ARE “WE” ASKING TOO MUCH OF ELECTRICITY MARKETS?

CEE 4th Mid-Year Meeting, June 28, 2016
Resource adequacy, capacity expansion optimization, and system costs

Results from Economic Dispatch Modeling, Tsai & Gülen
Partially Sponsored by UT Energy Institute as part of the Full Cost of Electricity (FCe) research program.
Collaborators: Prof. Erich Schneider & Neal Mann, UT Department of Mechanical Engineering; Prof. Jim Dyer, Prof. John Butler & Pedro Cuevas (UT McCombs School of Business); others

- ERCOT is an energy-only market
- Low electricity prices since 2010 (except for August 2011)
- Price cap increase should help
  - But, reserve margins also depend on environmental regulations, share of renewables, price of natural gas

ERCOT demand growth forecasts lower now than in the past
Small changes in demand growth leads to potentially significant changes in prices and price volatility
Generation cost trends by technology: significant declines in solar PV and wind, constant for gas

Data source: ERCOT 2016 LTSA
Rapid expansion of renewable energy in near term (2016-2020)

• Current Trends (projects under construction)
  • 4,413 MW wind
  • 642 MW solar

• Aggressive Renewables (projects announced, in early or advanced stage of development)
  • 13,546 MW wind
  • 2,162 MW of solar

Data source: ERCOT GIS report; CDR report; and SNL
Environmental regulations

• Environmental regulation compliance costs
  • Mostly for coal units
  • Range from $50 to $700/KW for potential retrofit costs

Data source: SNL, ERCOT analyses
Current Trends
resource expansion/retirement

ERCOT 2016 LTSA modeling yields 20GW plus solar new build in their Current Trend scenario.
Aggressive Renewables resource expansion/retirement

Work in Progress

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Additional 13GW+ hard-wired wind capacity does not reduce new NG builds
Energy Price and Reserve Margin

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Work in Progress
LACE Incorporates Portfolio Mix (If LACE>LCOE, “economic”) – ERCOT Scenarios (2016-2030)

<table>
<thead>
<tr>
<th></th>
<th>LACE ($2015/MWh)*</th>
<th>LCOE (2013$/MWh)**</th>
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<tbody>
<tr>
<td></td>
<td>Current Trends</td>
<td>Aggressive Renewables</td>
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<tr>
<td>Wind</td>
<td>34.05</td>
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<td>Solar</td>
<td>66.78</td>
<td>49.62</td>
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<td>Gas – Non-Cycling</td>
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<td>Gas – Peaking</td>
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<td>818.04</td>
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<td>Coal</td>
<td>73.16</td>
<td>53.88</td>
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Note:
* Based on FCe results;
** US EIA Annual Energy Outlook 2015, estimated for new generations resources in 2020

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