



ERCOT Energy Prices and Market Update

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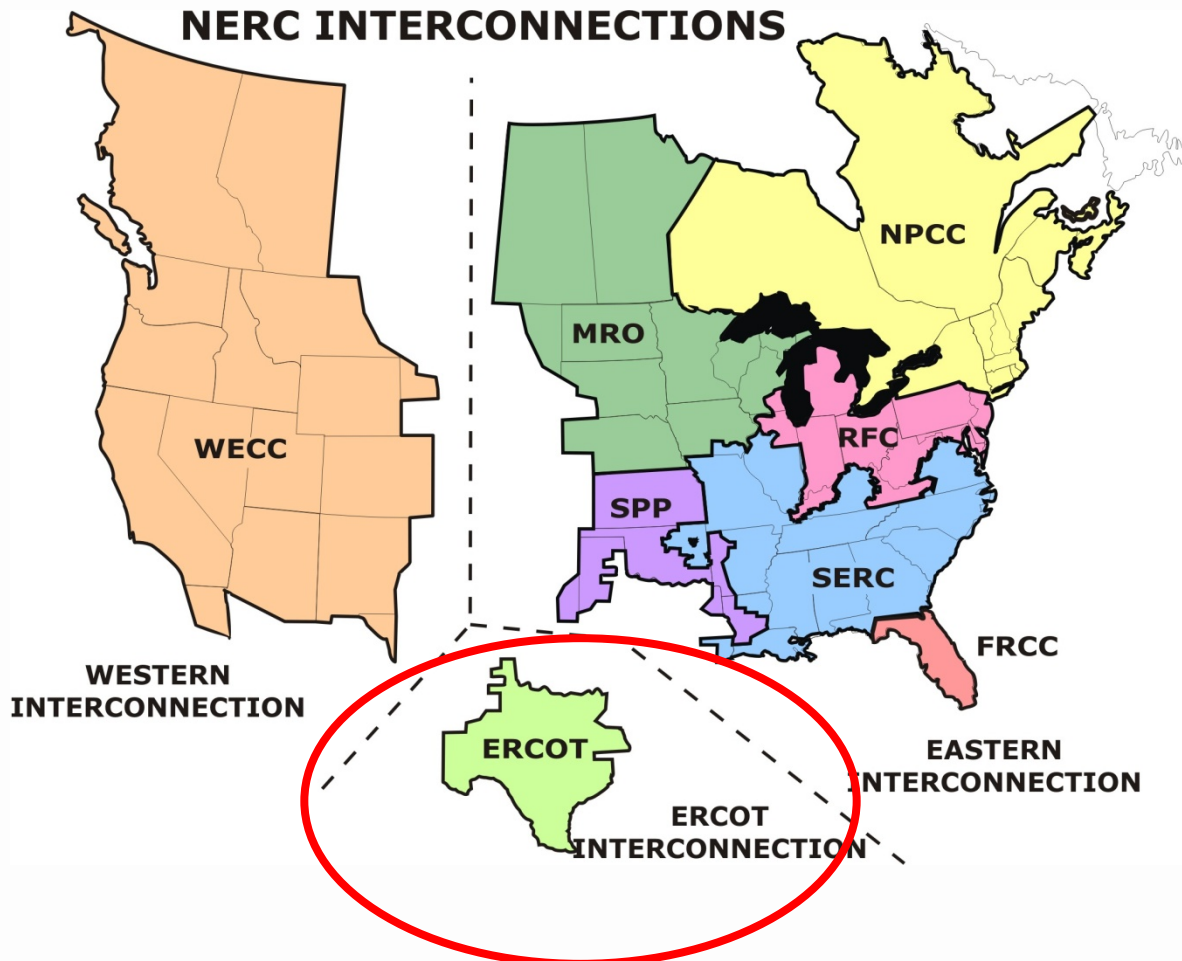
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North American Interconnected Grids

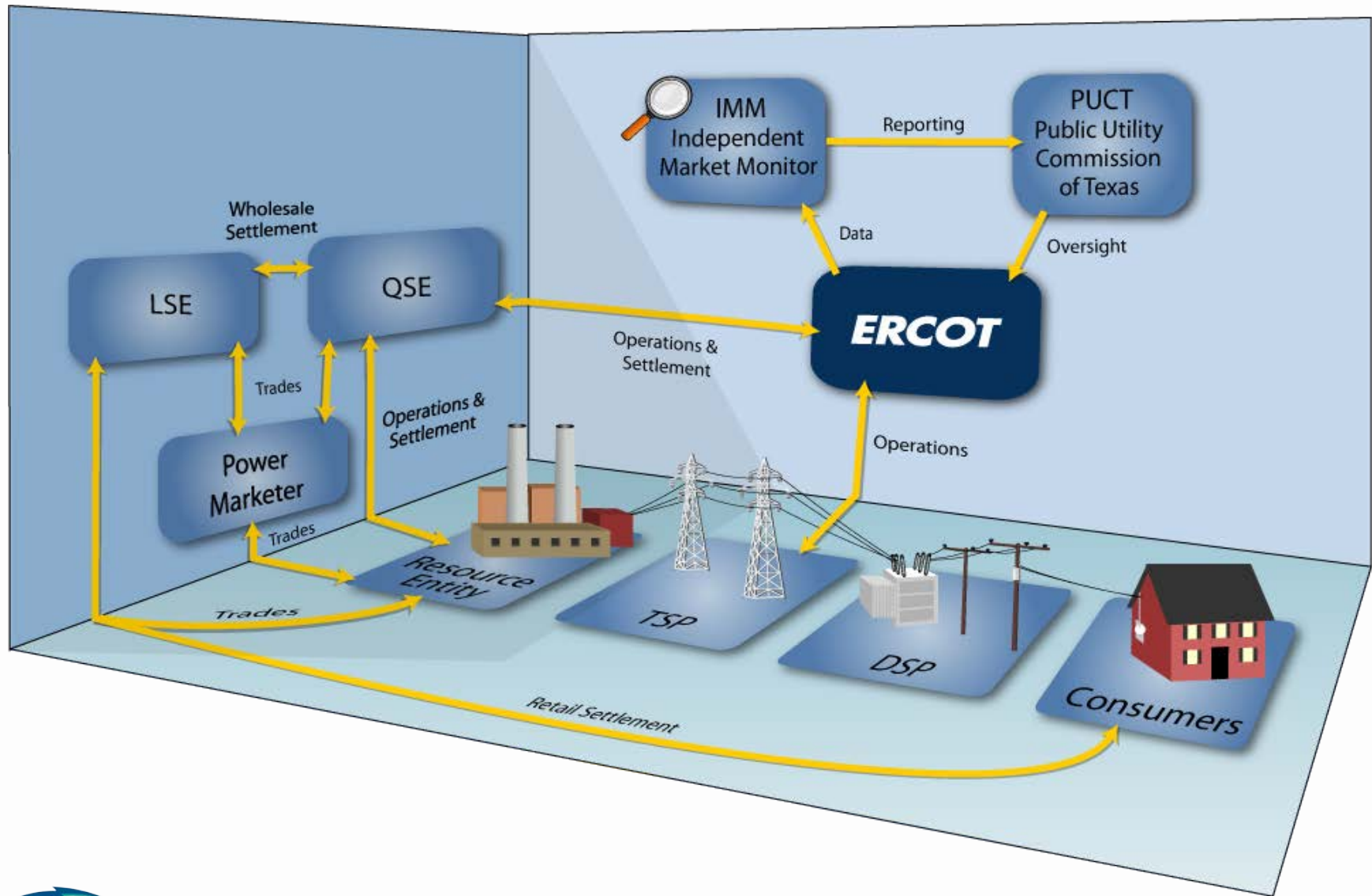


- The ERCOT Region is one of 3 North American grid interconnections
- Electric Reliability Council of Texas – the ERCOT grid:
 - Covers 75% of Texas land
 - Serves 85% of Texas load
 - >40,000 miles of transmission lines
 - >550 generation units
 - Physical assets are owned by transmission providers and generators, including municipal utilities and cooperatives
 - Peak Load Aug 3, 2011 68,294 MW 4-5pm average

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



ERCOT Relationships



Questions to be answered

- **Is the ERCOT market running efficiently?**
- **How are the wholesale energy prices in Texas?**
- **What is going on in the media with West Texas prices and concerns?**
- **Are the new CREZ lines connecting wind to population centers helping?**
- **What is the discussion and concern around resource adequacy?**
- **Are smart meters and load able to relieve the Peak Loads?**

Outline of Discussion

- **ERCOT Market Operations and Prices for 2012**
- **Transmission Constraint Costs and Markets**
- **Recent Market Design Changes**
- **Future Market Design Changes**

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ERCOT Real-Time Market (every 5 minutes)

Real-Time Market

Allow grid operator to satisfy real time demand by clearing energy offers in real-time and to dispatch ancillary services to maintain frequency

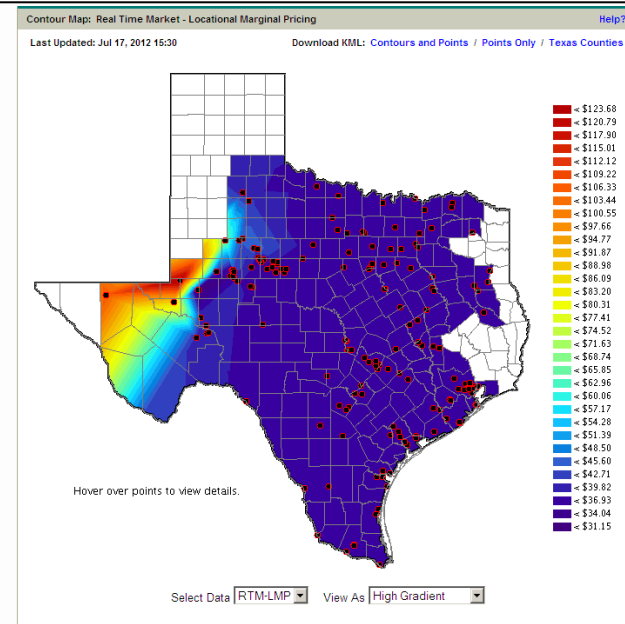
ERCOT Real-Time Market attributes:

- Executes every 5 minutes, settled on 15-minute interval to meet system demand
- Frequency control every 4-seconds with regulation services
- Offer cap of \$5,000 for energy
- Real-Time offers mitigated where transmission constraints are subject to non-competitive solutions (2-step clearing process mitigation)

Real-Time Market:

- Usually only has a handful of constraints activated by Operator
- On average overall lower price, but more volatile (shorter higher spikes)

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Last Updated: Jul 17, 2012 17:05

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Real-time Market

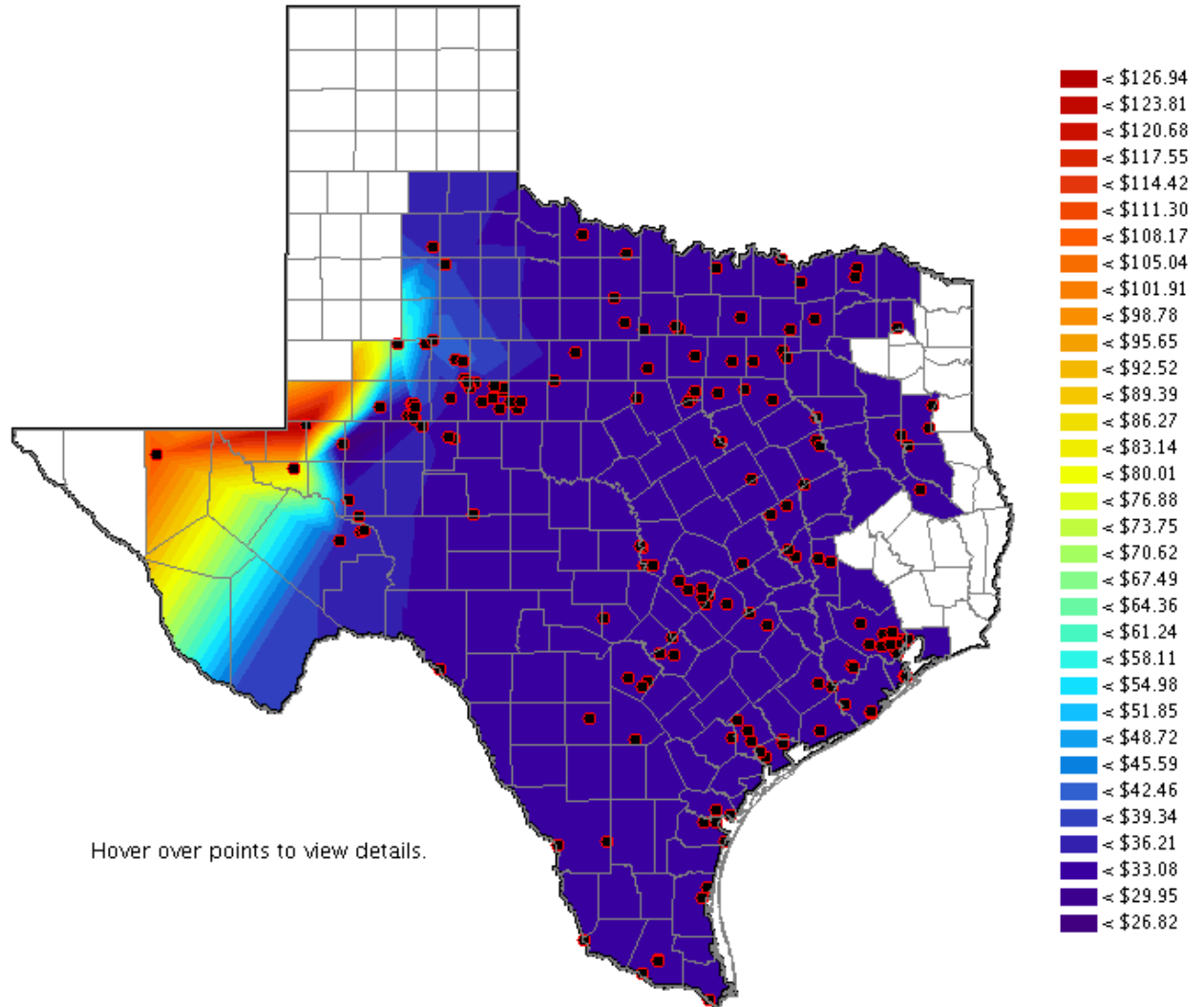
Average price = \$32

Price range is \$26-126

Public Link:

<http://www.ercot.com/content/cdr/contours/rtmLmpHg.html>

Price for every MWh consumed at meter.



Hover over points to view details.

Select Data View As



ERCOT Day-Ahead Market (next day market)

Day- Ahead Markets

Allow companies to buy/sell energy and ancillary services from a single source and hedge against real-time pricing

Services= Up/Down Regulation(4-sec), Responsive(10-min), Non-Spinning (30-min)

ERCOT Day Ahead Market attributes:

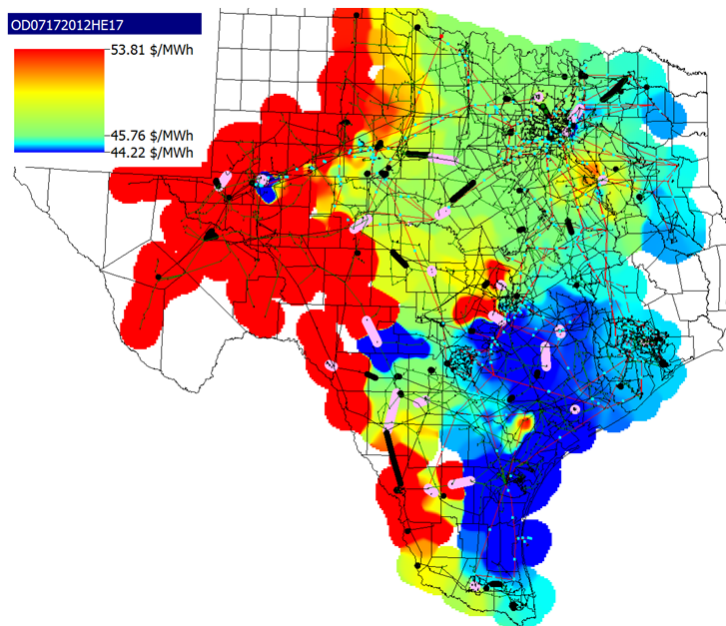
- Voluntary market- solution co-optimizes across energy, ancillary services, and congestion instruments
- Auctioned Congestion Revenue Rights are settled in Day-Ahead

Day-Ahead Market

- Usually has 50-100 binding constraints
- Higher average cost to lock-in
- Less volatile

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OD 07-17-2012 HE17 TUESDAY



OD 07-17-2012 HE17 TUESDAY

Day-Ahead Market

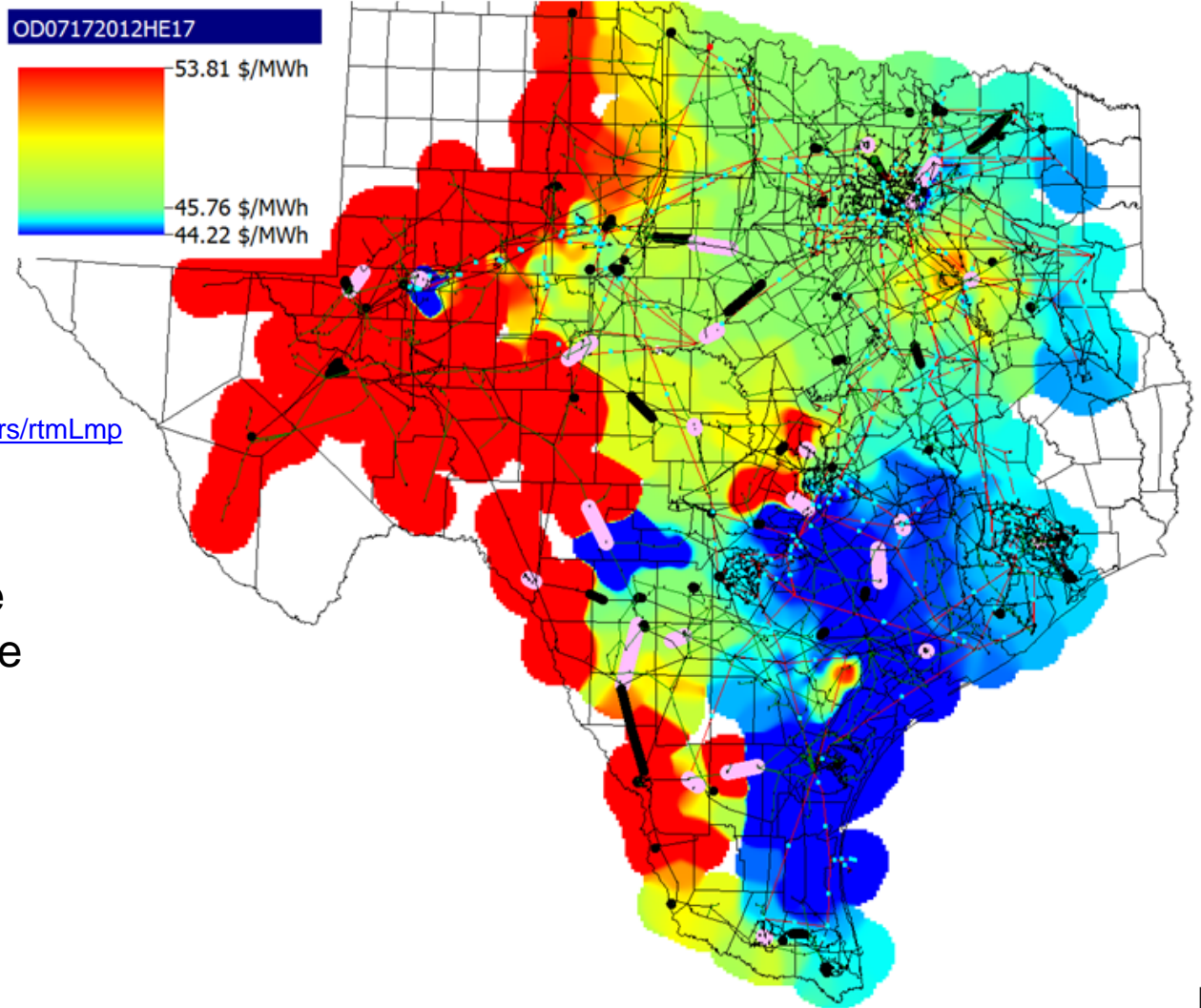
Average price = \$46

Price range is \$44-53

Public Link:

<http://www.ercot.com/content/cdr/contours/rtmLmpHg.html>

Voluntary Market is more expensive, but locks price



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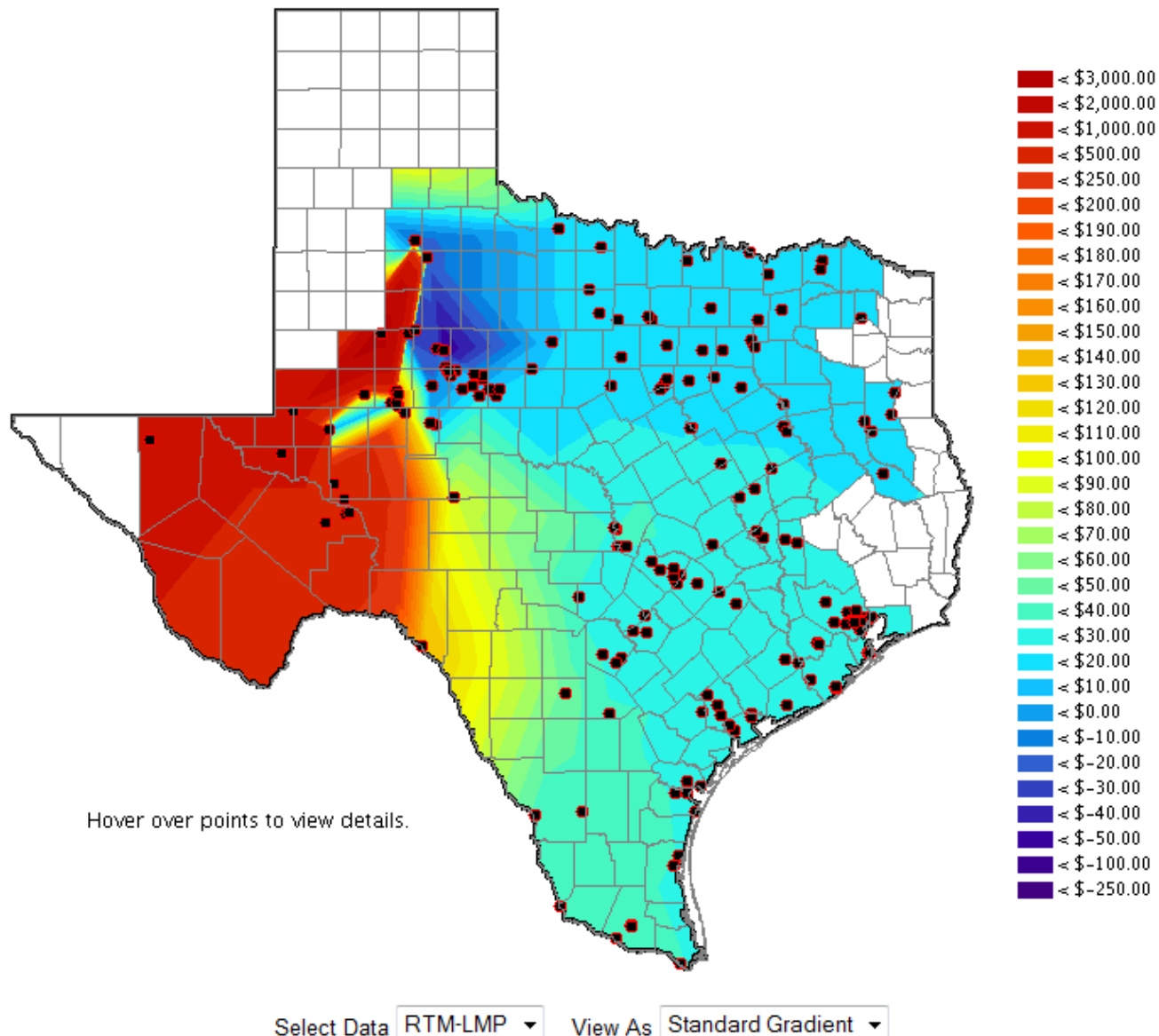
Question:

How high can prices get?

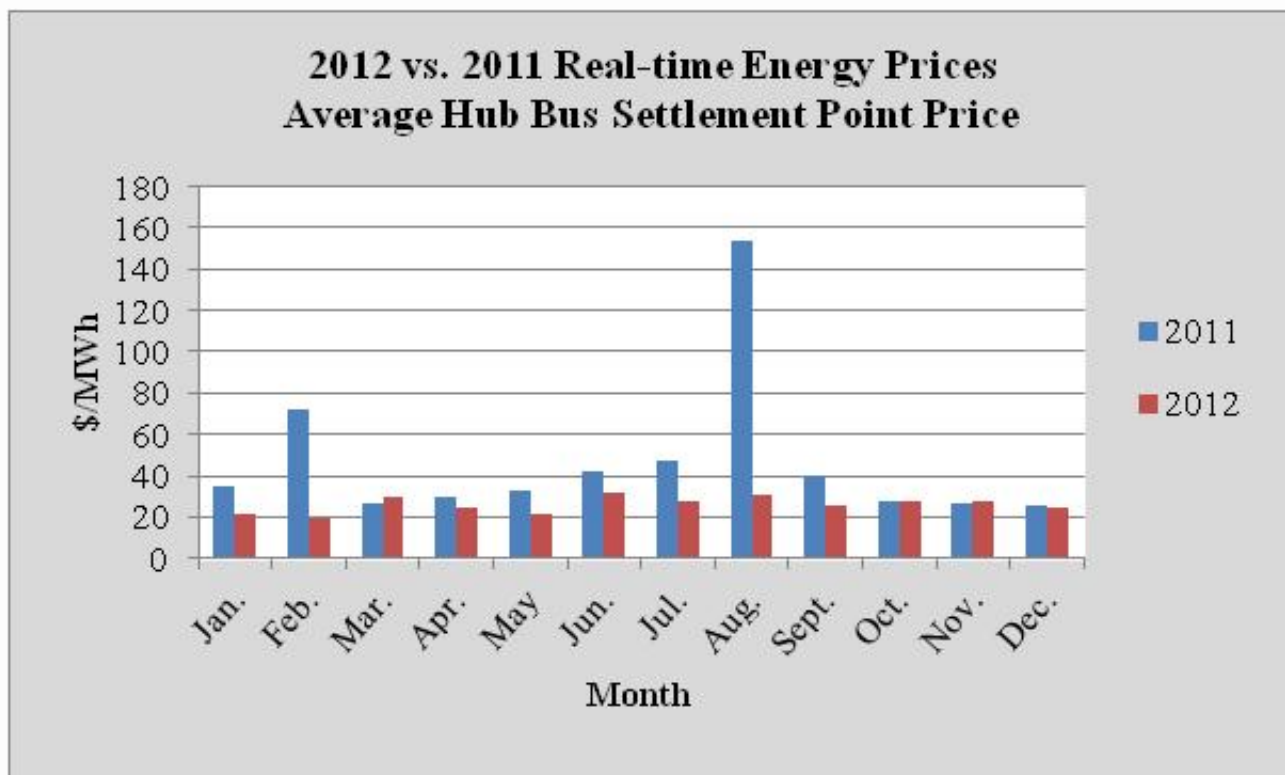
Answer:

As high as the offer cap or higher if congestion

It is worth noting that when ERCOT runs out of energy offers, the prices administratively set to the offer cap.



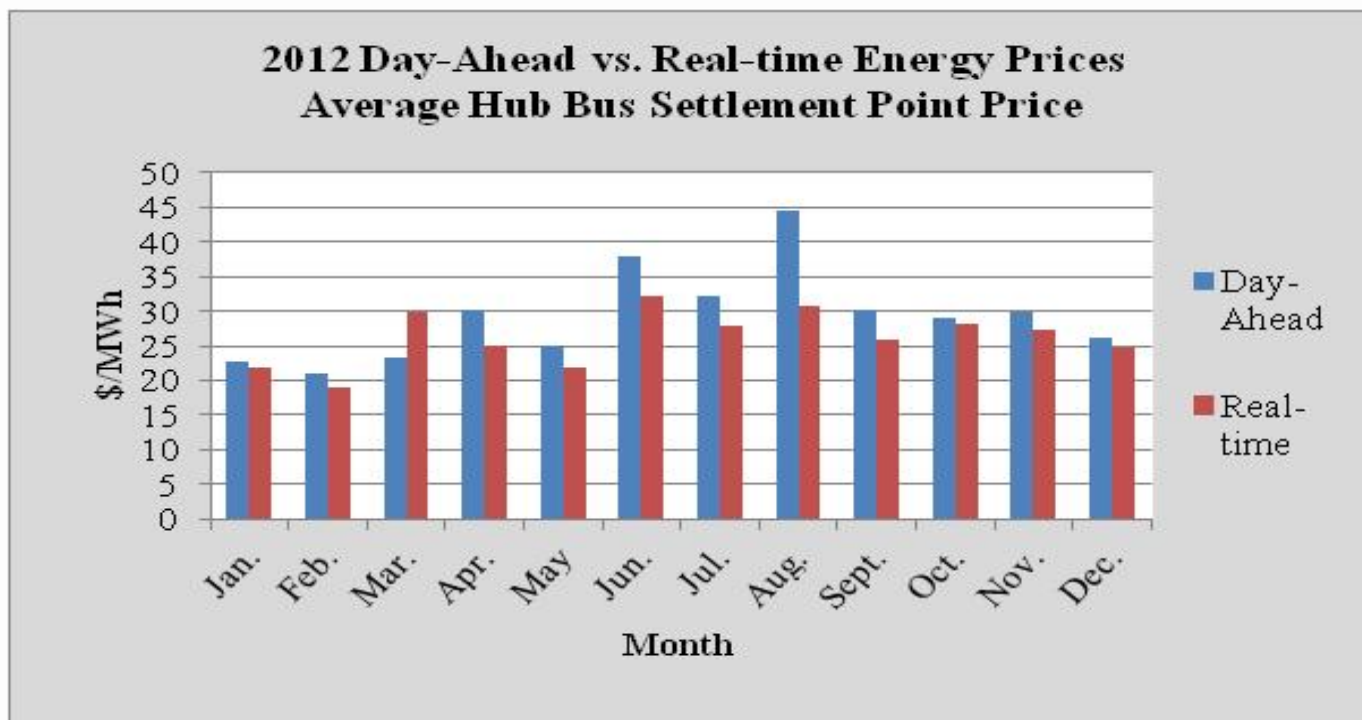
ERCOT Market Comparison 2011 and 2012



Observations:

- Moderate weather and steady fuel prices created lower average energy prices in 2012 than in 2011

ERCOT Day-Ahead vs Real-Time Pricing



Observations:

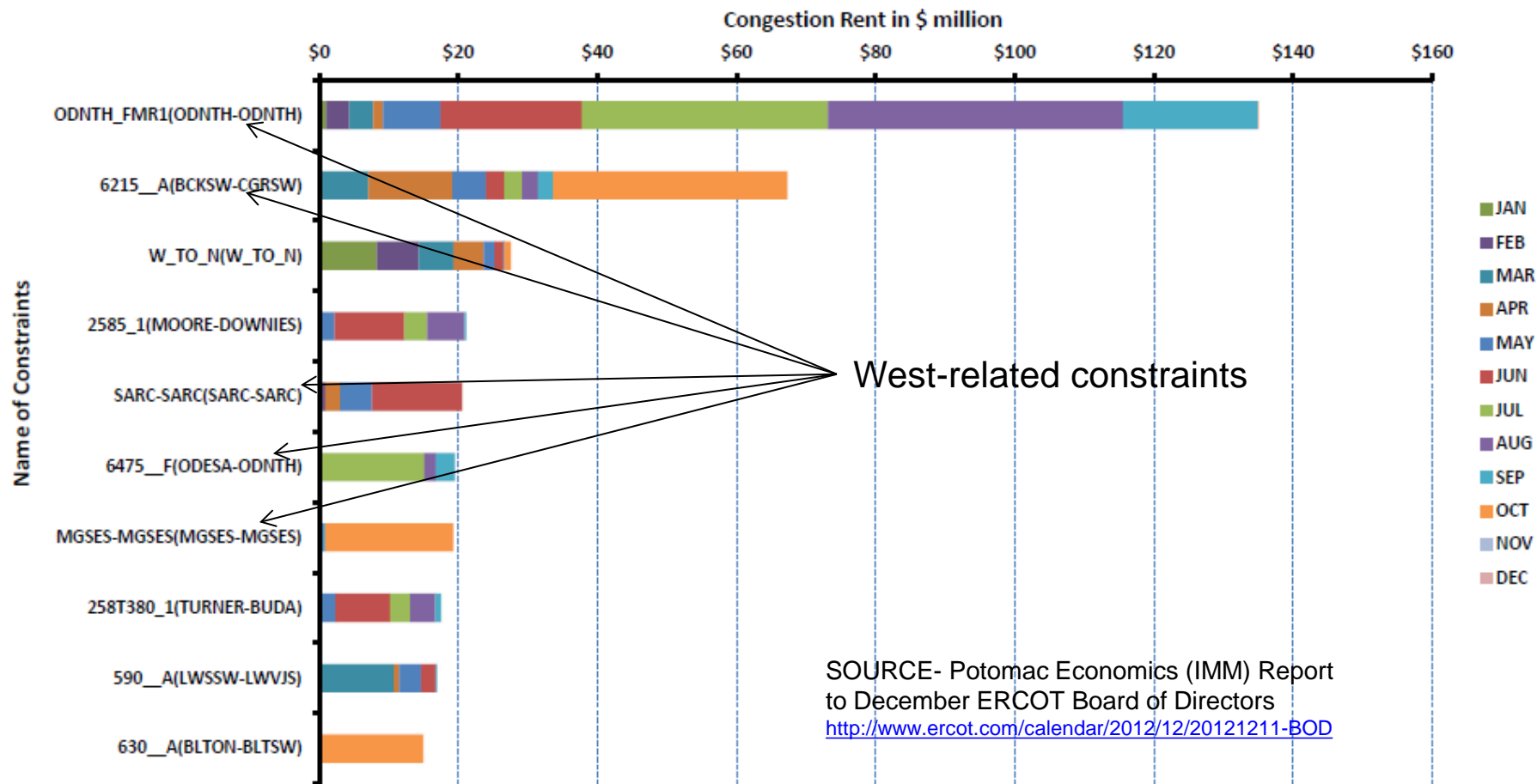
- Energy prices in DAM are less volatile than in real-time, but on average they are more expensive (risk premium for locking in next day prices)
- DAM energy prices were higher in all months except March 2012
 - Real-time scarcity prices and local congestion contributed to this exception

Outline of Discussion

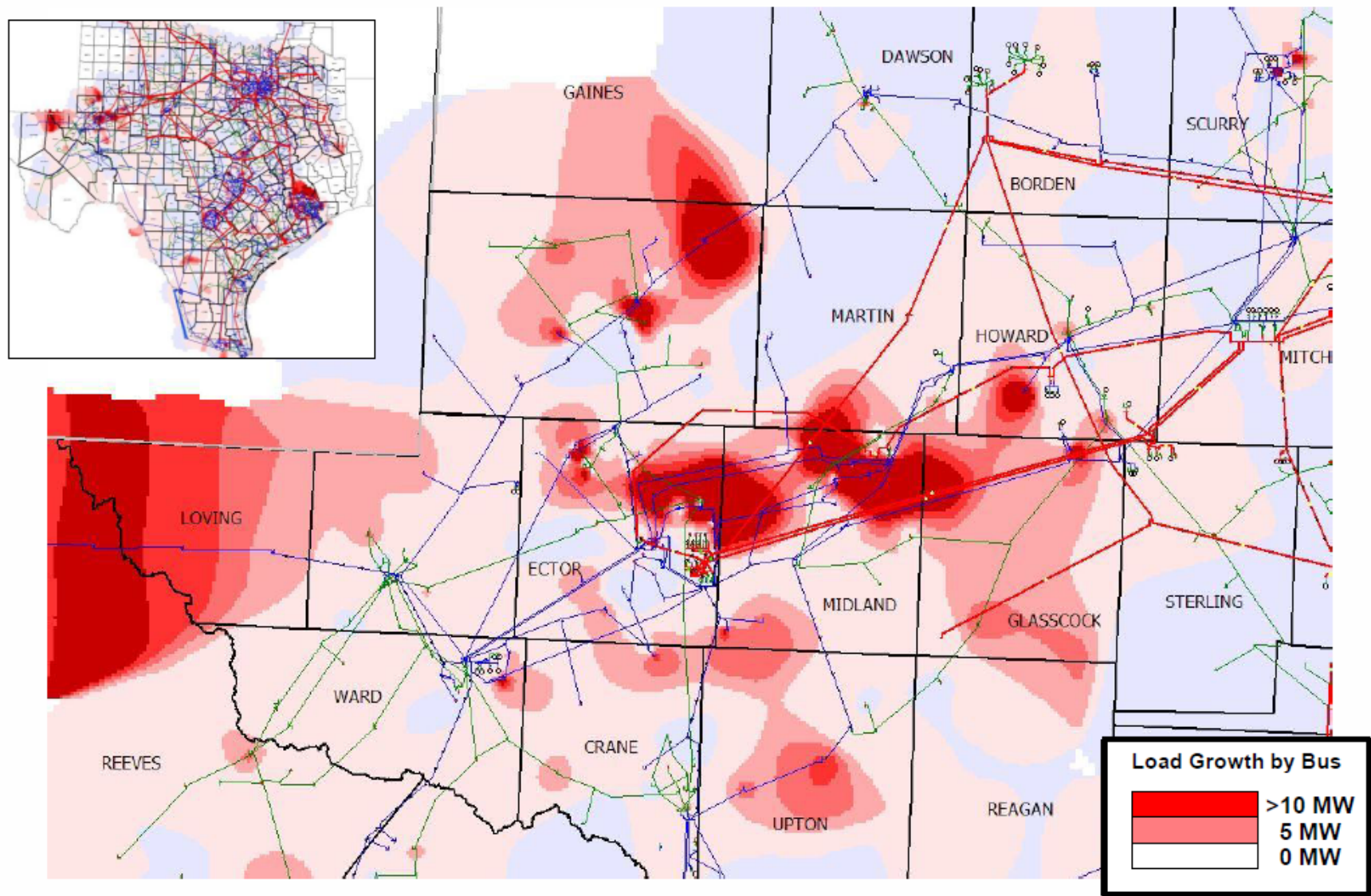
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Summary of 2012 Transmission Congestion Cost

Top 10 Constraints by Total Congestion Rent



Projected Load Growth from 2012 to 2013

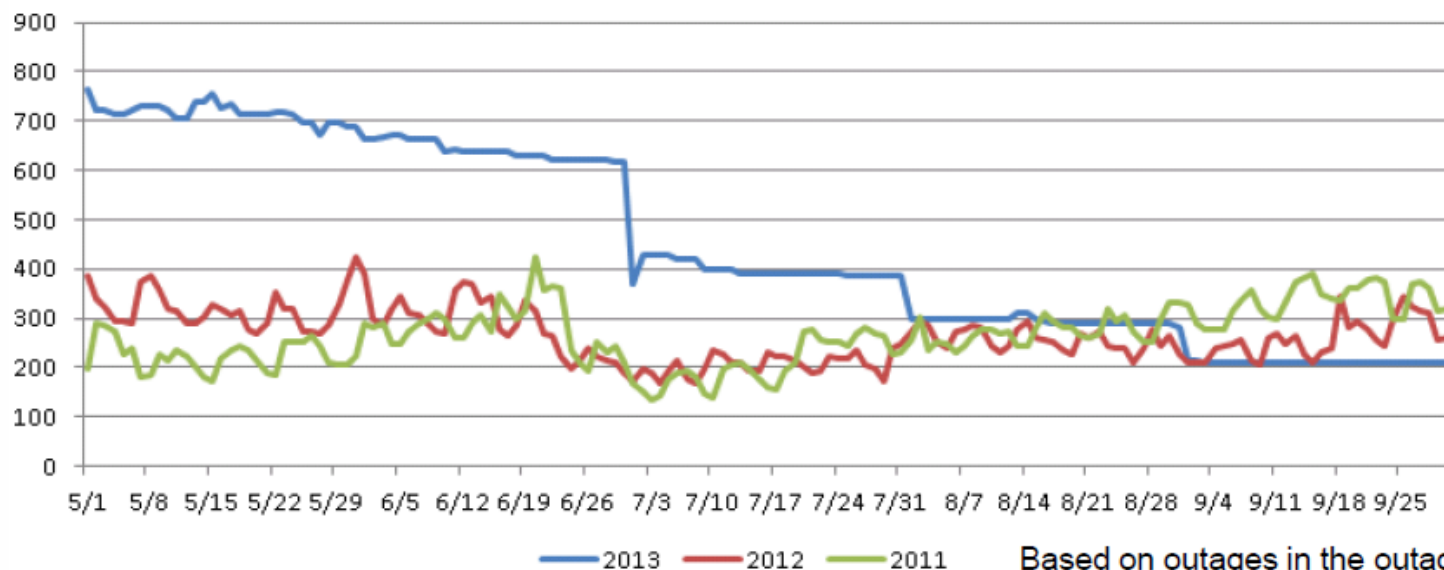


Comparison of Scheduled Outages (2011-2013)

The congestion impact of outages in 2013 appears likely to be greater than experienced in 2012

Daily West Texas Outages

Includes West, Far West, and North Weather Zones
Excludes all Canceled, Withdrawn, and Rejected Outages



Based on outages in the outage scheduling database as of 4/15/2013

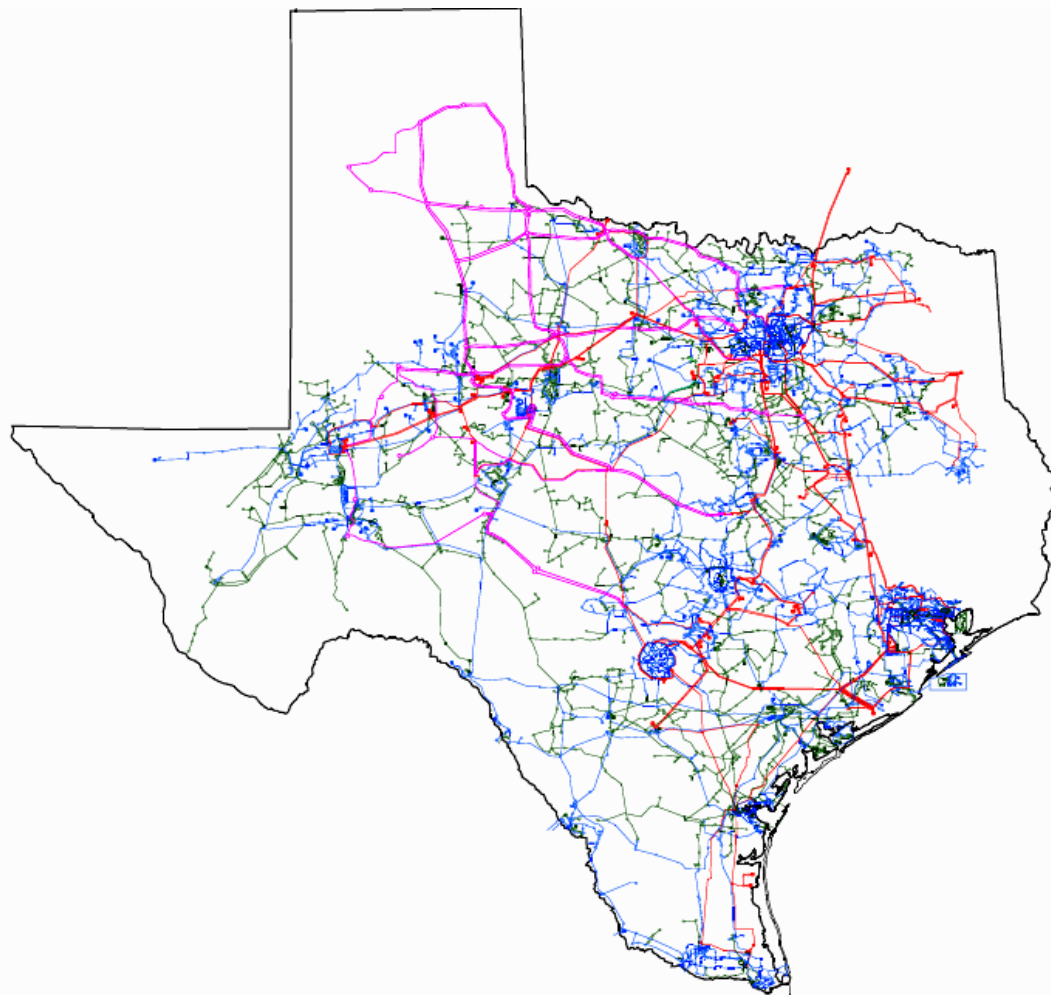
Outage volume is higher in 2013 due to system improvements to serve increased loads and new line construction for CREZ projects

Actions being taken to relieve constraints

Constraint	Short-term solution	Long-term solution
Odessa-Odessa North 138 kV line	Oncor will install dynamic line rating equipment by summer 2013	Reconductor line (December 2013)
Midland East-Windwood 138 kV line	Oncor will install dynamic line rating equipment by summer 2013	Under investigation
Moss-Odessa SW-Odessa EHV 138 kV line	Oncor will install dynamic line rating equipment by summer 2013	Upgrade line (2014)
Moss 345/138 kV autotransformer	Generation redispatch	Oncor proposed Odessa EHV-Moss-Permian Basin 345 kV line and autotransformer (2015)
Permian Basin-Barilla Junction 138 kV line	Oncor proposed SPS by summer 2013	CREZ (December 2013)
Permian Basin-Wink 138 kV line	Oncor proposed SPS by summer 2013	Permian Basin-Culberson County 138 kV line addition (2016)
Odessa North-Odessa Basin 69 kV line	Generation redispatch	Odessa North-Goldsmith Junction-Holt 138/69 kV double circuit (2014)

ERCOT Transmission

40,530 Miles of Transmission Lines in ERCOT



9,249 miles of 345 kV

19,565 miles of 138 kV

>8,000 circuit miles of transmission built since 1999

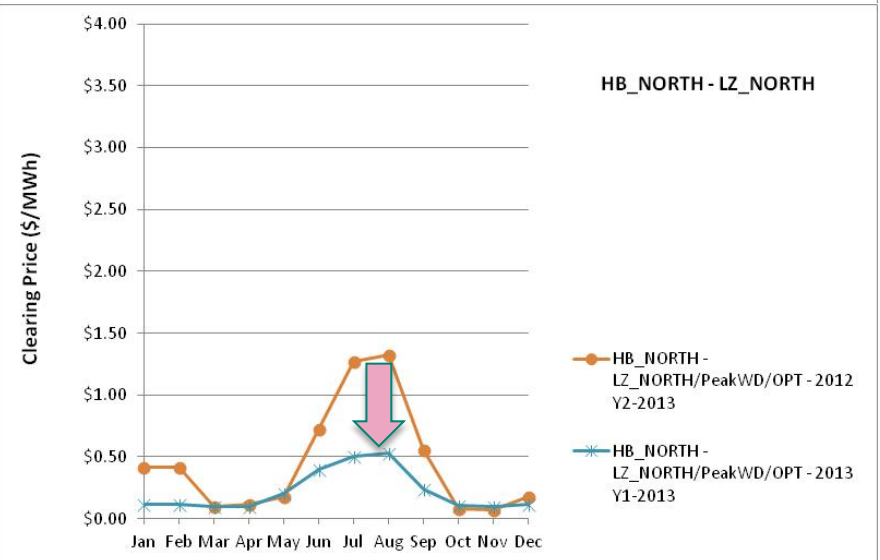
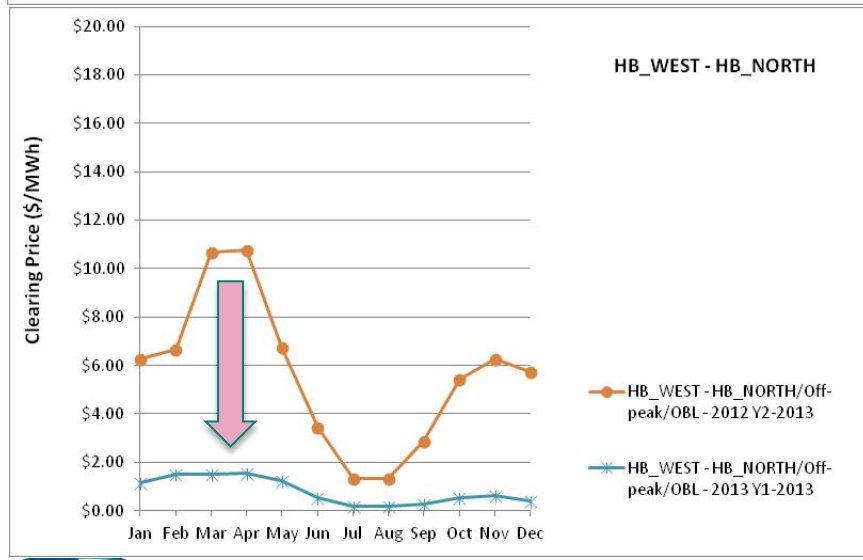
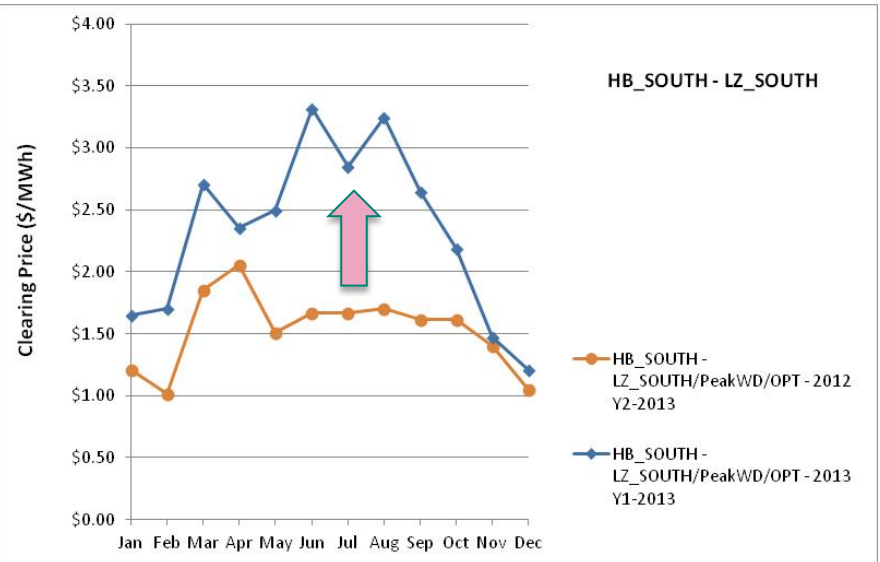
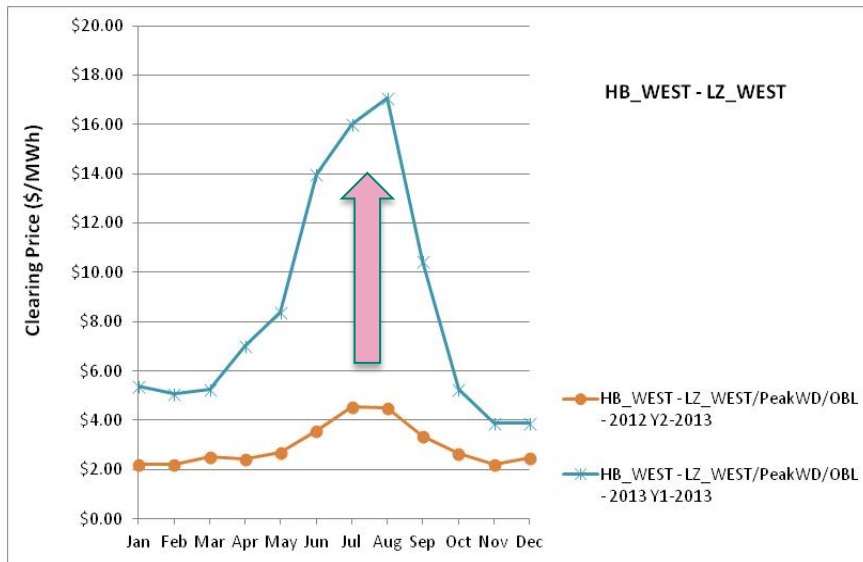
~8,000 circuit miles of transmission under study

\$6 billion investment in transmission placed in service since 1999

\$9 billion under development (including CREZ transmission for Wind)



Monthly Congestion hedge prices reflect when constraints are increasing or decreasing



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Recent Market Design Changes

- **Most significant were pricing rule changes:**
 - PUCT direction to prevent market price reversal when units committed for reliability by ERCOT
 - Example- prices during scarcity may gradually rise to \$200/MWh going into peak, then ERCOT deploys reserves for reliability and prices reverse direction down to \$70.
 - So rules put in place that when ancillary services are called or committed by ERCOT, the generators must have that energy offered and priced at a minimum floor:
 - Non-Spin at \$120-180
 - Responsive and Regulation at energy offer cap (\$5,000)
 - Reliability Unit Commitment at energy offer cap (\$5,000)
- **Other changes in effect or being tested**
 - Emergency Response Service (ERS) with 10-minute response
 - Capacity payment to load to be ready to drop in 10 minutes when EEA begins
 - Expanded beyond contracted load to include distributed generation response
 - Pilot added another ERS for 30-minute response (to increase participation)
 - Pilot added for Fast-Responding Regulation (battery response to frequency)

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Future of Market Design Changes

- A year ago, long-term ERCOT studies began reflecting deficient generation for meeting future load growth.
- Framework for ERCOT Resource Adequacy issues and options centered around Brattle study performed last year.

Final Brattle Report released to PUCT on June 1, 2012

- New investment in ERCOT is impeded by low wholesale prices, low natural gas prices, and an efficient existing generation fleet
- ERCOT's current energy-only market is not likely to support sufficient investment to meet the resource adequacy target
- Reliability targets could be achieved with a significant increase in price-responsive demand – would likely take several years before a sufficient level of demand response could be achieved
- Based on large and uncertain gaps, either the market design needs to be adjusted or the reliability objectives revised
- Four policy options for attracting greater investment to support a higher reserve margins
 - Energy-only market* with price adders
 - Energy-only market with backstop procurement
 - Resource adequacy requirements on load serving entities
 - Resource adequacy supported by a centralized forward capacity market
- Miscellaneous market design enhancements to better enable demand-side resources to participate, and to achieve efficient pricing during scarcity and non-scarcity conditions

* Note- many other ISOs have additional capacity market to incent/pay for capacity/installations

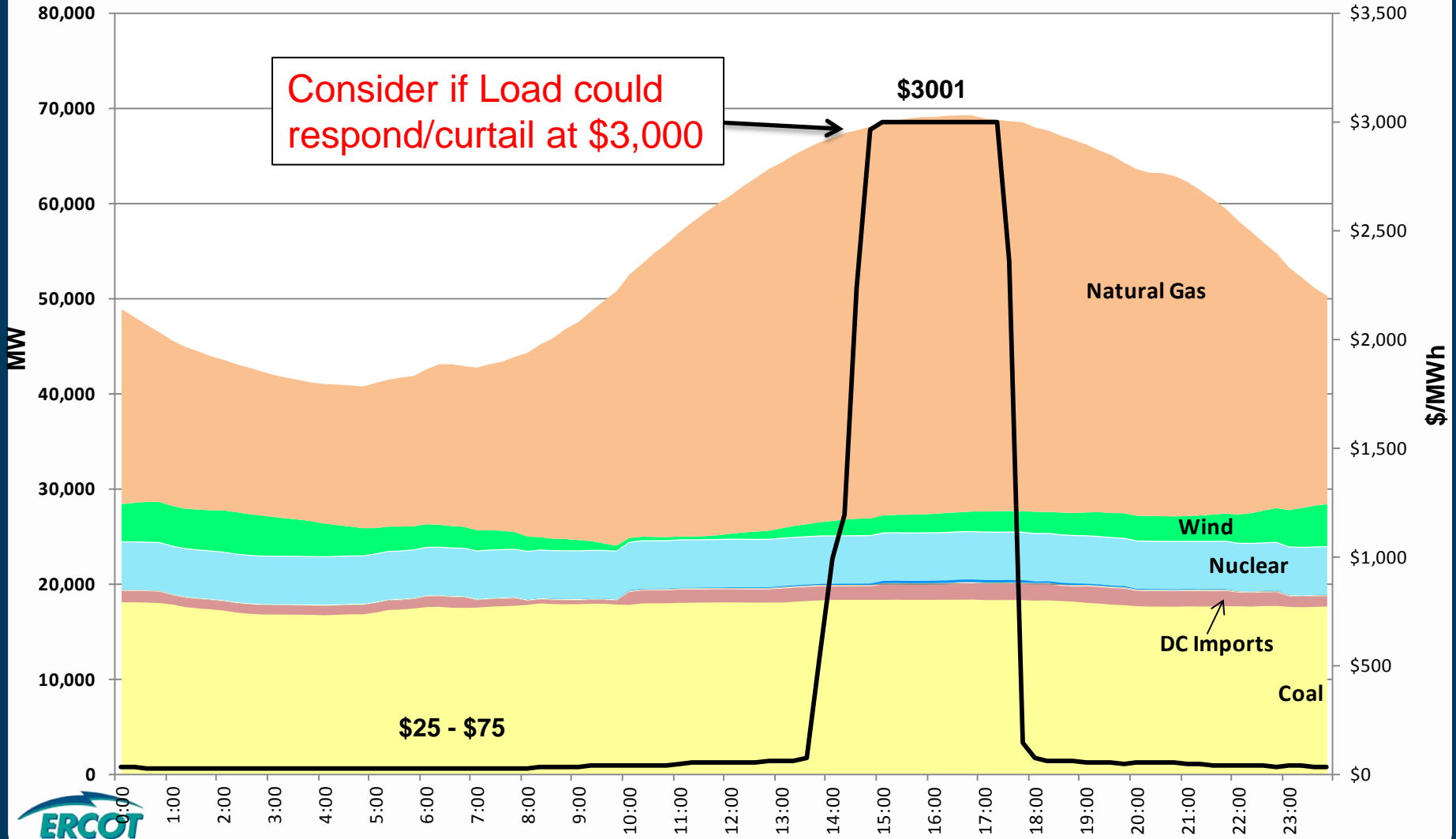
Future of Market Design Changes

- **Ongoing discussion that unless there are higher prices in ERCOT, the investment in new generation is at risk.**
 - New generation construction generally needs \$120,000/MW capacity each year above Operating Costs to be viable investment (construction debt, profit)
 - In an energy only market , would take 24 hours of \$5,000 prices each year to reach the threshold (not been occurring in the market).
 - Other options are a capacity market (capacity paid to be available through year) or the Hogan B+ proposal where price adders on top of energy prices as reserves become thin.
 - Options being considered at PUCT
 - Offer Cap continues planned ramp-up over next 2 years
 - June 1, 2013 increased to \$5,000
 - June 1, 2014 increase to \$7,000
 - June 1, 2015 increase to \$9,000

Summer Peak Day Load Shape with Fuel Mix

August 3, 2011

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

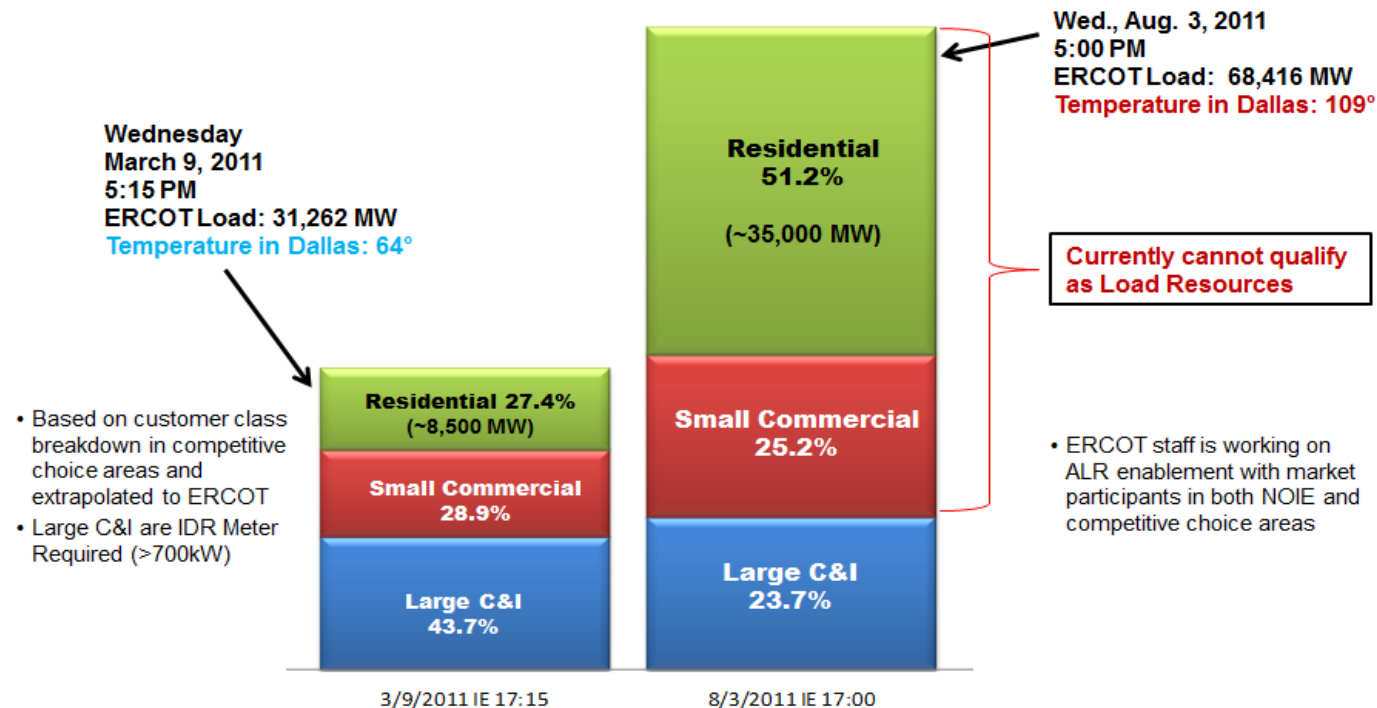


Future of Market Design Changes

- **Loads participating in Real-Time Energy market**

- Focus on getting an initial design in place for next summer
- Leverage smart meters and help reduce peak load (smart meters cannot control household, but can measure drops in energy at different times of day)
- Contribute to price formation in setting reasonable prices

- see more with NPRR555 (<http://www.ercot.com/mktrules/issues/npr/551-575/555/index>)



Questions to be answered

- **Is the ERCOT nodal market running efficiently?**
 - Yes, the ERCOT market has been running efficiently.
- **How are the wholesale energy prices in Texas?**
 - Wholesale prices in ERCOT have been low (low natural gas prices).
- **What is going on in the media with West Texas prices and concerns?**
 - Resolving congestion in west Texas is a priority of ERCOT and TSP (driven by drilling load growth and outages in area).
- **Are the new CREZ lines connecting wind to population centers helping?**
 - Yes new CREZ lines are coming into service opening up corridors for delivering more wind energy from west into other parts of Texas (1500->4000MW).
- **What is the discussion and concern around resource adequacy?**
 - Policy decisions still being considered at PUCT to ensure adequate supply.
- **Are smart meters and load able to relieve the Peak Loads?**
 - New technologies and markets offering more options for Load participation in markets, but still in early stages.

Two last things...

- **THANK YOU FOR YOUR TIME!**
- **ARE THERE ANY QUESTIONS?**

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