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CEE Analytics - Gas-Power Linkages *Resource Adequacy in ERCOT*

BEG/CEE Think Day, 7 June 2013



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Conclusions

- The average reserve margin will be higher under the \$9,000 price cap
 - 14.1% for \$9,000 and 13% for \$3,000
- Considering retirements, net capacity additions will be 12% higher during the 2013-2016 period but only 1% higher in the long-run under the \$9,000 scenario
- Increase in price cap does not lead to an increase in wholesale price

Conclusions (Preliminary)

- Energy efficiency reduces the need for new generation in the short run
 - -33% in the short term (through 2016)
 - -16% in the long run (through 2022)
- Forcing wind into the grid results in reduced average reserve margins; however, prices were not affected



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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, concern is that generation capacity expansion would not keep up with demand growth in the future
- System-wide offer cap (price cap) is being gradually increased to \$9,000 by 2015 from \$3,000 in 2011.
- We tested impacts of these price caps on reserve margins, prices, curtailment



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Demand Growth

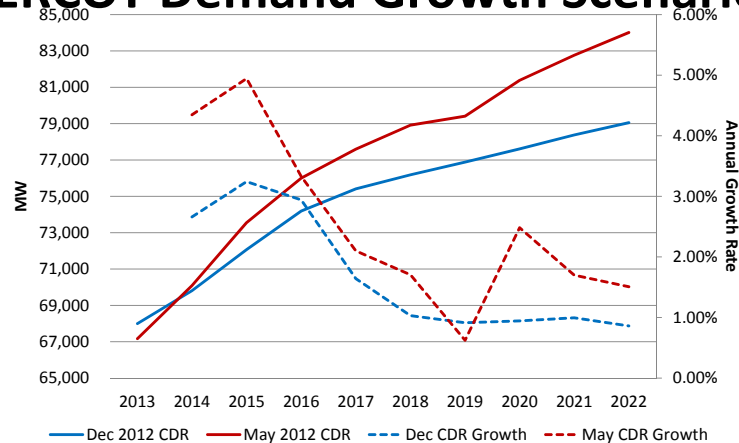
- Since 2000, the population in Texas grew by >20%
- Texas economy continued to grow despite the 2008 crisis
 - increased oil & gas activity is a key driver
- Demand for electricity grew accordingly
 - ~1.5% per year for overall demand
 - >2% per year for peak demand

Last Summer vs. Current Analysis

- Last year, we studied the impact of the increased caps under ‘extreme’ summer of 2011 conditions, growing at 2% a year.
- Now, we use ERCOT’s growth scenarios described in the CDR report
 - Low demand growth from December 2012 CDR
 - High demand growth from May 2012 CDR (still not ‘extreme’)

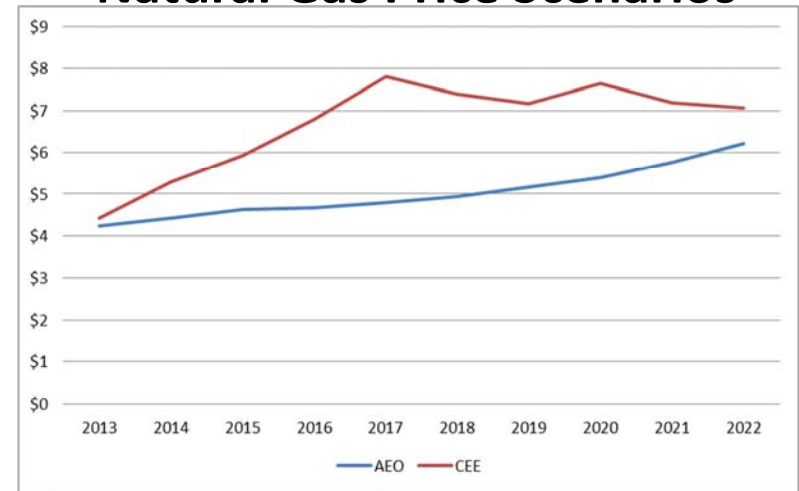
\$9,000 cap baseline case (2013-22 values)		
	July 2012 study	Current study
Average RM	9.0%	14.1%
Extreme Price Hours	180	3
Average Price	\$73	\$49

ERCOT Demand Growth Scenarios



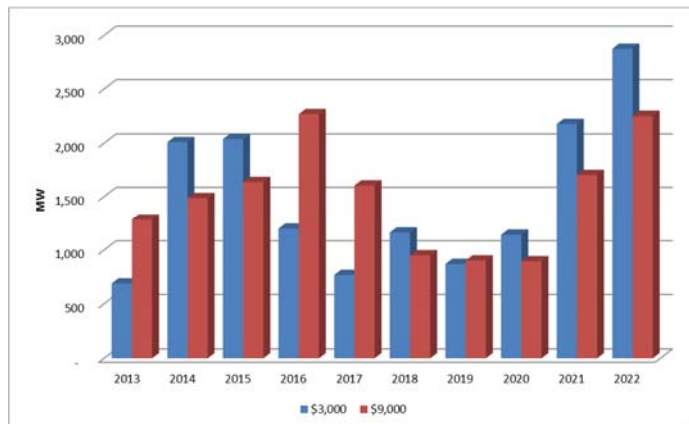
- Average growth in December 2012 CDR is 1.7%, revised downwards from the May 2012 CDR of 2.5%

Natural Gas Price Scenarios



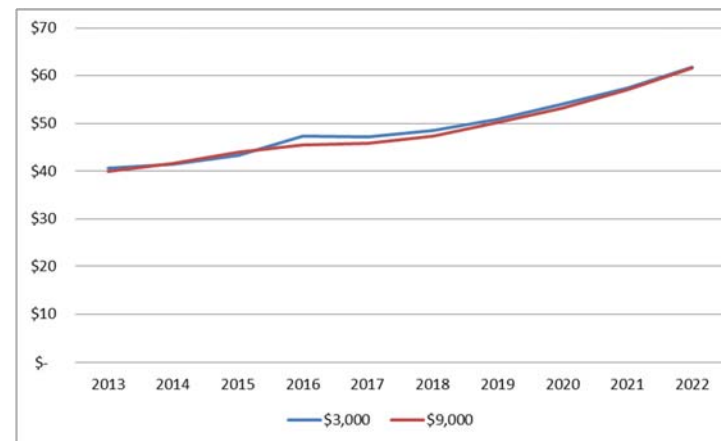
Source: Annual Energy Outlook 2012, Energy Information Administration and Dr. Foss

Net Capacity Additions - Baseline



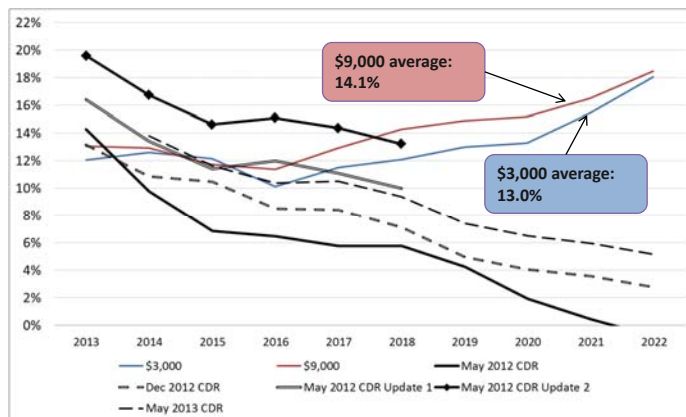
- Through 2016, 12% more builds in the \$9,000 case than the \$3,000
- Overall, increased cap leads to 1% increase in builds through 2022

Wholesale Electricity Prices - Baseline



- Prices do not differ significantly: 10-year average is about \$49/MWh for both

Reserve Margins



- Higher reserve margins in later years due to slower demand growth
- CDR always predicts a declining reserve margin; can only count 'confirmed' capacity

Alternative Scenarios

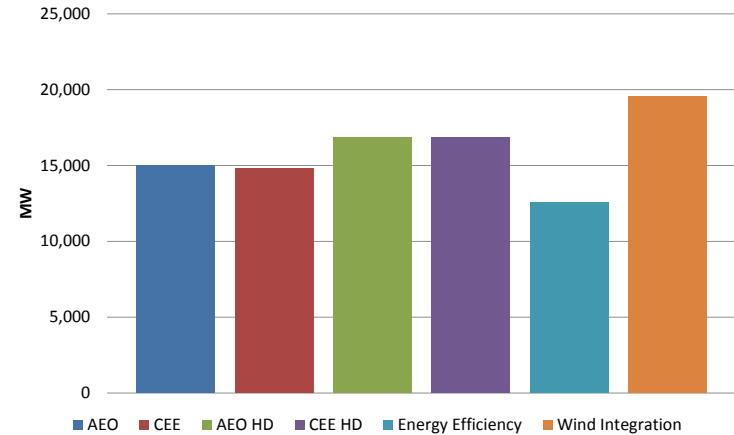
Scenario	Natural Gas Price	Demand Growth
AEO	AEO Forecast	ERCOT Low Demand
AEOHD	AEO Forecast	ERCOT High Demand
CEE	CEE Forecast	ERCOT Low Demand
CEEHD	CEE Forecast	ERCOT High Demand
Energy Efficiency Scenario	AEO Forecast	ERCOT Low Demand
Wind Integration Scenario	AEO Forecast	ERCOT Low Demand

- Energy Efficiency and Wind Integration scenarios are preliminary results
- Each scenario was run with a \$3,000 and \$9,000 price cap

Alternative Scenarios

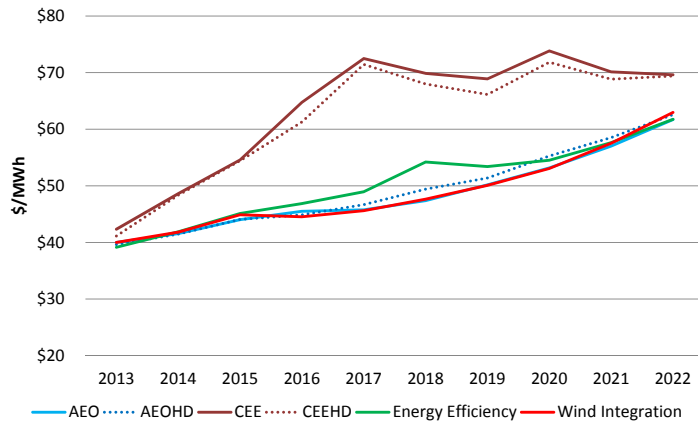
- Our energy efficiency scenario integrates higher levels of energy efficiency into ERCOT
 - Twice the amount predicted in CDR
- The wind integration scenario forces 1,000 MW per year of new wind capacity
 - 500 MW in West Zone and 500 MW in Houston Zone (Coastal) with different availability profiles

Net Capacity Additions (\$9,000 Cap)



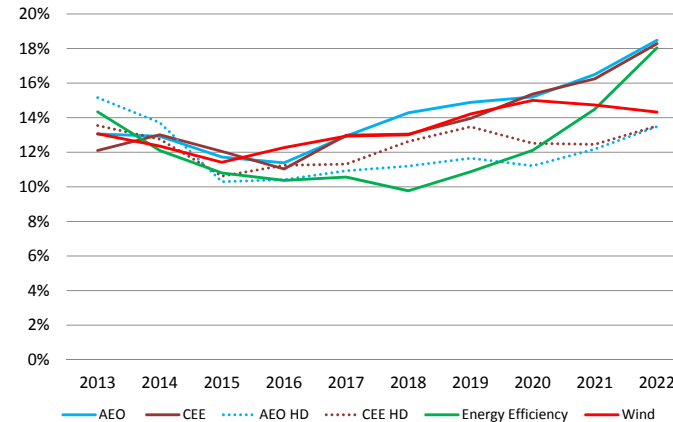
- Energy Efficiency scenario sees 16% less builds in comparison to AEO case
- Wind integration scenario experiences 31% more builds compared to AEO case

Wholesale Price (\$9,000 Cap)



- Wholesale prices are nearly identical under both price caps
- No significant difference between low demand and high demand scenarios
- Unlike wind integration, increased energy efficiency, cause higher prices in some years

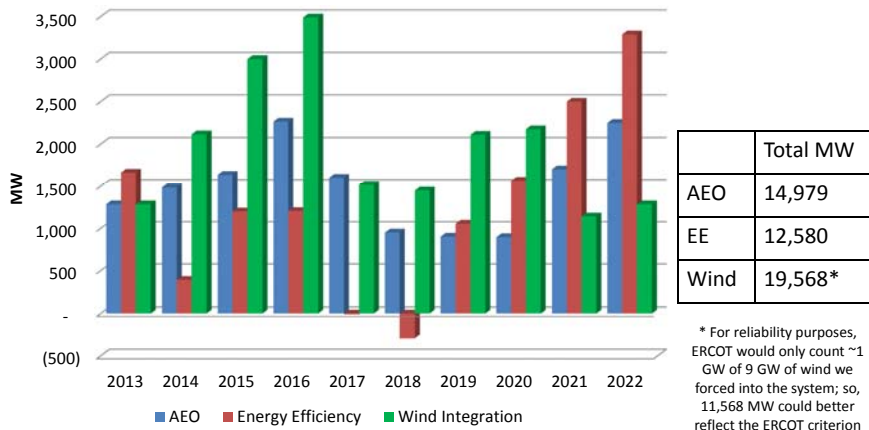
Reserve Margin (\$9,000 Cap)



Scenario	Avg RM
AEO	14.1%
AEOHD	12.3%
CEE	13.8%
CEEHD	14.7%
EE	12.4%
Wind	13.3%

- \$3,000 cap very similar to \$9,000 over the long-term
- Lower reserve margins under high demand growth scenarios

Net Capacity Additions



	Total MW
AEO	14,979
EE	12,580
Wind	19,568*

* For reliability purposes, ERCOT would only count ~1 GW of 9 GW of wind we forced into the system; so, 11,568 MW could better reflect the ERCOT criterion

- With EE, there is less capacity early on; investment picks up in later years
- With wind, there are a lot more new builds early, and less builds later on

Further Research

- Demand response—flattening the demand curve by providing incentives for consumers to switch off their power during periods of high demand
- Implementing EPA regulations such as MATS and water for cooling
- Different Natural Gas Scenarios
- What is the ‘optimal’ reserve margin?