Resource Adequacy in Texas

- ERCOT is an energy-only market
- There is a reserve margin target of 13.75% (was 12.5%)
  - ERCOT’s interpretation of “1 load-shed event in 10 years” is more stringent than “1 day of outage in 10 years”
- After the summer of 2011, a concern has emerged that generation capacity expansion would not keep up with demand growth in the future
- System-wide offer cap (price cap) was raised to $4,500 (from $3,000) on August 1, 2012; and will increase to $9,000 by 2015.
- We tested impacts of these price caps (AURORAxmp)
Departure from normal temperature (F)
8/2/2011 – 8/31/2011

Was this a “once in 100 years” event or more of a new normal?

ERCOT Forecasts of Reserve Margin

2012 Update 1: de-mothballed units
2012 Update 2: de-mothballed units, lower demand growth, new resources
Conclusions

- On average, the reserve margin will be highest under the $9,000 price cap
  - 12.8%, 12.4%, 11.4% for $9,000, $4,500 and $3,000 respectively (but lower than 13.75% target RM).

- The 15-year (2013-2027) average nominal price is roughly the same for all 3 scenarios
  - In real terms, prices > average prices since 2009 but similar to prices seen before 2009 because they reflect an increase in natural gas price from its lows in 2009-2012.

- Curtailment is highest with $3,000 cap & increases over time while it is low and fairly stable with $9,000 cap.
Conclusions – Sensitivity to NG Price

- Reserve margins slightly higher
  - 12.9%, 11.8% for $9,000 and $3,000, respectively.
- Average nominal prices are slightly higher
- Slightly more new builds earlier but less overall (also less retirements); lot more wind gets built earlier.

Open Questions

- What is the right price cap?
- What is the optimal reserve margin?
- What role can demand response play?
- What impact external factors will have on resource adequacy in Texas?
**Gas/Power Linkages**

- **Impact on power sector gas use** of EPA regs (CSAPR, MATS), CO₂ penalty, subsidies for renewables, CREZ lines in Texas, alternative ng price scenario (AURORAxmp)

- **Impact on the economy** of electricity & ng prices, and new builds (REMI PI+)

- To be updated for publication: stay of CSAPR, new costs for renewables, plant-level compliance costs, comparison w similar analyses
Gas/Power Linkages

- Joint modeling of multiple factors with AURORAxmp
  - EPA CSAPR for NO\textsubscript{x} and SO\textsubscript{2}
  - EPA MACT/MATS for mercury & other hazardous pollutants
  - CO\textsubscript{2} ($14/t in 2018 to $40/t in 2030)
  - Renewable incentives ($15/MWh to $30/MWh)
  - Natural gas price cycle
  - CREZ transmission addition in ERCOT

Natural Gas Price Inputs

- CEE gas upstream economics research

[Graph showing natural gas price inputs over time]
Increase in Gas Use for Power - Results from A Modeling Exercise*

*See U.S. Gas-Power Linkages: Building Future Views for details:  

Emission Regulations Force Coal Retirements

- Over 50 GW retire by 2030. Most occur before 2020 - ~40GW (consistent with current predictions).
New Builds Mostly Gas and some Wind

New Builds Over Time by Type
CSAPR CEE

• Outer years, greater gas consumption than CSAPR.
• Coal declines by only 7% (as opposed to 20% w EIA forecast).
Power Price Changes

- CSAPR will increase power prices as retirements take time for the market to adjust.
- However, a gas price change of a dollar can result in much more prolonged changes in power prices.

Impact of Power Price Changes on Texas Economy (preliminary) *

*Using REMI PI+
Fixed Investments in Generation

- Even without regulation ~$750 billion (includes Control Equipment, New Builds, O&M) is needed.
- CSAPR case: $1,300 billion – more than $73 billion in ERCOT.

Impact of Generation Investments on Texas Economy (preliminary)*

*Using REMI PI+
Combined Economic Impact (preliminary)*

*Using REMI PI+

CREZ and Renewable Incentives

- CREZ by itself does not lead to new renewables capacity.
- CREZ with high subsidies will result in more renewables.
- Coincidentally, renewable builds start when CO₂ prices are introduced.