

# **Grid Challenges and Energy Storage— the Lone Star State Perspective....**

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# Grid Challenges and Energy Storage

- ERCOT's "Grid Challenge" is a "Peak" or "Super Peak" Load Problem.
  - ERCOT's December 2012 Capacity, Demand and Reserves Report (Dec. 2012 CDR) shows ERCOT falling below its target capacity reserve margin of 13.75% in 2013.
  - My analysis of ERCOT's Dec. 2012 CDR can be found in Attachment "A" this presentation, and shows ERCOT doesn't fall below its target capacity reserve margin until after 2018.
- Renewable Energy Generation in Texas is growing rapidly, particularly Wind Energy Generation in ERCOT.
- Storage can help address and manage the resulting challenge.

# Renewable Energy and Storage in Texas and ERCOT

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- Renewable energy in Texas is growing fast:
  - 13% higher in 2011 than in 2010, and
  - approximately 8% higher in 2012 than in 2011.
- ERCOT and Wind Energy:
  - *2012 Wind Generation in ERCOT was nearly 30 TWh (terrawatt-hours or millions of MWhs)*
  - ERCOT has over 10GW of installed wind capacity (372 MW added in Dec. 2012)
  - Wind represents about 12.38% of ERCOT's installed generation capacity.
  - Most wind generation of any state and fifth highest in the world.
  - Wind averaged about 9.2% of ERCOT's total generation in 2012.
  - *New wind generation records occur regularly:*
    - ✦ 7,403 MW on March 6, 2012 – 24% of load
    - ✦ 7,599 MW on March 7, 2012 - 22% of load
    - ✦ 7,917 MW on March 18, 2012 – 24% of load
    - ✦ 8,521 MW on November 10, 2012 – 26% of load
    - ✦ 8,838 MW on January 2, 2013 – 26% of load
    - ✦ 9,481 MW on February 13, 2013 – nearly 28% of load.

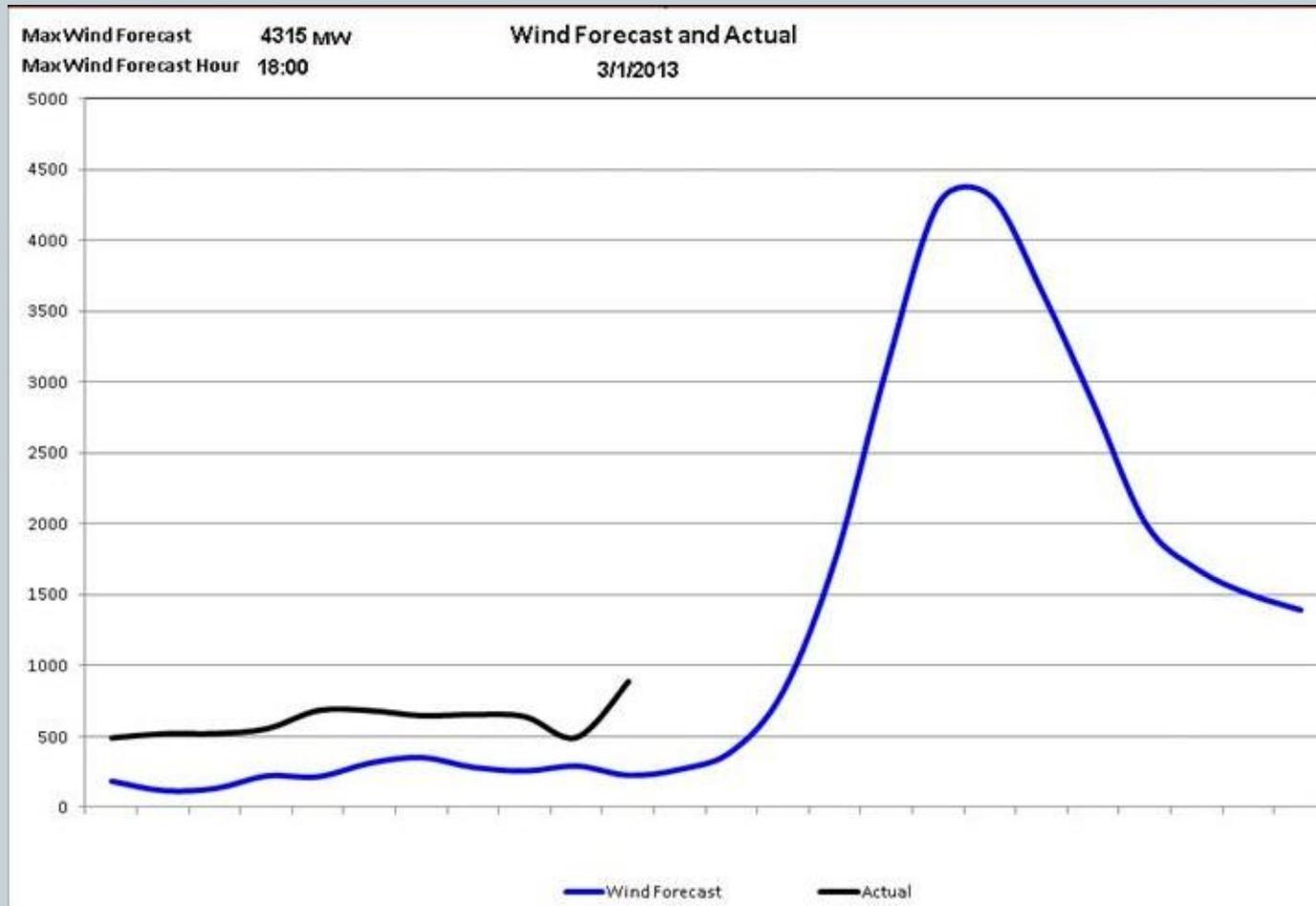
# Wind Energy and Storage

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- *The next two slides demonstrate, ERCOT's wind generation is sometimes very intermittent, which increases the complexity of ERCOT's "super peak" grid challenge*

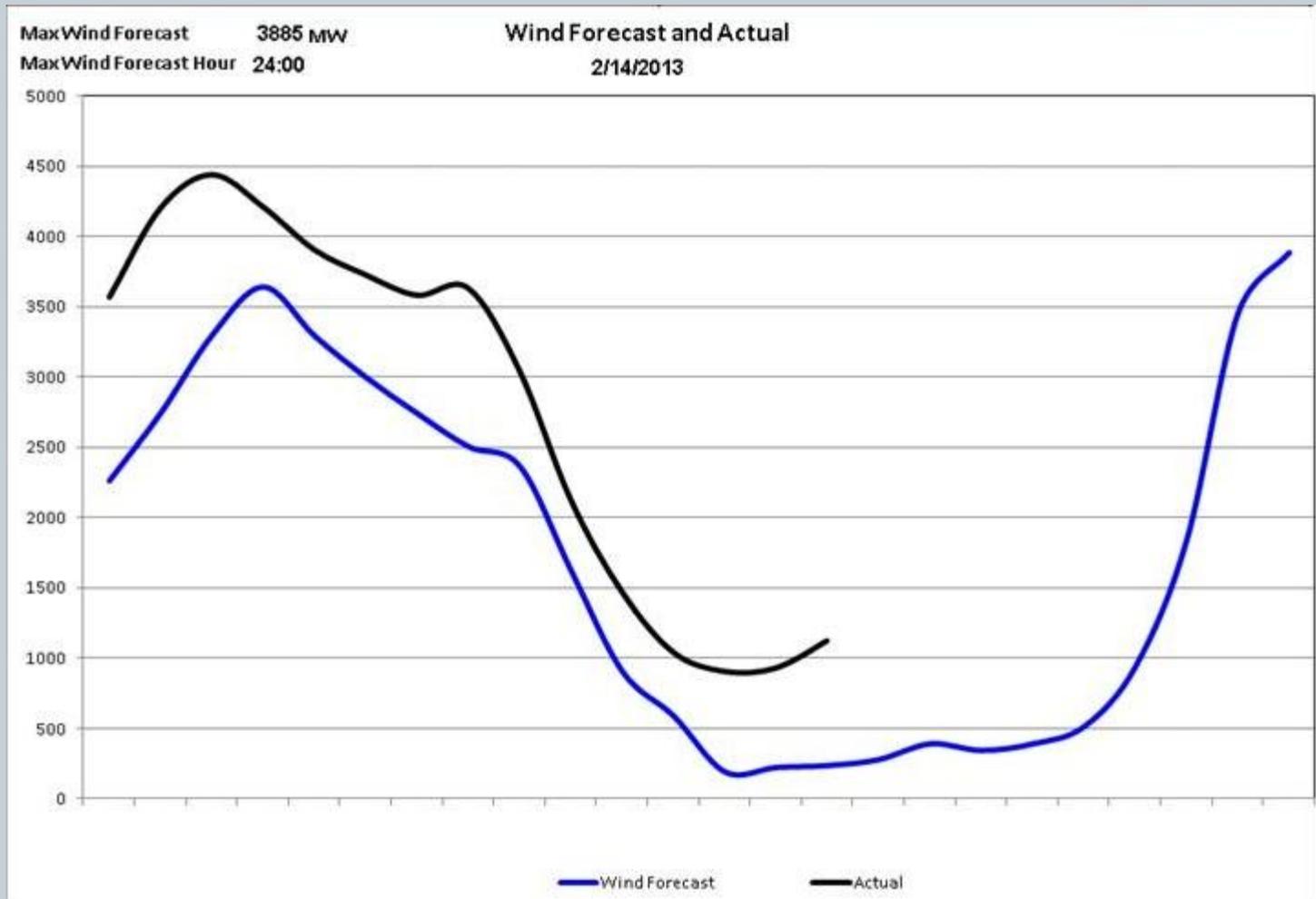
# Example: Sharp Wind Generation Increase

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# Example: Sharp Wind Generation Decrease

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# Energy Storage Benefits

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- Storage, particularly utility scale projects, can facilitate the integration of intermittent renewables into the ERCOT Grid.
- Some storage facilities are co-located with wind generation facilities, so that they can maximize the arbitrage between charging the storage facility during off-peak hours and selling energy during peak hours.

# Recent Developments in Energy Storage: Texas Law

- Texas Legislature enacted storage legislation effective September 1, 2011:
  - TEX. UTIL. CODE. ANN. §§ 35.151 – 152 (Vernon 1998 & Supp. 2011) (PURA)
- Applies to energy storage equipment and facilities that intend to provide energy or ancillary service in ERCOT
- Classifies energy storage facilities as “generation assets”
- Requires the owner of “generation assets” to register with the PUCT, unless registered with FERC.
- Entitles Energy Storage facilities to:
  - Interconnection
  - Obtain transmission service
  - Sell electricity at wholesale.

# PUCT and Energy Storage

- September 21, 2011: opened a general project dealing with issues around energy storage and emerging technologies – **Project No. 39764**
  - Requested and received comments on:
    - ✦ The issues the PUCT should address, and
    - ✦ The actions the PUCT and ERCOT should take to facilitate the deployment and use of energy storage facilities in ERCOT.
  - Requested and received a second set of comments on questions related to *“changes to the [PUCT’s] rules that would eliminate barriers to energy storage, encourage participation by energy storage providers, or clarify ambiguities in current [PUCT] rules relating to energy storage.”*
- **Example Commenters:**
  - Chamisa CAES at Tulia, LLC and Apex CAES, LLC
    - ✦ 270+ MW projects,
    - ✦ Fully dispatchable, and
    - ✦ Business plan = Arbitrage between peak and off-peak pricing.
  - AES Energy Storage
    - ✦ Planned battery storage facility,
    - ✦ 40 MW in Houston zone, CenterPoint’s service area,
    - ✦ Fast and flexible, and
    - ✦ Business plan = Providing ancillary service for grid stability (regulation and spinning reserves).

# PUCT and Energy Storage –Rule Changes

- As a result of Project No . 39764, the PUCT opened several rule projects to implement changes.
- **Project No. 39917** - adopted amendments to two substantive rules in March 2012.
- **(1) P.U.C. SUBST. R. 25.192 :**
  - Wholesale storage (i.e. charging an energy storage facility) is exempt from transmission service rates, and
  - Wholesale storage load is excluded from ERCOT’s 4CP demand calculations.
- **(2) P.U.C. SUBST. R. 25.501(m):**
  - Defines “wholesale storage” as occurring when :
    - ✦ electricity is used to charge a storage facility,
    - ✦ the storage facility is separately metered from all other facilities including auxiliary facilities; and
      - If a storage facility has more than one delivery point, ERCOT shall net the impact of the delivery points for settlement purposes.
    - ✦ energy from the electricity is stored in the storage facility and subsequently re-generated and sold at wholesale as energy or ancillary services.

# PUCT and Energy Storage – Rule Changes

- Wholesale storage is wholesale load and ERCOT was directed to settle accordingly :
  - ✦ PURA 35.152 requires that storage facilities entitled to be treated like other generation facilities in the sale of energy and ancillary services at wholesale.
  - ✦ Commission decided that energy acquired to charge a storage facility is to be treated as wholesale because energy acquired for storage and resale is not “consumed” as provided in the definition of a “retail customer” in PURA.
  - ✦ Settlement prices:
    - Nodal price settlement if the facility is connected at the transmission level.
    - If connected at the distribution level, settlement prices would be the nodal price at the nearest electrical bus that connects to the transmission system.
- Wholesale storage (i.e. charging the energy storage facility) is not subject to retail tariffs, rates and charges or fees assessed in conjunction with the retail purchase of electricity.
- Wholesale storage will not be subject to ERCOT charges and credits associated with ancillary service obligations or other load ratio share or per megawatt-hour based charges and allocations.
- The owner or operator of electric storage equipment or facilities will not make purchases of electricity for storage during a system emergency declared by ERCOT unless ERCOT directs that such purchases occur.

# PUCT and Energy Storage – Rule Changes

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- Any storage facility that attempts to interconnect ERCOT with another power region must obtain a declaratory order from FERC providing that the facility would not affect FERC jurisdiction over ERCOT.
- **Project No. 40150:** adopted amendments to **P.U.C. SUBST. R. 25.361(k)** on May 18, 2012.
- Authorized ERCOT to:
  - Conduct pilot projects, and
  - Grant temporary exceptions from ERCOT rules, as necessary, to effectuate the purposes of a pilot project.

# ERCOT Actions and Energy Storage

- **December 2012:**
  - Approved NPRR No. 461;
    - ✦ Protocol revisions necessary to implement energy storage settlement “Wholesale Storage Load” consistent with the PUCT’s amendments to P.U.C. SUBST. R. 25.192 and P.U.C. SUBST. 25.501 (auto-settlement).
      - Expect completion in late 2013
    - ✦ Limits Wholesale Storage Load to batteries, flywheels, compressed air energy storage, pumped hydro-electric power and electro chemical capacitors.
    - ✦ Exempts compressed air storage facilities from the requirement that the facility be electrically connected to a common switchyard for purposes of netting (400 yard rule).
- **January 2013:**
  - Approved ad hoc settlement process (effective mid-February 2013) for storage facilities that are operational before auto-settlement is effective.

# ERCOT Energy Storage Projects

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- **Currently Operational Energy Storage Facilities:**
  - Deepwater Horizon (AES), a 1MW facility in operation since 2010 (behind the meter), and
  - NoTrees (Extreme Power and Duke Energy), a 36 MW facility in operation since December 2012 (in Winkler County).
    - ✦ Participant in ERCOT's Fast-Responding Regulation Service (FRRS) Pilot.
    - ✦ A form of Regulation Service requiring resources to respond within 60 cycles of an instruction or triggering event.
    - ✦ When providing FRRS, pulls or discharges energy to help maintain ERCOT system frequency.
  
- **Planned Energy Storage Facilities:**
  - Deepwater Energy Storage (AES)
    - ✦ 40 MW
    - ✦ Battery
    - ✦ July 2013
    - ✦ Included in the Dec. 2012 CDR
  - Three other confidential projects:
    - ✦ Total of 874 MW
    - ✦ Compressed Air
    - ✦ 2014 and 2015

# Contact Information

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**2012 Report on the Capacity, Demand, and Reserves in the ERCOT Region  
December Update**

Load Forecast:	2013	2014	2015	2016	2017	2018
<b>Firm Load Forecast, MW</b>	<b>65,952</b>	<b>67,592</b>	<b>69,679</b>	<b>71,613</b>	<b>72,637</b>	<b>73,214</b>
<b>Annual Load Growth</b>	<b>1,334</b>	<b>1,640</b>	<b>2,087</b>	<b>1,934</b>	<b>1,024</b>	<b>577</b>
<b>Annual % Demand Growth</b>	<b>2.1%</b>	<b>2.5%</b>	<b>3.1%</b>	<b>2.8%</b>	<b>1.4%</b>	<b>0.8%</b>

Dec. 10, 2012 CDR

	2013	2014	2015	2016	2017	2018
<b>Total Existing Resources</b>	<b>74,633</b>	<b>74,943</b>	<b>76,974</b>	<b>77,703</b>	<b>78,742</b>	<b>78,435</b>
less Switchable Units Unavailable to ERCOT, MW	0	0	0	0	0	0
1 Calpine Unit expansions	0	520	520	520	520	520
2 CPS solar	25	43	95	148	200	200
3 Austin Energy Sand Hill Peakers	0	0	0	0	200	200
4 LCRA Ferguson Plant	0	0	0	0	0	0
5 Summit Power - Net to Grid	0	0	0	0	0	0
6 STEC Peakers	0	0	200	200	200	200
7 minus coletto creek	0	0	0	0	0	0
8 minus las brisas	0	0	0	0	0	0
9 GDF suez uprates	134	134	134	134	134	134
10 Sharyland DC Tie expansion	0	0	0	0	0	0
11 NRG Peaker	75	75	75	75	75	75
12 actual incremental Load Response seen in 2012	0	0	0	0	0	0
13 additional wind	0	0	0	0	0	0
14 Deeley Retirement by CPS Energy	0	0	0	0	0	0
15 Frontera TIAC uprate	45	45	45	45	45	45
16 NoTrees Battery Storage	0	0	0	0	0	0
17 RRE Solar delay	0	0	0	0	0	0
18 BPUB Tenaska Plant	0	0	0	800	800	800
19 Coastal wind at 32.9% ELCC net add'l MW *	408	496	496	496	496	496
20 Non-coastal wind at 14.2% ELCC net add'l MW *	512	541	582	602	602	602
subtotal	1,199	1,853	2,147	3,020	3,272	3,272
<b>Total Resources</b>	<b>75,832</b>	<b>76,796</b>	<b>79,121</b>	<b>80,723</b>	<b>82,014</b>	<b>81,707</b>
<b>Reserve Margin (December 2012 Report)</b>	<b>13.2%</b>	<b>10.9%</b>	<b>10.5%</b>	<b>8.5%</b>	<b>8.4%</b>	<b>7.1%</b>
<b>Reserve Margin (with above new resources)</b>	<b>15.0%</b>	<b>13.6%</b>	<b>13.6%</b>	<b>12.7%</b>	<b>12.9%</b>	<b>11.6%</b>
<b>Remaining Mothballed Capacity with return of less than 6 mos</b>	<b>1,720</b>	<b>1,563</b>	<b>1,431</b>	<b>1,754</b>	<b>2,095</b>	<b>2,402</b>
<b>Reserve Margin (with above &amp; mothballed with &lt;6 mo return)</b>	<b>17.6%</b>	<b>15.9%</b>	<b>15.6%</b>	<b>15.2%</b>	<b>15.8%</b>	<b>14.9%</b>

Accounted for in Dec. 2012 CDR (-317 MW)

Public announcement, not in Dec. 2012 CDR

Public announcement, not in Dec. 2012 CDR, assumed 50% Effective Load Carrying Capacity (ELCC)

Referenced in Austin rate review documents posted on City of Austin website, not in Dec. 2012 CDR

Included in Dec. 2012 CDR (116 MW)

Included in Dec. 2012 CDR (240 MW)

Referenced in Platts and other media, not in Dec. 2012 CDR

Accounted for in Dec. 2012 CDR (cancelled) (-660 MW)

Accounted for in Dec. 2012 CDR (air permit cancelled) (-1,240 MW)

Per recitation in Voluntary Mitigation Plan

Included in Dec. 2012 CDR (75 MW)

Public announcement, not in Dec. 2012 CDR (filed IA 12-12-12)

Included in Dec. 2012 CDR (300 MW)

Included in Dec. 2012 CDR (62 MW)

Accounted for in Dec. 2012 CDR, retiring after 2018 (-845 MW)

Public announcement - 10/4/2012

Included in Dec. 2012 CDR (36 MW)

Accounted for in Dec. 2012 CDR (cancelled) (-60 MW)

Public announcement, not in Dec. 2012 CDR

ERCOT Staff's recommended coastal wind ELCC based on ERCOT's 2012 Loss of Load Probability Study.

ERCOT Staff's recommended non-coastal wind ELCC based on ERCOT's 2012 Loss of Load Probability Study.

Available mothballed capacity not already included in Dec. 2012 CDR, by year

Does not include Sargas Texas 250 MW project announced October 25, 2012 - possible operational date of 2015

Does not include 700 MW La Paloma power plant project in discussion for tax abatements.

Does not include 652 MW of new generation from two compressed air energy storage (CAES) systems that have applied for EPA Green House Gas permits.

Does not include 80 MW 30-Minute ERS Pilot.

\* Note: On January 18, 2013, ERCOT staff presented the results of the 2012 Loss of Load Study to the Generation Adequacy Task Force, and recommended a 14.2% ELCC for non-coastal wind resources and a 32.9% ELCC for coastal wind resources.

**ATTACHMENT "A"**

**KWA REVISED PROJECTED DEC. 2012 CDR**