td>
<td></td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Adjusted Capacity Available for Operating Reserves (4+6)</td>
<td>2,745</td>
<td>-836</td>
<td>-2,903</td>
</tr>
</tbody>
</table>

*Less than 2300MW indicates risk of EEA1
**Represents effects of price responsive demand, conservation appeals, demand programs, etc. based on summer 2011 experience; does not include Load Resources or EILS activation
**RESOURCE ADEQUACY MITIGATION ACTIONS**

**Completed**
- Online Non-Spin standing deployment & offer floor
- Offline Non-Spin offer floor
- Responsive Reserve & Regulation Up offer floor
- Institutionalize the process to recall units for capacity
- Pricing of energy for RUC units deployed for capacity at SWCAP
- Expansion of Responsive Reserve with a corresponding reduction in Non-Spin

**Work In Progress**
- The proper magnitude and slope of the Power Balance Penalty Curve
- Review raising the System Wide Offer Cap
- Low Sustainable Limit problem for units RUC’ed online for capacity
- Compensation for Reliability Unit Commitments made to provide local reliability and transmission relief and address the issue of whether and how RUC claw-back should be adjusted
- Review Peaker Net Margin Cap
- Demand Response & Load Management Initiatives
- Posting non-binding near real-time forward prices
- Brattle Group Study
RESOURCE ADEQUACY STUDY

• **Scope**
  – Identify and examine the factors that influence investment decisions related to the financing and development of projects to meet ERCOT’s resource adequacy goals. Consider supply-side and demand-side resources, from both a wholesale and retail perspective.
  – Provide suggestions for ways to enhance favorable investment outcomes for long-term resource adequacy in ERCOT

• **Estimated Project Completion** – June 01, 2012

• **Approach**
  – Interview stakeholders regarding investment criteria and concerns
  – Analyze likely outcomes under current and proposed rules
  – If we find that resource adequacy shortfalls are likely, evaluate the pros and cons of a range of policy options
DROUGHT
The 2011 Texas Drought

Excerpts from Oct 2011 Report by Office of State Climatologist:

- Large portion of Texas will likely endure a second summer of drought.
- 2011-12 La Niña is forecasted to be less intense than 2010-11.
- It is impossible to determine at this point whether the drought will last beyond a second year.
  - On rare occasions in the past, La Niña conditions were observed for 3 consecutive years.
- Texas precipitation is also influenced by Pacific Decadal Oscillation & Atlantic Multidecadal Oscillation.
  - During the past decade, both patterns have been in an unfavorable state.
- Global patterns tend to reverse themselves over time, possibly leading to an extended period of wetter weather for Texas, though this may not happen for another 3-15 years.
ERCOT ACTIONS TO MANAGE DROUGHT IMPACT

- Surveyed generation entities in the state and reviewed drought concerns and possible mitigations
- Identified surface water most impacted and projected impacts to generation for 2012
- Reviewed public sources regarding state and regional water plans
- Met with TCEQ staff and drought response teams
- Facilitated a workshop with generation and transmission entities to share best practices relevant to drought conditions
SURFACE WATER SUPPLIES AT 10 YEAR LOWS (OCT 2011)

SURFACE WATER RESERVOIRS AT 10 YEAR LOW
(as of Oct. 2011)

LAKE GRANBURY
983 MW

BARDWELL LAKE
312 MW

LAKE RAY HUBBARD
916 MW

LAKE LIMESTONE
1,689 MW

MARTIN LAKE
2,425 MW

TWIN OAKS RESERVOIR
1,616 MW

LAKE HOUSTON
1,016 MW

LAKE TEXANA
56 MW

LAKE COLORADO CITY
407 MW
<table>
<thead>
<tr>
<th>Surface Water &amp; (MW)</th>
<th>*Level @ Full Conservation Pool</th>
<th>*Level on Jan 1, 2011</th>
<th>*Level on Oct 7, 2011</th>
<th>*Level on Apr 01, 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Texana (56)</td>
<td>44.50</td>
<td>41.00</td>
<td>32.81</td>
<td>44.05</td>
</tr>
<tr>
<td>Bardwell Lake (312)</td>
<td>421.00</td>
<td>420.71</td>
<td>416.23</td>
<td>425.47</td>
</tr>
<tr>
<td>Lake Colorado City (407)</td>
<td>2,070.20</td>
<td>2057.33</td>
<td>2052.4</td>
<td>2,051.70</td>
</tr>
<tr>
<td>Lake Ray Hubbard (916)</td>
<td>435.50</td>
<td>432.37</td>
<td>429.22</td>
<td>435.55</td>
</tr>
<tr>
<td>Lake Granbury (983)</td>
<td>693.00</td>
<td>691.90</td>
<td>686.27</td>
<td>692.72</td>
</tr>
<tr>
<td>Lake Houston (1016)</td>
<td>41.73</td>
<td>42.10</td>
<td>36.76</td>
<td>42.14</td>
</tr>
<tr>
<td>Twin Oaks Reservoir (1616)</td>
<td>401</td>
<td>398.87</td>
<td>398.27</td>
<td>401.02</td>
</tr>
<tr>
<td>Lake Limestone (1689)</td>
<td>363</td>
<td>359.03</td>
<td>354</td>
<td>363.17</td>
</tr>
<tr>
<td>Martin Lake (2425)</td>
<td>306</td>
<td>300.48</td>
<td>295.06</td>
<td>301.68</td>
</tr>
</tbody>
</table>

* In Feet above Mean Sea Level
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu
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http://droughtmonitor.unl.edu

Released Thursday, April 5, 2012
Brian Fuchs, National Drought Mitigation Center
MANAGING DROUGHT IMPACT – GENERATION SECTOR ACTIONS INCLUDE …

- Generators are designed to
  - Conserve – minimize water usage
  - Reuse – Reuse water from one process for another
  - Recycle – Return clean water to the source after usage
- Generators regularly account for all water withdrawn to regulatory authorities
- Many generators utilize salt water or effluent, where practical
- Generators regularly maintain equipment to avoid water leakage/wastage
- A couple of generators have installed pipelines to access accumulated (from rain & seepage) water at mine sites
- Some generator resources are re-engineering their water intake structures to allow for deeper intake level conditions
Managing Drought Impact – Transmission Sector Concerns Include …

- Increased insulator contamination incidents (salt, smoke, bird excrement, etc.)
- Fires, smoke implications, vegetation management, and risks to wooden h-frame infrastructure
- Potential issues associated with transmission system planning if there are significant generator de-rations
- Coordination with the local authorities (police, fire, etc.) requesting de-energizing of transmission facilities for safety to allow for aerial firefighting.
DROUGHT CONCLUSIONS

• Persistent drought conditions are impacting electric generation resources, but are unlikely to cause significant generation shortfalls in 2012

• If the drought continues into 2013, consequences to electric generation availability are likely to become more severe

• ERCOT will continue to analyze survey results and will continue to keep regulatory authorities well-informed
Did you know real time grid information is available through social media?

Facebook: Electric Reliability Council of Texas

Twitter: http://twitter.com/ercot_iso